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FIRE RESISTANCE AND FIRE PREVENTION

Publications by the Staff of the National Bureau of Standards.

GENERAL INFORMATION

Some of the publications in this list have appeared in the regular series of publications of the Bureau and others in various scientific and technical journals. Unless specifically stated, papers are not obtainable from the National Bureau of Standards.

Where the price is stated, the publication can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. The prices quoted are for delivery to addresses in the United States and its territories and possessions and in certain foreign countries which extend the franking privilege. In the case of all other countries, one-third the cost of the publication should be added to cover postage. Remittances should be made either by coupons (obtainable from the Superintendent of Documents in sets of 20 for \$1.00 and good until used), or by check or money order payable to the "Superintendent of Documents, Government Printing Office", and sent to him with order.

Publications marked "O P" are out of print, but in general, may be consulted at technical libraries.

Series letters with serial numbers are used to designate Bureau publications:

T = "Technologic Paper". This series was superseded by the "Bureau of Standards Journal of Research" in 1928.

RP = "Research Paper". These are reprints of articles appearing in the "Bureau of Standards Journal of Research" and the "Journal of Research of the National Bureau of Standards", the latter being the title of this periodical since July 1934 (volume 13, number 1). The numbers underscored indicate the volume numbers.

- C = "Circular".
- BH = "Building and Housing" publication.
- BMS = "Building Materials and Structures" publication.
- H = "Handbook"
- M = "Miscellaneous Publication".
- LC = "Letter Circular" distributed free on application directly to the National Bureau of Standards.

Circular C24 and supplements, the complete list of the Bureau's publications (1901-1936), is sold by the Superintendent of Documents for 55 cents. Announcement of new publications is made each month in the Technical News Bulletin which is obtainable by subscription at 50 cents per year.

<u>Title</u>	<u>Series</u>	<u>Price</u>
Heat insulating properties of building materials. W. A. Hull, Tech. Pap. BS <u>12</u> (1919) - - - - Gives results of fire tests of cylindrical specimens of burned clay, concrete and gypsum. The insulation was measured by the temperature progress toward the center of the specimens.	T130	0 P
Fire tests of building columns. S. H. Ingberg, H. K. Griffin, W. C. Robinson, and R. E. Wilson. Tech. Pap. BS <u>15</u> (1921) - - - - - Gives results of tests of 106 protected and unprotected building columns when exposed under load to a standard fire test, followed in some tests by hose-stream application.	T184	75 ¢
Fire resistance of concrete columns. W. A. Hull and S. H. Ingberg. Tech. Pap. BS <u>18</u> , 635 (1924-25) - - - - - The paper reports results of 62 fire tests and 16 compression tests of concrete columns.	T272	25 ¢
Fire resistance of hollow load-bearing wall tile. S. H. Ingberg and H. D. Foster. BS J. Research <u>2</u> , 1 (1929) - - - - - Gives results of fire tests of typical hollow tile wall constructions and resulting fire resistance classifications.	RP37	75 ¢
Fire tests of columns protected with gypsum. Nolan D. Mitchell. BS J. Research <u>10</u> , 737 (1933) - - - - - Gives results of tests of six columns protected with hollow and solid gypsum blocks and with gypsum cast in place.	RP563	5 ¢

<u>Title</u>	<u>Series</u>	<u>Price</u>
Fire hazard of domestic heating installations. G. Q. Voigt. BS J. Research <u>11</u> , 353 (1933) Gives results of tests with smokepipes, stoves and furnaces placed at different dis- tances from combustible constructions.	RP596	0 P
Tests of theatre proscenium curtains. Nolan D. Mitchell. BS J. Research <u>11</u> , 491 (1933) -- Gives results of fire and operation tests of typical curtain constructions.	RP603	5 ¢
Compression tests of structural steel at ele- vated temperatures. Prentiss D. Sale. J. Research NBS <u>13</u> , 713 (1934) - - - - - Gives results with shapes and round bars at temperatures up to 945°C (1733°F), the slenderness ratio for the bars being in the general range 20 to 150.	RP741	0 P
Fire tests of treated and untreated wood parti- tions. Clement R. Brown. J. Research NBS <u>20</u> , 217 (1938) - - - - - Includes results of fire tests of 17 par- titions from 3/4 to 2 1/4 in. thick, con- structed of untreated or fire retardant treated wood.	RP1076	10 ¢
Safety for the household. (1932) - - - - - Describes household hazards from fire, gas, electricity, lightning, and precautions to be taken.	C397	25 ¢
Recommended minimum requirements for fire re- sistance in buildings. (1931) - - - - - Report of building code committee.	BH14	10 ¢
Fire tests of wood- and metal-framed partitions. S. H. Ingberg and Nolan D. Mitchell. (1941) Gives results of 147 fire-endurance or fire and hose-stream tests.	BMS71	20 ¢
Manual of fire loss prevention of the Federal Fire Council. (1934) - - - - - Covers the general field of construction, equipment, inspection and organization for fire prevention and fire extinguishment.	H19	20 ¢
Design and construction of building exits. (1935) Gives results of surveys and methods of pro- portioning requirements for emergency egress from buildings.	M151	10 ¢

<u>Title</u>	<u>Series</u>	<u>Price</u>
The fire resistance of brick walls - bricks made of clay or shale. (1927) - - - - - Gives summary of results with fire resistance periods for solid and hollow walls.	LC228	Free
The fire resistance of brick walls - walls made of concrete or sand-lime bricks. (1927) Gives summary of results and fire resistance periods for solid walls.	LC229	Free
Theatre safety curtains. (1934) - - - - - Gives summary of tests and recommended requirements for theatre proscenium curtains.	LC406	Free
Flameproofing of textiles. (1936) - - - - - Summarizes researches and testing methods and describes processes with formulas.	LC467	Free
Classification of acoustic materials. (1941) Compilation of acoustic materials giving sound absorption coefficients and fire resistance ratings.	LC633	Free
Specifications for fire tests of building constructions and materials. American Standards A.S.A. No. A2-1934. - - - - - Sponsored by the Fire Protection Group, the American Society for Testing Materials, and the National Bureau of