
UNITED STATES DEPARTMENT OF LABOR
Frances Perkins, *Secretary*
BUREAU OF LABOR STATISTICS
Isador Lubin, *Commissioner*

+

Safety Codes for the Prevention of Dust Explosions

Supplement to Bulletin No. 562

National Fire Protection Association and
United States Department of Agriculture
Sponsors



Bulletin No. 617

AMERICAN STANDARD
Approved by the
AMERICAN STANDARDS ASSOCIATION

+

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1936

For sale by the Superintendent of Documents, Washington, D. C. - - - - Price 10 cents

CONTENTS

	Page
Introduction.....	1
Increased hazards.....	1
Committee on dust explosion hazards.....	2
Safety codes already formulated.....	2
New and revised codes.....	3
Woodworking plants.....	3
Starch factories.....	3
Flour and feed mills.....	4
Terminal grain elevators.....	4
Pulverized-fuel systems.....	4
Safety code for the prevention of dust explosions in woodworking plants:	
Definitions.....	7
Section 1—Introduction.....	7
Section 2—Structural features.....	7
Section 3—Ventilation.....	9
Section 4—Wood-waste collecting equipment.....	9
Section 5—Wood-waste disposal.....	10
Section 6—Housekeeping.....	11
Section 7—Miscellaneous.....	11
Section 8—Fire protection.....	12
Safety code for the prevention of dust explosions in starch factories.....	13
Safety code for the prevention of dust explosions in flour and feed mills:	
Definitions.....	15
Section 1—Introductory.....	15
Section 2—Structural features.....	15
Section 3—Equipment.....	17
Section 4—Grain driers.....	21
Section 5—Removal and control of dust.....	23
Section 6—Removal of static dust.....	23
Section 7—Electrical equipment.....	24
Section 8—Miscellaneous.....	24
Section 9—Fire protection.....	26
Safety code for the prevention of dust explosions in terminal grain elevators.....	27
Safety code for the installation of pulverized-fuel systems.....	29
Arrangement of systems.....	29

Bulletin of the Bureau of Labor Statistics

Number 617

WASHINGTON

January 1936

Safety Codes for the Prevention of Dust Explosions

Supplement to Bulletin No. 562

Introduction

Since the publication of Bulletin No. 562 under the above title in December 1931, additional codes have been developed by the Dust Explosion Hazards Committee of the National Fire Protection Association to cover other industries in which the dust explosion hazard was recognized, and some of the original codes have been revised to keep pace with developments in industry.

The scope of the activities of this committee, which was formed with the cooperation of the United States Department of Agriculture, covers the prevention of dust explosions in connection with processes and industries producing combustible or explosive dusts, including measures for the prevention of ignition, restriction of potential damage by proper construction and arrangement of buildings, restriction of the production and escape of dust through the control of dust-producing processes and equipment, extinguishing methods, and related features. Fire prevention and extinguishing are included, since dust explosions may result from fire.

Increased Hazards

Large losses of life, property, and foodstuffs have occurred recently in lines of industry in which dust explosions had not previously taken place. Greatly increased industrial operations and the utilization of byproducts and waste materials resulting in the production and accumulation of large quantities of explosive dusts have greatly increased the hazard. The introduction of new manufacturing processes and new types of mechanical equipment with additional sources of ignition has increased the need for a thorough knowledge of dust explosion prevention.

Committee on Dust Explosion Hazards

(Personnel as of May 1935, when last committee action was taken)

DAVID J. PRICE, *Chairman*, United States Bureau of Chemistry and Soils,
Department of Agriculture

HYLTON R. BROWN, *Secretary*, United States Bureau of Chemistry and Soils,
Department of Agriculture

- | | |
|---|---|
| L. F. ADAMS: National Electrical Manufacturers Association. | J. H. MORROW: American Society of Mechanical Engineers. |
| C. J. ALGER: Corn Industries Research Foundation. | J. A. MULL: Terminal Grain Elevator Merchants Association. |
| EUGENE ARMS: American Feed Manufacturers Association, Millers National Federation, Association of Mill and Elevator Mutual Insurance Companies. | H. E. NEWELL: National Board of Fire Underwriters. |
| E. G. BAILEY: The American Boiler Manufacturers Association and affiliated industries. | A. H. NUCKOLLS: Underwriters' Laboratories. |
| H. W. BROWN: United States Department of Labor. | ROBERT PALM: Consulting engineer, sugar industry. |
| W. J. BURK: Association of Governmental Officials in Industry of the United States and Canada. | GEORGE S. RICE: United States Bureau of Mines. |
| G. F. BUTT: Grain elevator construction. | EDWIN B. RICKETTS: Edison Electric Institute. |
| H. W. DONNAN: National Board of Fire Underwriters. | JOHN ROACH: International Association of Industrial Accident Boards and Commissions. |
| W. J. FAIRBAIRN: Western Factory Insurance Association. | F. W. SEHL: National Bureau of Casualty and Surety Underwriters. |
| JAMES HAYHOE: Society of Grain Elevator Superintendents of North America. | LESTER C. SMITH: Dust collection equipment manufacture. |
| G. R. HURD: Railway Fire Protection Association. | PETER STEINKELLNER: International Association of Fire Chiefs, International Association of Fire Fighters. |
| W. DEAN KEEFER: National Safety Council. | J. F. TEMPLIN: Western Actuarial Bureau. |
| | N. J. THOMPSON: Associated Factory Mutual Fire Insurance Companies. |

Safety Codes Already Formulated

The codes previously prepared by the committee and published in Bulletin 562 were designed to assist owners and operators in adopting proper control measures for the prevention of dust explosions in industrial plants and the reduction of losses resulting therefrom. They included the following codes which were approved by the American Standards Association as "American Standard":

1. Safety code for the prevention of dust explosions in starch factories.
2. Safety code for the prevention of dust explosions in flour and feed mills.
3. Safety code for the prevention of dust explosions in terminal grain elevators.
4. Safety code for pulverizing systems for sugar and cocoa.
5. Safety code for the prevention of dust ignitions in spice-grinding plants.

6. Safety code for the prevention of dust explosions in wood-flour manufacturing establishments.
7. Safety code for the installation of pulverized-fuel systems.
8. Safety code for the prevention of dust explosions in coal pneumatic cleaning plants. (This code was prepared under the general supervision of George S. Rice, Chief Mining Engineer, U. S. Bureau of Mines.)
9. Safety code for the use of inert gas for fire and explosion prevention.

New and Revised Codes

Included in this supplemental bulletin are the following new and revised codes designed along the same lines and for the same purpose as the previous regulations. These new codes have also been approved by the American Standards Association as "American Standard."

1. Safety code for the prevention of dust explosions in woodworking plants.
2. Revision of safety code for the prevention of dust explosions in starch factories.
3. Safety code for the prevention of dust explosions in flour and feed mills (complete revision of original code).
4. Revision of safety code for the prevention of dust explosions in terminal grain elevators.
5. Revision of safety code for the installation of pulverized-fuel systems.

Woodworking Plants

The Safety Code for the Prevention of Dust Explosions in Woodworking Plants has two principal objects: (1) To prevent dust explosions and minimize the resulting damage should an explosion occur; and (2) to provide regulations for minimizing fire hazards.

This safety code is intended primarily to apply to new construction and to rebuilt or remodeled plants. It is recommended that wherever possible existing installations be modified to conform to these regulations.

The safety code for woodworking plants is intended to cover the hazards involved in the production of finely divided wood particles in the course of woodworking operations, the removal of these particles from the point of operation, and their subsequent disposal. This should serve as a supplement to the present American Standard, Safety Code for Woodworking Plants (Bureau of Labor Statistics, Bulletin No. 519), which covers primarily "point of operation" hazards. In cases where the wood waste is used for making wood flour, the Safety Code for the Prevention of Dust Explosions in Wood-flour Manufacturing Establishments (Bureau of Labor Statistics Bulletin No. 562) should apply, together with the Safety Code for Woodworking Plants.

Starch Factories

The revisions in the Safety Code for the Prevention of Dust Explosions in Starch Factories deals with the speed of spiral conveyors and applies to paragraph 91 in the American Standard as approved by

the American Standards Association on September 24, 1931, and published in Bulletin No. 562 of the Bureau of Labor Statistics, United States Department of Labor.

The paragraph has been revised to eliminate ball or roller bearings from the requirement that the speed of revolution of spiral conveyors should not exceed 100 revolutions per minute.

Flour and Feed Mills

The Safety Code for the Prevention of Dust Explosions in Flour and Feed Mills is a complete revision of the safety code approved by the American Standards Association on January 12, 1928, and published in Bulletin No. 562 of the Bureau of Labor Statistics, United States Department of Labor.

These regulations have but two principal objects, (1) to prevent dust explosions and minimize the resulting damage should an explosion occur, and (2) to minimize fire hazards. These regulations are applicable to flour and feed mills erected subsequent to the date of approval of these regulations, and are offered as an advisory guide for owners and operators who may wish to avail themselves of the information to improve existing mills.

Terminal Grain Elevators

The revision in the Safety Code for the Prevention of Dust Explosions in Terminal Grain Elevators applies to paragraph 906, relating to insect control. This safety code was approved as American Standard by the American Standards Association on September 24, 1931, and published in Bulletin No. 562 of the Bureau of Labor Statistics, United States Department of Labor.

The paragraph has been revised to provide that processes and materials used for the extermination of weevils, Mediterranean moth, etc., shall be in accordance with the requirements of the regulations prepared by the National Fire Protection Association Committee on Fumigation Hazards.

This committee is now engaged in the preparation of regulations covering recommended practice for fumigation in grain-handling operations.

Pulverized-Fuel Systems

The revisions in the Safety Code for the Installation of Pulverized-fuel Systems apply to section 20 (b) on vents and sections 41 and 42 on arrangement of unit systems, approved as American Standard by the American Standards Association on September 5, 1930, and published by the Bureau of Labor Statistics, United States Department of Labor, in Bulletin No. 562. The revision provides for a change in the wording, "each pipe to the furnace" to read "each vent from mill or

bin to the furnace", and also specifies that the "fan and discharge pipe shall be so proportioned that the velocity (of air and pulverized fuel) in the discharge pipe from the fan is not less than 70 feet per second."

The revision in the requirement in section 41 for arrangement of unit systems provides that "No pulverizer shall be connected to supply more than one furnace at a time (unless each pipe leaving the mill is provided with an approved dust-tight valve installed in a vertical riser, in such a way that dust accumulations back of the valve will fall into the mill)."

The revision in the requirement for unit systems in section 42 provides that piping from mill to burners shall be so arranged that when a mill is in use all burners which that mill can supply shall be in operation (unless each pipe leaving the mill is provided with an approved dust-tight valve installed in a vertical riser, in such a way that dust accumulations back of the valve will fall into the mill).

Safety Code for the Prevention of Dust Explosions in Woodworking Plants

(American Standard, approved Feb. 4, 1935, by American Standards Association)

Definitions

In this safety code the following words are used as defined below:

“Shall” is intended to indicate requirements.

“Should” is intended to indicate recommendations, or that which is advised but not required.

“Approved” refers to approval by the authority having jurisdiction in the enforcement of regulations.

Section 1.—Introduction

11. *Object.*—These regulations have two principal objects: First, to prevent dust explosions and minimize the resulting damage, should an explosion occur; and second, to provide regulations for minimizing fire hazards.

12. *Application.*—These regulations are intended to apply to new construction and to rebuilt or remodeled plants. It is recommended that wherever possible existing installations be modified to conform to these regulations.

13. *Scope.*—These regulations are intended to cover the hazards involved in the production of finely divided wood particles in the course of woodworking operations, the removal of these particles from the point of operation, and their subsequent disposal. They should serve as a supplement to the present American Standard Safety Code for Woodworking Plants (United States Department of Labor. Bureau of Labor Statistics, Bul. No. 519), which covers primarily “point of operation” hazards. In cases where the wood waste is used for making wood flour, the Safety Code for the Prevention of Dust Explosions in Wood-Flour Manufacturing Establishments (see p. 39 of Bul. No. 562) shall apply, together with these regulations.

Section 2.—Structural Features

21. *Construction.*—In view of the flammable nature of the contents of woodworking plants, it is desirable that the buildings be of full fire-resistive construction (all steel work protected by approved fire-proofing) or of heavy timber construction.

Adequate precautions should be taken to prevent the spread of fire from one section of the plant to another. This includes the erection

of adequate fire walls, the elimination of all unnecessary openings between sections or floors, and the proper protection of all necessary horizontal or vertical openings to prevent spread of fire. (See Regulations of the National Fire Protection Association for the Protection of Openings in Walls and Partitions.¹)

22. *Surface and ledges.*—All inside surfaces shall be as smooth as practicable, and horizontal surfaces, ledges, or pockets where dust might collect, particularly in inaccessible locations, shall be reduced to a minimum. Such ledges as must necessarily exist shall be inclined as steeply as possible.

23. *Locations.*—As great a space as is practicable should be provided between the various buildings of the plant to prevent spread of fire.

24. *Communications.*—Where it is necessary for separate buildings of the plant to adjoin they shall be separated by an approved fire wall with all door openings protected by approved self-closing fire doors.

25. *Storage vaults for wood waste.*—Vaults used for the collection and storage of sawdust, shavings, or hog wood should, wherever possible, be isolated from the mill proper.

When the plant arrangement prevents the isolation of such vaults they shall be so designed and constructed as to provide a complete fire and explosion cut-off between them and adjacent plant areas and the vault structure protected by adequate means of pressure release to prevent its destruction in the event of an explosion.

In all cases either one side or the top of the vault, so located as not to endanger the balance of the plant, shall be of such light construction that it will fail in the event of an excessive explosion pressure and prevent the failure of the balance of the vault structure. This side or top shall be provided with vent areas closed only by light, freely opening panels, doors or covers in the ratio of 1 square foot of vent area to each 80 cubic feet of vault contents. The vault shall be so proportioned that the distance from the vent area to the most remote point shall in no case exceed $1\frac{1}{2}$ times the least dimension of the vault.

The desired safety provisions may be made by so locating the vault that at least one wall shall be flush with an outside wall of the building. This wall shall be the light construction wall and provided with vents as specified above. The remaining walls of the vault shall be of strong fire- and explosion-resistant construction.

Where plant conditions make it more suitable the vault may be built with all four walls of strong fire- and explosion-resistant construction and the vault top of light construction and provided with vents as specified above.

In cases where a cyclone or other type of collector is located directly above the vault it shall be supported independently or in such a way

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

that it will not be affected by failure of the vault walls or vault roof structure.

26. *Shafts*.—All stairways and elevators shall be enclosed in tight noncombustible shafts, with all doors noncombustible and self-closing, or closed from within by elevator operator.

Section 3.—Ventilation

31. *Walls*.—In sections of the plant where dust accumulates or is present in suspension in the air, a portion of the exterior walls in the ratio of not less than 1 square foot of wall surface for each 80 cubic feet of volume in a given room shall be of light, noncombustible material, preferably $\frac{1}{8}$ -inch thin glass, or of automatic venting devices in the form of hinged windows or panels so balanced as to open under a predetermined pressure.

32. *Windows*.—All rooms and buildings shall be provided with the largest practicable area of windows, or a combination of windows and louvers. Windows shall be easily accessible for operation, shall be arranged to provide maximum ventilation when open, and shall be preferably of the hinged or tilting type.

Section 4.—Wood-Waste Collecting Equipment

41. *Exhaust fans and mains*.—An exhaust system shall be provided comprising one or more main exhaust fans with main and branch exhaust ducts connecting to individual exhaust hoods or ports at the various locations where they are needed.

Each exhaust fan shall be protected from foreign material or large particles by the installation of a pneumatic separator in the exhaust main just ahead of the fan intake.

NOTE.—For detailed information as to the proper installation of fans and mains see Regulations of the National Fire Protection Association for the Installation of Blower and Exhaust Systems.¹

42. *Suction at Machines*.—All cutting shaping, planing, sanding, or other machines which produce finely divided wood particles or shavings shall be equipped with adequate exhaust hoods or ports to remove the finely divided product as it is produced.

Each exhaust port shall be so located that it will be in the direct line in which the wood particles are normally thrown by the operation.

Sufficient suction shall be maintained at each port so that the velocity of the air past the point of operation will carry the finely divided product into the exhaust port.

Each exhaust duct leading to a port should be provided with a shut-off blast gate.

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

Each exhaust connection shall be so located as not to interfere with the safe and satisfactory operation of the machine.

NOTE.—In many cases the exhaust connections can be so designed as to supplement or replace the point of operation guards, serving a double purpose.

For detailed information regarding the installation of suction connections see Regulations of the National Fire Protection Association for the Installation of Blower and Exhaust Systems.¹

43. *Floor sweeps.*—In addition to the exhaust intakes at the individual machines, connections to the exhaust system should be provided at the floor level in convenient locations to provide for removal of such fine material as may fall to the floor around the machines and be swept up.

44. *Separators.*—Each exhaust fan shall discharge to a separator (or collector) of sufficient size and capacity to separate the wood particles from the air before the air is vented to the outside.

Collectors shall discharge to storage vaults, preferably through a screw conveyor, with a choke section in the conveyor.

45. *Scrap wood.*—Wood scrap, blocks, ends, etc., may be collected in vaults, portable trucks, or, where the quantity justifies, by belt conveyors and transferred to a central storage. If the wood is disposed of as collected without further breaking up, no special precautions are required.

Section 5.—Wood-Waste Disposal

51. *Hogs for scrap wood.*—If the scrap wood is to be crushed by “hogs” and used as fuel, there is considerable danger of fire or explosion, and the necessary precautions must be taken.

The hog or hogs shall be isolated from the rest of the mill either by location or by providing strong fire- and explosion-resistant walls between the hog room and other operating areas.

The hog room shall be provided with adequate venting area so located that in the event of an explosion the explosive pressure will be relieved in a direction which will not endanger the personnel or property in the remainder of the mill.

The product of the hog or hogs shall be transferred to a separate storage vault used only for this material. If possible, this material should be transferred through a closed choke feed conveyor to eliminate the danger of the spread of flame which is inherent in an air transfer system.

If an air transfer system through fans is used for the hog wood, each hog shall discharge through a separate fan to a separate collector. Each collector shall discharge to the hog wood storage vault.

52. *Storage vaults.*—If the finely divided wood particles in the vaults, either the hog wood vault or the vaults used for the wood dust

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

from the mill, are to be disposed of by removal from the premises, provision should be made for loading without releasing excessive quantities of dust to the air.

If the finely divided wood particles are to be used as fuel, further precautions are necessary.

The vault, or vaults, should discharge through a conveyor to magazines at each furnace where the wood fuel is to be used. The discharge system shall be so designed that either by means of a choke feeder or choke conveyor a positive cut-off is provided to prevent a flash-back from the magazine to the vault.

The operation of vaults should be so controlled that their outlets will be at all times covered with the fuel to a depth of at least a foot as an added means of preventing a flash-back.

53. *Magazine feeders.*—The discharge from feed magazines to furnaces shall be so designed that either by means of a choke feeder or choke conveyor a positive cut-off is provided between the furnace and the magazines. The installation of a steam spray in the discharge line from the magazine to the furnace blowing steam in the direction of the fuel flow is recommended, as it provides an added safety factor in preventing a flash-back.

The operation of the magazines should be so controlled that their outlets will at all times be covered with the fuel to a depth of at least a foot.

Each magazine shall be equipped with a vent duct leading as directly as possible to the outside air and provided with a swinging cap or damper so designed as to be normally closed but to open freely in the event of development of excessive pressure in the magazine. The area of this vent at the magazine and throughout its length shall be at least 1 square foot for every 80 cubic feet of magazine volume.

Section 6.—Housekeeping

61. Provision shall be made for systematic, thorough cleaning of the entire mill at sufficiently frequent intervals to prevent the accumulation of any considerable amounts of finely divided wood dust which might be dislodged by a minor explosion and lead to a major explosion.

62. Adequate provision should be made for separately collecting and disposing of any metal scrap such as nails or band iron or any wood containing metal so that it will not enter the wood dust collecting system or be fed to the hog with scrap wood.

Section 7.—Miscellaneous

71. *Electric wiring and equipment.*—All electric wiring and equipment shall conform to the National Electrical Code.¹ In sections of the plant where dust accumulates or is present in suspension in the

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

air all equipment and installations shall be in accordance with the requirements of article 32 of the National Electrical Code.

72. *Lighting for vaults and magazines.*—Portable spotlights of suitable design and approved construction to be directed in to the vaults or magazines through convenient openings should be used as temporary or occasional lights for examination of the vaults or magazines. Neither open lights nor electric extension cord lights should be used in the vaults or magazines.

Section 8.—Fire Protection

81. *First-aid appliances.*—First-aid fire protection in the form of hand extinguishers, casks and pails, hand hose connections, or other suitable units shall be provided in the quantities and locations directed by the inspection department having jurisdiction.

NOTE.—See Regulations of the National Fire Protection Association for First-Aid Fire Appliances.¹

82. *Automatic sprinklers.*—In view of the large amount of combustible material in this type of plant, full automatic sprinkler protection for the entire property is recommended, including the interior of collectors and vaults in the wood waste handling system.

NOTE.—See Regulations of the National Fire Protection Association for the Installation of Sprinkler Equipments.¹

In cases where automatic sprinkler protection is not provided for the entire plant it is particularly desirable that automatic sprinklers or manually controlled spray systems be installed in collectors or vaults for fighting fire in these units.

83. *Fire in vaults or collectors.*—In case of fire, a full hose stream never should be turned into a vault or collector used for finely divided wood particles, as an explosion may occur in the dust cloud created by the high velocity of the hose stream.

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

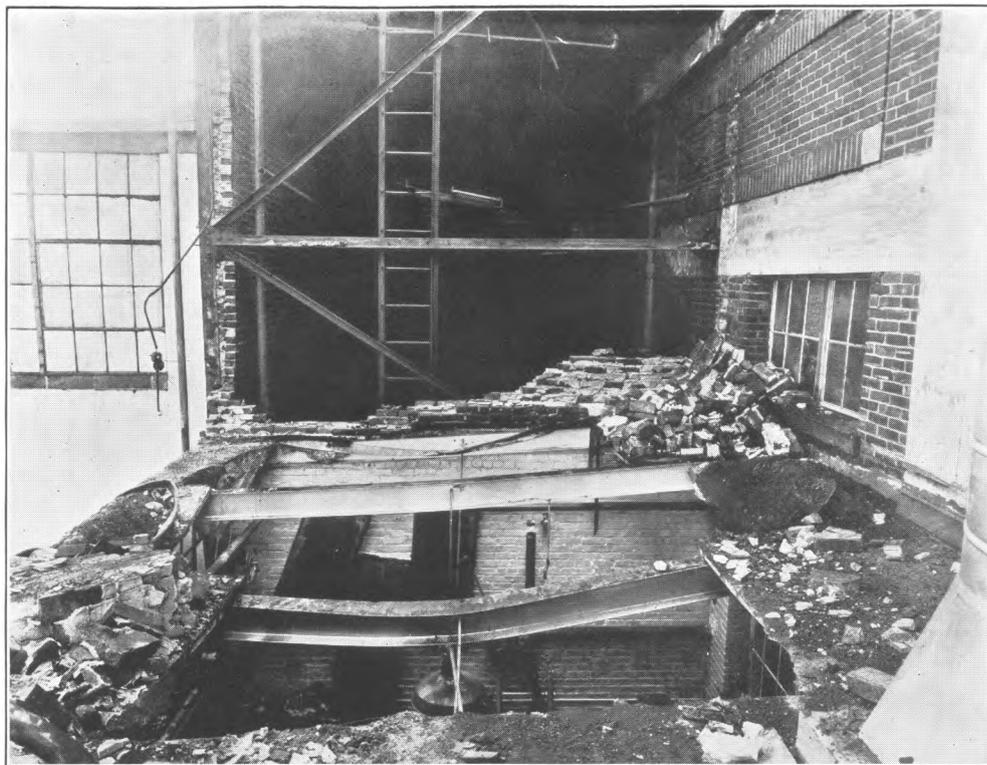
Safety Code for the Prevention of Dust Explosions in Starch Factories

(American Standard, approved, including following revision, Feb. 4, 1935, by American Standards Association)

The entire text of this safety code appears in the Bureau of Labor Statistics Bulletin No. 562, page 5.

In accordance with adoption by the National Fire Protection Association (Proceedings, 1934, p. 280), section 9, Mechanical Precautions, paragraph 91, has been revised to read as follows:

Unless ball or roller bearings are employed the speed of revolution of spiral conveyors shall not exceed 100 revolutions per minute, and graphite buttons or other suitable material shall be inserted in the bearing surfaces of all sleeve bearings. When feasible the upper half of the sleeve bearing may be removed to permit the stock to move freely over the bearing surfaces.



RESULTS OF A DUST EXPLOSION IN A WOODWORKING PLANT. FOUR MEN WERE KILLED AND 14 WERE INJURED. PROPERTY DAMAGE AMOUNTED TO \$35,000.



DUST EXPLOSION IN A FLOUR MILL, IN WHICH ONE WORKMAN WAS KILLED, FIVE OTHERS WERE INJURED, AND PROPERTY DAMAGE WAS APPROXIMATELY \$60,000.



DUST EXPLOSION IN A FEED MILL. ONE KILLED, FIVE INJURED, AND PROPERTY DAMAGE \$150,000.



WORKHOUSE OF GRAIN ELEVATOR OF LARGE FLOUR MILL COMPLETELY WRECKED BY A DUST EXPLOSION. ONE MAN WAS KILLED, FOUR WERE INJURED, AND PROPERTY LOSS WAS MORE THAN \$190,000.

Safety Code for the Prevention of Dust Explosions in Flour and Feed Mills

(American Standard, approved Feb. 4, 1935, by American Standards Association. Revision of American Standard approved Jan. 12, 1928)

Definitions

In this safety code the following words are used as defined below:

“Shall” is intended to indicate requirements.

“Should” is intended to indicate recommendations, or that which is advised but not required.

“Approved” refers to approval by the authority having jurisdiction in the enforcement of regulations.

Section 1.—Introductory

101. *Object.*—These regulations have two principal objects: First, to prevent dust explosions and minimize the resulting damage, should an explosion occur; and second, to provide regulations for minimizing fire hazards.

102. These regulations are applicable to flour and feed mills erected subsequent to the date of these regulations, and are offered as an advisory guide for owners and operators who may wish to avail themselves of the information herein contained to improve existing mills.

103. *Good Housekeeping and clean premises are the first essentials in the elimination of explosion hazard. Consequently, these regulations are not intended to lessen in any way the responsibility of the owner or operator in this respect.*—It should also be emphasized that every potential fire cause may produce a dust explosion. All devices and processes should be safeguarded in accordance with the regulations applying.

Section 2.—Structural Features

201. *Construction of mill buildings.*—Modern mills of large capacity are, with few exceptions, of fire-resistive construction, with walls, floors, and roofs of brick and concrete. However, these rules apply equally well to mill-constructed buildings, brick, open-joisted, or even-frame mill buildings. The processes of milling require heavy construction, and dependence for venting explosion must be placed on large window area. Glass should be no thicker than necessary, and wired glass should be used only where necessary as protection against

exposure. Windows should be arranged to provide maximum ventilation when open and should preferably be of hinged or tilting type.

202. *Construction of grain storage.*—Modern grain storages are, with few exceptions, constructed of concrete, but these regulations are devised to apply equally well to steel or frame construction. Cupolas, galleries, and those sections of grain storages not requiring strength should be of as light construction as is practicable. The lighter the construction, the less damage will result from explosion, but the type employed will be influenced by considerations of resistance to wind pressures, permanence, ease of obtaining smooth interior finish, condensation of atmospheric moisture, etc. With heavy wall construction, dependence for explosion venting must be placed on large window area. Glass should be no thicker than necessary, and wired glass should be used only where necessary as protection against exposure. Windows should be arranged to provide maximum ventilation when open, and should preferably be of the hinged or tilting type.

203. *Surfaces and ledges.*—All interior surfaces, including the inside of bins and garner, should be as smooth as practicable. Horizontal surfaces inaccessible to cleaning and all pockets and ledges should be minimized. Such as must necessarily exist shall be inclined as steeply as possible.

204. *Locations.*—As great a space as is practicable should be provided between the grain storage sections and the mill.

205. *Communications.*—At the points where belt conveyor galleries or tunnels are connected to main buildings, tight incombustible partitions should be provided. When communicating with structures wholly or partly of combustible construction, partitions should be of fire-resistance equal to adjoining incombustible walls. Belt openings in the partitions should be as small as possible and equipped with a vertical automatic fire door with roller at bottom, closing down on belt, leaving smallest possible opening when closed. Screw conveyors should be protected at fire walls with effective choking devices. Door openings should be protected by self-closing fire doors. All fire doors shall be of approved class A type if partition is of masonry; if partition is of metal, approved class B or class C doors may be used. All other openings toward or into the combustible structure should be protected by approved fire doors, shutters, or fire windows. The requirement for self-closing doors on communications is to prevent circulation of dust-laden air.

NOTE.—For the installation of fire doors and shutters see Regulations of the National Fire Protection Association for the Protection of Openings in Walls and Partitions.¹

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

206. *Grain bins and tanks.*—All bins and tanks should be provided with dust-tight covers or decks.

NOTE.—If bins are covered, bin floor should be water-tight to prevent water damage to grain in event of explosion or fire, and manholes should be curbed at least 2 inches, with overlapping covers. Curbs may be sloped if desired. Bin floor should be scuppered. For standards applying to scuppers see Regulations of the National Fire Protection Association for Mill Construction.¹ Manholes should be large enough to admit workmen wearing respiratory apparatus; at least 24-inch diameter is suggested.

207. *Basements, tunnels, and galleries.*—Exterior walls of basements and tunnels should have as much natural light and ventilation as possible. When natural ventilation is insufficient to prevent dust clouds, positive aspiration should be provided. Tunnels and galleries should be of such width and height as to afford easy access for sweeping on both sides and under each belt.

208. *Shafts.*—All stairways and passenger elevators shall be enclosed in tight incombustible shafts, with all doors incombustible and self-closing, or closed from within by elevator operator.

209. *Roofs.*—Roofs of grain storage unit, cupolas, and galleries should be provided with monitors or other ventilators which will, in conjunction with windows, provide frequent change of air.

210. *Venting of bins and tanks in grain storage unit.*—(a) Each bin or tank, including interspaces, should be separately vented to outside. Each vent should be equivalent in area to a round opening 12 inches in diameter, or larger. All vents, wherever possible, should be vertical stacks and should be equipped with a weather hood of a type that will not permit wind to blow into vent. Where there is a story above the bins, such vent may necessarily be located in the side of bin immediately below its top, in which case the terminal of vent shall be of special design which will not permit wind to blow into vent. No portion of vent shall be other than vertical if such arrangement is possible, on account of liability of choking with accumulation of dust.

(b) If a vertical stack cannot be installed on a bin or tank on account of interference with operation of house, or structural conditions, stack may be inclined not more than 45 degrees from vertical, and, where necessary, two or more such stacks may be connected to a common header stack and thence to the outside. Such stacks (including header) may be inclined not more than 45 degrees from vertical. There shall be no intercommunication of bins except through stacks which may necessarily join in a common header stack as above.

Section 3.—Equipment

301. *Elevator legs.*—(a) Elevator legs, heads, and boots should be constructed of metal. Elevator leg belts shall be enclosed in separate casings for both up and down legs. Heads shall be hopped to either

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

the down or up leg, but not to both. Leg casings and connecting spouts shall be dust-tight. All doors or other openings in same shall be equipped with dust-tight covers. Wood or wood rim pulleys shall not be used. Boots should be above floor, rather than in pits, but, if latter, should be afforded ample room for cleaning and oiling, be accessible by permanent iron ladder, and well lighted without the use of extension cords.

(b) Elevator boots should be so constructed as to minimize the possibility of chokes.

(c) Hand holes should be provided at head and boot for convenience in inspection of belts and pulleys.

(d) Where grain is delivered to boot by conveyor belt, the latter should be equipped with an automatic mechanical or electrical device that will stop the belt or notify operator when the leg chokes or slows down.

302. *Back stops.*—Elevator legs handling grain should be equipped with special automatic back stops.

303. *Legs, run idle.*—All legs, conveyors, machines, car-pullers, etc., should be so arranged as to avoid, insofar as possible, the necessity for running idle.

304. *Cleaners.*—All cleaning, or other grain processing machinery should be of incombustible construction. When wooden machines are used, such machines should be metal clad; i. e., metal sheathing is tightly secured to all wooden surfaces that may feasibly be so covered. All clippers, smutters, and scourers shall be equipped with a screen to exclude all matter of larger size than the grain treated by the machine.

305. *Space under machines.*—All cleaners and similar machines should be set at least 8 inches above floor, to provide access for sweeping.

306. *Electromagnetic or pneumatic separators.*—(a) Approved electromagnetic or pneumatic separators shall be installed ahead of all grinding or pulverizing machines, such as roller mills, attrition mills, and hammer mills (except those mills which further reduce ground stock in the same system for which adequate protection has already been provided). Such separators shall be in effective service at all times when the mill is in operation.

(b) The electromagnetic separator coil shall be energized from a source of direct current supplied by a circuit from direct current lighting or power supply, by an approved direct current generator, or by an approved rectifier.

(c) The magnetic field of the electromagnetic separator shall be thoroughly effective through the entire width of the spout or feed apron in which it is installed if the separator is of the spout type, or, if of the drum or pulley type, shall be effective through the entire

width of the enclosure or belt. The design shall be such as to prevent the passage of grain, or other materials being ground, through the separator without coming under the influence of the magnetic field. Due consideration shall be given to providing sufficient gap between pole pieces to insure effectiveness of the field to a reasonable height above the magnetic plate or drum.

(d) Separators which are not of the self-cleaning type shall be so constructed or equipped that, should the current in the magnet coil be interrupted or seriously decreased, the accumulated magnetic materials will be prevented from entering the mill by means of a safety gate or trap designed to open and close automatically. In the spout-type separator a baffle or other effective means shall be provided ahead of the magnetic plate to prevent foreign material from bounding over the magnetic plate and to insure that the grain stream passing over the magnetic plate shall be of a depth and speed not too great to permit of effective separation.

(e) There shall be installed in the circuit to each electromagnetic separator a pilot light located at a point where it will be readily seen by the mill operator to indicate when the separator is receiving current.

(f) In installing the electromagnetic separator it is desirable that it be placed as near the mill it is intended to protect as practicable. Spout-type separators should not be placed at an angle greater than 35 degrees to the horizontal, and in no case shall the angle exceed 45 degrees.

(g) Pneumatic separators shall be so designed that all foreign materials will be removed from the grain being ground. Proper provisions shall be made for the removal of such accumulated foreign materials from the separator.

(h) It is recommended that a scalping shoe or other rough cleaning machine be installed ahead of the magnetic or pneumatic separator in order that sticks, large stones, and other bulky foreign material be prevented from entering the spouts leading to the grinding machinery.

(i) It is also required that scourers, when used, be protected by effective pneumatic or electromagnetic separators.

307. *Friction clutches.*—If friction clutches are used, they shall be constructed entirely of incombustible material.

308. *Screw conveyors.*—Screw conveyors should be fully enclosed in tight, substantial metal housings, with free-lifting covers at discharge and over each shaft coupling.

309. *Bearings.*—Roller or ball bearings are recommended for all head shafts, boot pulleys, fans, cleaning, processing or grinding machinery, trippers, and belt conveyors. Ordinary sleeve or flat bearings in old equipment should be equipped with approved journal alarms.

All bearings should be provided with dust caps or other tight closure of all lubrication inlets.

310. *Space under conveyors.*—There should be at least 6 inches clear space under all rollers supporting conveyor belts, to provide access for sweeping.

311. *Spouts and throw of grain in the open.*—Spouts shall be stationary wherever feasible. Portable and movable spouts will be permitted in working floor, bin, or distributing floor. There should be no throw of grain in the open for considerable distances not confined in spouts (not applying to discharge of grain inside of bins). Grain chutes also permit large amounts of dust to escape and should not be used if their use may be dispensed with.

NOTE.—Dropping grain from bin bottoms or conveying in open chutes releases dust clouds dense enough to explode if a source of ignition is present and scatters large amounts of dust which must be swept up, producing a highly undesirable condition in an elevator in which all other danger spots may be well safeguarded. Specially designed aerators located on the exterior of elevator or separated from same by a space are now used to some extent and are recommended as removing a dust-creating process from the working story to the open air.

312. *Spouting of grain into bins or tanks.*—Spouts introducing grain into bins or tanks should be arranged, where possible, to prevent grain stream striking side of bin, on account of the possibility of tramp iron striking a spark on contact with side.

313. *Flour and feed bins.*—Manufactured stock bins should be constructed of materials not less fire-resistive than the building. If of wooden construction, those bins receiving stocks of feed directly from attrition or hammer mills should be lined with metal. All manufactured stock bins should be provided with signs placed on inspection doors, warning against the use of open lights or unprotected light bulbs.

314. *Attrition and hammer mills.*—(a) In addition to the pneumatic or electromagnetic separators required under section 306, attrition and hammer mills shall be equipped with all-metal ground stock handling systems. When the pneumatic system of ground stock handling is used, all spouting, air trunking, fans, and collectors shall be of metal. The collector shall be vented to the outside of the building. When the elevator system of stock handling is used, all spouting, elevator legs, and other connections shall be of all-metal construction. The elevator should be vented to the outside of the building or provided with positive air aspiration.

(b) When the stock collector or elevator handling the ground stock discharges into a bin of combustible construction, such bin shall be dust-tight except for vent to outside and shall be lined with metal. (See sec. 313.)

(c) All spouts, trunking, elevator legs, and bins shall be tightly joined to prevent so far as possible escape of dust into the rooms where they are located.

(d) Attrition and hammer mills should be overhauled regularly to prevent mechanical rupture of plates or hammers through excessive wear.

315. *Manufactured stock driers.*—(a) Stock driers should be of metal construction, including all spouting connected therewith. Steam heated driers may be located in any suitable part of the plant. Rotary steam driers should not be stopped until after the steam has been shut off and the steam pipes have had appreciable time to cool.

(b) Direct fire-heated driers, whether fired by coal, coke, gas, or fuel oil, should be permitted only when in a separate fire-resistive room, containing no other machine or process which tends to or may produce dust. Conveyors and spouts to and from drier should be of metal, and all openings from room should be protected with fire doors.

Section 4.—Grain Driers

401. *Location.*—Driers should be placed in a separate fire-resistive division, separated from elevator or tanks by as much space as practicable.

402. *Louvers.*—Louvers, or other permanent openings where air enters or is exhausted from buildings, shall be protected by substantial corrosion resistive wire screens, not exceeding one-third inch mesh, to exclude sparks, birds, paper, etc.

403. *Garner and hoppers.*—Garner, hopper, or bin over drier and same under cooling section shall be dust-tight and provided with adequate positive air aspiration or effective vents to outside.

NOTE.—No special ventilation is required for hopper open to cooler which is under suction.

404. *Removal of refuse from grain.*—All grain should pass over a coarse screen immediately ahead of drier to remove cobs, paper, sticks, etc.

405. *Floors.*—Where floors or runways around drier and cooler are necessary, same should be of gratings. Where air separation is necessary (as between drier and cooler), a dust hopper under the grating floor connected to dust-collecting system should be provided.

NOTE.—Solid floors may be used if all air is drawn from drier and cooler through continuous ducts to fan and blown to dust-settling chamber with hopper bottom connected with dust-collecting system.

406. *Floor sweeps.*—A floor sweep (“sweep-up” pipe) is recommended and should be located on each solid floor in building containing drier.

407. *Fans*.—Fans shall conform to Regulations of the National Fire Protection Association for Blower and Exhaust Systems.¹ The requirement for nonferrous parts (section 411 of Blower Regulations) shall apply unless blowing only air taken from outside building through continuous tight duct.

408. *Steam coils*.—(a) Steam coils shall be so designed, installed, and arranged that dust will not lodge on coils, headers, or elsewhere in casing containing same. Coil room should be separated by dust-tight partitions and floors from drying section and all other parts of drier house.

(b) Room containing coils shall have grating floor, and, if system requires separation from room below, same should consist of dust hoppers under the grating floor, such hoppers to be connected at bottom to dust-collecting system. This rule shall not apply if room containing coils is segregated as recommended in section 409 (a), or if all air is drawn from drier and cooler through continuous ducts to fan and blown to dust-settling chamber with hopper bottom connected with dust-collecting system, but floor of coil room shall be so arranged that hand sweeping is not rendered difficult by obstructions.

409. *Fire-heated driers*.—(a) The drier furnace shall be located in a fire-resistive room or division separated from the drier columns and fans and the plant proper by masonry walls with no communication except the ducts leading from furnace to the drier fans carrying products of combustion.

(b) Fire-heated driers shall be provided with reliable automatic means for regulating the temperature in the drying columns, which shall consist of two independent control systems consisting of:

(1) An automatic control system designed to hold the temperature within predetermined limits at the discretion of the operator, and

(2) An emergency control system which will operate when the temperature in the drying column reaches a dangerous point (usually set at 230° Fahrenheit and sealed) by permitting the entrance of cold air into the drying columns.

Where such temperature controls are operated by air pressure, suitable means shall be provided to stop the drier fans automatically in case of air failure caused by leaking or broken air lines or other reasons.

In addition to the automatic temperature controls required in the preceding paragraphs, suitable visual thermometers shall be provided. One of these shall preferably be of the extension dial type with the dial located at a point near the firing end of the furnace so as to be in plain sight of the operator.

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

The temperature control systems for fire-heated driers shall be kept in proper operating condition at all times when the drier is in use.

(c) When coal or coke is used as fuel for fire-heated driers, due consideration shall be given to the proper storage of these fuels and the disposal of their ashes. When gas is used as the fuel, it is important that the piping system be properly installed with tight joints to prevent leakage. In addition to the gas control valves located at the drier furnace, there shall be provided an additional valve outside of the buildings in an accessible place to permit shutting off the gas supply to the furnace in case of emergency. Oil may be used for fuel only when special permission is given by the inspection department having jurisdiction, whereupon special instructions for the installation will be given.

Section 5.—Removal and Control of Dust

501. *Heads and boots.*—All heads and boots shall be dust-tight and provided with adequate positive air aspiration or effective vents to outside.

502. *Belt loaders.*—All places where grain is discharged onto belts should be provided with adequate positive air aspiration, except where equipped with specially designed choke feed or other arrangement which is effective in preventing the liberation of dust.

503. *Belt discharges and trippers.*—All places where belts discharge grain should be provided with adequate positive air aspiration both above and below grain stream. Trippers may be equipped with a self-contained fan unit mounted on tripper carriage and driven by the belt, or by other effective means. It is recommended that air aspiration or other effective means be applied to ends of these belts where no grain is discharged, to prevent tailings of chaff and dust accumulating on floor at end of belt.

504. *Machines.*—All cleaning and similar machines which produce an appreciable amount of dust shall be provided with adequate positive air aspiration.

505. *Dust-collecting system.*—The entire dust-collecting system shall conform to Regulations of the National Fire Protection Association for Blower and Exhaust Systems.¹ All machines which produce an appreciable amount of dust should be made dust-tight. Cleaners, scourers, purifiers, roll housing, and similar machines shall be provided with positive air aspiration.

Section 6.—Removal of Static Dust

601. *Sweeping.*—Dust on floors and other surfaces, including all galleries and tunnels, shall be removed daily by sweeper. As many sweepers shall be employed as are necessary to keep the building

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

clean. Push brooms of hair or soft fiber are recommended, as they will throw less dust into suspension than ordinary brooms and are better adapted to sweeping under belts and other machinery. Spills and chokes shall be cleaned up daily. (See section 806, Shovels.) General cleaning should not be done with compressed air (for use in cleaning motors, see note under section 701).

Section 7.—Electrical Equipment

701. *Wiring and equipment.*—All electric wiring and equipment shall conform to the National Electrical Code.¹ All parts of flour and feed mills, grain elevators, tanks, and driers shall be considered class II locations under article 32 of the National Electrical Code,¹ except offices and similar locations so occupied and segregated as to be reasonably free from dust, and so approved by the authorities having jurisdiction.

NOTE.—Unenclosed motors, such as are used in many old mills and elevators, gather dust in the windings, which is blown out by compressed air. While objectionable because it throws dust into suspension, periodic cleaning is necessary, and no better method being known, it is recommended that such motors be blown frequently under supervision of plant electrician. Motors shall not be blown while running.

702. *Extension cords.*—It is important that the provisions of the National Electrical Code,¹ article 32, be observed. This requires dust-tight globes, with substantial guards fitted with type S or type P. A. cord and approved receptacles and attachment plugs.

703. *Lighting.*—Lighting shall be incandescent electric, conforming to provisions of article 32, class II, of the National Electrical Code.¹ Watchman shall use electric lantern or flashlight, or a separate light circuit on each floor for use of watchman shall be provided. Electric lantern or flashlight shall be used in mills and elevators where electric current is not available.

Section 8.—Miscellaneous

801. *Heating.*—Steam is recommended for heating, and steam generator should be located outside of mill or elevator proper, preferably in a fireproof building or enclosure. Radiators and pipes shall be kept free of all combustible material. Approved electric heaters will be permitted in offices and similar locations so occupied and segregated as to be free from dust.

802. *Protection against sparks.*—All openings less than 50 feet above ground in exterior walls on track or dock side should be protected against sparks by substantial wire screens of one-third to one-quarter inch mesh.

803. *Locomotives excluded.*—Steam locomotives should not be permitted to enter mill or elevator or track shed, on account of the spark hazard and possibility of live coals dropping into track hoppers.

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

804. *Railway cars.*—Railway cars should not be allowed to remain inside mill, elevator, or car shed nights, Sundays, holidays, or when elevator is shut down and not in operation.

805. *Insect control.*—Processes and materials for the extermination of weevils, Mediterranean moth, etc., shall be without fire hazard or with hazard reduced to an acceptable degree, and shall be in accordance with the requirements of the regulations¹ prepared by the Committee on Fumigation Hazards of the National Fire Protection Association.

806. *Shovels.*—In shoveling of grain, dust, and other refuse on concrete or steel bin bottoms, floors, etc., the danger of igniting suspended dust by sparks should be reduced by equipping the cutting edge of shovels with a strip of nonferrous metal.

807. *Smoking.*—Smoking shall be prohibited, and conspicuous signs to that effect posted throughout the buildings.

808. *Waste cans.*—Approved containers shall be provided, all oily waste and other rubbish deposited therein and emptied daily.

809. *Lockers.*—Workmen's clothing shall be kept in metal lockers, preferably in a separate building.

810. *Oils.*—Main storage of lubricating oil and grease shall be outside. Storage of lubricating oil and grease in the building shall be limited to a maximum of 5 barrels and shall be in an oil room of incombustible construction.

811. *Lightning protection.*—All combustible mills and elevators should be equipped with approved lightning protection, or, if roof and walls are metal clad, same may be accepted as constituting lightning protection if provided with approved metallic contacts at eaves, and walls grounded in approved manner.

812. *Static electricity.*—Static electricity shall be removed from such machines or equipment as accumulate a charge, by permanent ground wires and from belts by grounded metal combs or other equally efficient means. Grounds shall be attached to equipment and to the earth in accordance with the National Electrical Code,¹ article 9.

813. *Spontaneous ignition.*—Spontaneous ignition occurs in flour and feed mills in accumulations of dust, oily waste, many kinds of feeds, hay, and even in some grains. The obvious remedy for the first two is the prevention of accumulation of quantities of dust and the proper storage and removal of oily waste.

Various kinds of feeds, such as molasses feeds, gluten, brewer's grains and even bran, will ignite spontaneously. The usual cause is excessive moisture, and the remedy is a safe moisture content at time of manufacture and protection against accumulation of moisture during storage.

Storing such feeds in bulk should be avoided if possible. Other-wise temperature reading should be provided for, either by means

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

of temperature recording systems or by iron rods driven to bottom of bins and extracted regularly for inspection.

Sacked feeds should be so piled as to provide free circulation of air. Incoming stocks should be carefully examined for moisture content and for stocks which have become wet during the process of transportation.

Baled hay is particularly subject to spontaneous ignition under certain climatic conditions. Very dry hay brought into a territory of high moisture content of air induces rapid absorption of oxygen and ignition. Also wet hay heats rapidly and starts the process of ignition. The remedy is to pile bales loosely so that each bale has a free air surface for the radiation of heat and for free circulation of air.

Hot feeds or hay should be removed from the premises at once and so stored that ignition of feed will not endanger other property.

Section 9.—Fire Protection

901. *First Aid Appliances.*—Casks and pails and other suitable first aid protection shall be provided to protect all buildings. Non-conducting liquid or gas fire extinguishers shall be maintained near all motors and other electrical apparatus (other than lighting equipment). See Regulations of the National Fire Protection Association for First Aid Fire Appliances.¹

902. *Watchman.*—All mills and elevators should be patrolled by watchman reporting to or by approved time-recording apparatus. See section 703 for recommendations as to lights for use of watchman. For further information on this subject see the National Fire Protection Association pamphlet entitled "The Watchman."¹

903. *Standpipe and Hose.*—Standpipe systems should be installed to protect all parts of mills and elevators. See Regulations of the National Fire Protection Association for Standpipe and Hose Systems.¹

904. *Use of hose streams.*—Fire department or standpipe hose stream should be used with great care around a mill or elevator. Their careless and unnecessary use may cause dust explosions by throwing dust into suspension.

905. *Fire in bin or tanks.*—If fire occurs in a bin, no attempt to clear the bin should be made until it is definitely known that the fire has been extinguished, as there is possibility of a dust explosion in dropping grain on to a belt if a trace of fire remains in the grain.

906. *Automatic sprinklers.*—An approved system of automatic sprinklers is recommended for any combustible mill or elevator, and, where feasible, for the protection of such parts of incombustible mills or elevators as contain combustibles, other than grain and belts, in quantity sufficient to produce a serious fire.

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

Safety Code for the Prevention of Dust Explosions in Terminal Grain Elevators

(American Standard, approved, including following revision, Feb. 4, 1935, by American Standards Association)

The entire text of this safety code appears in the United States Bureau of Labor Statistics Bulletin No. 562, page 15.

In accordance with adoption by the National Fire Protection Association (Proceedings, 1933, p. 344), section 9, Miscellaneous, paragraph 906, has been revised to read as follows:

906. *Insect control.*—Processes and materials for the extermination of weevils, Mediterranean moth, etc., shall be without fire hazard or with hazard reduced to an acceptable degree, and shall be in accordance with the requirements of the regulations¹ prepared by the National Fire Protection Association Committee on Fumigation Hazards.

¹ Obtainable from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

Safety Code for the Installation of Pulverized-Fuel Systems

(American Standard, approved, including following revisions, Feb. 4, 1935, by American Standards Association)

The entire text of this safety code appears in the United States Bureau of Labor Statistics Bulletin No. 562, page 45.

In accordance with adoption by the National Fire Protection Association (Proceedings, 1933, pp. 344-5) the following paragraphs have been revised to read:

Section 20 (b) revised to read:

Where operating bin and mill vents are discharged into the furnace, each vent from mill or bin to the furnace shall be provided with a fan; fan and discharge pipe shall be so proportioned that the velocity of air and pulverized fuel in the discharge pipe from the fan is not less than 70 feet per second. Each fan shall be provided with tight inlet and outlet dampers, arranged to open only when the flow is toward the furnace, to close automatically on interruption of flow and be positively held closed when the fan is not in operation. The pipe from the fan to furnace shall be laid out at such an angle as to provide no place for dust to accumulate, and from the outlet damper to the furnace shall be at least equal to the requirements for section 26, specification no. 2.

Arrangement of Systems

Section 41 revised to read:

No pulverizer shall be connected to supply more than one furnace at a time unless each pipe leaving the mill is provided with an approved dust-tight valve installed in a vertical riser, in such a way that dust accumulations back of the valve will fall into the mill. This shall not be construed as preventing the installation of spare pulverizers which may be connected to any of several furnaces if the regular pulverizer is disconnected, i. e., a section of the discharge pipe between the pulverizer and the furnace removed.

Section 42 revised to read:

Piping from mill to burners shall be so arranged that when a mill is in use, all burners which that mill can supply shall be in operation, unless each pipe leaving the mill is provided with an approved dust-tight valve installed in a vertical riser, in such a way that dust accumulations back of the valve will fall into the mill.

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. Publications indicated by an asterisk, which are not available for free distribution, can in some cases be obtained by purchase from the Superintendent of Documents, Government Printing Office, Washington D. C.; all can be consulted at libraries which are Government repositories.

Collective agreements.

- *No. 191. Collective bargaining in the anthracite coal industry. [1916.]
- *No. 198. Collective agreements in the men's clothing industry. [1916.]
- 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.

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. 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 and activities, etc. [1921.]
- *No. 303. Use of Federal power in settlement of railway labor disputes. [1922.]
- *No. 481. Joint industrial control in the book and job printing industry. [1923.]

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).
- *No. 531. Consumers', credit, and productive cooperative societies, 1929.
- *No. 598. Organization and management of consumers' cooperative associations and clubs (with model bylaws). [1934.]
- No. 606. Organization and management of cooperative gasoline and oil associations (with model bylaws). [1934.]
- No. 608. Organization and management of cooperative housing associations (with model bylaws). [1934.]
- No. 612. Consumers', credit, and productive cooperation in 1933.

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 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 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. 542. Report of the Advisory Committee on Employment Statistics. [1931.]
- *No. 544. Unemployment-benefit plans in the United States and unemployment insurance in foreign countries. [1931.]
- No. 553. Fluctuation in employment in Ohio, 1914 to 1929.
- *No. 555. Social and economic character of unemployment in Philadelphia, April 1930.
- No. 610. Revised indexes of factory employment and pay rolls, 1919 to 1933.
- No. 611. Unemployment insurance and reserves in the United States: A selected list of recent references. [1935.]
- No. 613. Average annual wage and salary payments in Ohio, 1916 to 1932.

Housing.

- *No. 158. 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, 1920.
- No. 545. Building permits in the principal cities of the United States [1921] to 1930.
- No. 608. Organization and management of cooperative housing associations (with model bylaws). [1934.]

Industrial accidents and hygiene (including occupational diseases and poisons).

- *No. 104. Lead poisoning in potteries, tile works, and porcelain-enameled sanitary ware factories. [1912.]
- No. 120. Hygiene of the painters' trade. [1913.]
- *No. 127. Dangers to workers from dusts 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 costs 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. The safety movement in the iron and steel industry, 1907 to 1917.
- *No. 236. Effects of the air hammer on the hands of stonemasons. [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. 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. [1930.]
- *No. 582. Occupation hazards and diagnostic signs: A guide to impairments to be looked for in hazardous occupations. (Revision of Bul. No. 306.) [1933.]
- No. 602. Discussions of industrial accidents and diseases at the 1933 meeting of the International Association of Industrial Accident Boards and Commissions, Chicago, Ill.

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.]
- No. 483. Conditions in the shoe industry in Haverhill, Mass., 1928.
- No. 534. Labor conditions in the Territory of Hawaii, 1929-1930.

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. 581. Laws relating to employment agencies in the United States, as of January 1, 1933.
- No. 583. Proceedings of the National Conference for Labor Legislation, held at Washington, D. C., February 14 and 15, 1934.
- No. 590. Labor legislation, 1931 and 1932.
- *No. 592. Decisions of courts and opinions affecting labor, 1931 and 1932.
- No. 596. Laws relating to prison labor in the United States, as of July 1, 1933.
- *No. 603. Comparative digest of labor legislation for the States of Alabama, Florida, Georgia, South Carolina, Tennessee. [1933.]
- No. 609. Discussions of labor laws and their administration at the 1933 convention of the Association of Government Officials in Industry of the United States and Canada, Chicago, Ill.

Labor laws of foreign countries.

- *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.]
- No. 529. Workmen's compensation legislation of the Latin American countries. [1930.]
- No. 549. Labor legislation of Venezuela. [1931.]
- No. 554. Labor legislation of Paraguay. [1931.]
- No. 559. Labor legislation of Ecuador. [1931.]
- No. 569. Labor legislation of Mexico. [1932.]

Labor organizations.

- *No. 342. International Seamen's Union of America: A study of its history and problems. [1923.]
- *No. 461. Labor organizations in Chile. [1928.]
- *No. 465. Beneficial activities of American trade unions. [1928.]
- *No. 506. Handbook of American trade unions: 1929 edition.

Minimum wage.

- *No. 167. Minimum-wage legislation in the United States and foreign countries. [1915.]
- *No. 176. Effect of minimum-wage determinations in Oregon. [1915.]
- *No. 285. Minimum-wage laws of the United States: Construction and operation. [1921.]
- *No. 467. Minimum-wage legislation in various countries. [1928.]

Old-age care, pensions, and insurance.

- *No. 386. Cost of American almshouses. [1925.]
- *No. 465. Beneficial activities of American trade unions. [1928.]
- *No. 477. Public-service retirement systems, United States, Canada, and Europe. [1929.]
- *No. 489. Care of aged persons in the United States. [1929.]
- *No. 505. Directory of homes for the aged in the United States. [1929.]
- No. 561. Public old-age pensions and insurance in the United States and in foreign countries. [1932.]

Prison labor.

- No. 372. Convict labor in 1923.
- No. 595. Prison labor in the United States, 1932.
- No. 596. Laws relating to prison labor in the United States, as of July 1, 1933.

Proceedings of annual conventions of the International Association of Government Labor Officials.

- *No. 266. 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.
- *No. 530. Seventeenth, Louisville, Ky., May 20-23, 1930.
- *No. 563. Eighteenth, Boston, Mass., May 18-22, 1931.
- *No. 609. Nineteenth, Chicago, Ill., September 14-15, 1933.

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.
- No. 536. Seventeenth, Wilmington, Del., September 22-26, 1930.
- No. 564. Eighteenth, Richmond, Va., October 5-8, 1931.
- No. 577. Nineteenth, Columbus, Ohio, September 28-29, 1932.
- *No. 602. Twentieth, Chicago, Ill., September 11-14, 1933.

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.
- No. 538. Seventeenth, Philadelphia, Pa., September 24-27, 1929; eighteenth, Toronto, Canada, September 9-12, 1930.

Productivity of labor and technological unemployment.

- 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 cost of production and wages and hours of labor in the paper box-board 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.]
- No. 550. Cargo handling and longshore labor conditions. [1932.]
- No. 574. Technological changes and employment in the United States Postal Service. [1932.]
- No. 585. Labor productivity in the automobile-tire industry. [1933.]
- No. 593. Technological changes and employment in the electric-lamp industry. [1933.]

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, 1890 to 1923.

Safety codes.

- *No. 336. Safety code for the protection of industrial workers in foundries.
- *No. 350. Rules governing the approval of 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. 382. Code of lighting school buildings.
- No. 410. Safety code for paper and pulp mills.
- *No. 430. Safety code for power presses and foot and hand presses.
- 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.
- No. 527. Safety code for the use, care, and protection of abrasive wheels, as revised 1930.
- No. 556. Code of lighting: Factories, mills, and other workplaces. (Revision of 1930.)
- No. 562. Safety codes for the prevention of dust explosions.

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. 407. Labor cost of production and wages and hours of labor in the paper box-board 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. 494. Wages and hours of labor of common street laborers, 1923.
- *No. 502. Wages and hours of labor in the motor-vehicle industry, 1923.
- No. 514. Pennsylvania Railroad wage data. From Report of Joint Fact Finding Committee in wage negotiations in 1927.
- No. 523. Wages and hours in the manufacture of airplanes and aircraft engines, 1929.
- No. 525. Wages and hours of labor in the portland cement industry, 1929.
- No. 532. Wages and hours of labor in the cigarette-manufacturing industry, 1930.
- No. 534. Labor conditions in the Territory of Hawaii, 1929-30.
- No. 539. Wages and hours of labor in cotton-goods manufacturing, 1910 to 1930.
- No. 547. Wages and hours of labor in the cane-sugar refining industry, 1930.
- No. 567. Wages and hours of labor in the iron and steel industry, 1931.
- No. 568. Wages and hours of labor in the manufacture of silk and rayon goods, 1931.
- No. 570. Wages and hours of labor in foundries and machine shops, 1931.
- No. 571. Wages and hours of labor in the furniture industry, 1910 to 1931.
- No. 573. Wages and hours of labor in metalliferous mining, 1924 to 1931.
- No. 575. Wages and hours of labor in air transportation, 1931.
- No. 576. Wages and hours of labor in the slaughtering and meat-packing industry, 1931.
- No. 578. Wages and hours of labor in gasoline filling stations and motor-vehicle repair garages, 1931.
- No. 579. Wages and hours of labor in the boot and shoe industry, 1910 to 1932.
- No. 580. Wages and hours of labor in the baking industry—bread and cake departments, 1931.
- No. 584. Wages and hours of labor in woolen and worsted goods manufacturing, 1932.
- No. 586. Wages and hours of labor in the lumber industry, 1932.
- No. 587. Wages and hours of labor in the rayon and other synthetic yarn manufacturing, 1932.
- No. 588. Wages and hours of labor in the dyeing and finishing of textiles, 1932.
- No. 589. Wages and hours of labor in the leather industry, 1932.
- No. 591. Wages and hours of labor in the hosiery and underwear industry, 1932.
- No. 594. Wages and hours of labor in the men's clothing industry, 1932.
- No. 600. Union scales of wages and hours of labor, May 15, 1933.
- No. 601. Wages and hours of labor in bituminous-coal mining, 1933.
- No. 604. History of wages in the United States from colonial times to 1928. Revision of Bulletin No. 499, with supplement, 1929-33.
- No. 613. Average annual wage and salary payments in Ohio, 1916 to 1932.

Welfare work.

- *No. 123. Employers' welfare work. [1913.]
- *No. 222. Welfare work in British munition 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.
- No. 565. Park recreation areas in the United States, 1930.

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. 572. Wholesale prices, 1931.

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. 175. Summary of the report on condition 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. [1917.]
- *No. 223. Employment of women and juveniles in Great Britain during the war. [1917.]
- No. 253. Women in the lead industries. [1919.]
- No. 467. Minimum-wage legislation in various countries. [1928.]
- No. 558. Labor conditions of women and children in Japan. [1931.]

Work of Federal and State departments of labor.

- 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. 479. Activities and functions of a State department of labor. [1928.]
- No. 599. What are labor statistics for? [1933.]
- No. 614. Bulletins and articles published by the Bureau of Labor Statistics: A selected list of references. [1935.]

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 of 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 on 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. 423. Workmen's compensation legislation of the United States and Canada, as of July 1, 1926.
- No. 496. Workmen's compensation legislation of the United States and Canada, as of January 1, 1929. (With text of legislation enacted in 1927 and 1928.)
- No. 529. Workmen's compensation legislation of the Latin American countries. [1930.]

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. 346. Humanity in government. [1923.]
- No. 398. Growth of legal-aid work in the United States. [1926.]
- No. 401. Family allowances in foreign countries. [1926.]
- No. 518. Personnel research agencies: 1930 edition.
- No. 599. What are labor statistics for? [1933.]
- No. 605. Labor through the century, 1833-1933. (Revised.)
- No. 607. Growth of legal-aid work in the United States. (In press.)
- No. 615. The Massachusetts system of savings-bank life insurance. [1935.]
- No. 616. Handbook of labor statistics, 1935 edition. (In press.)

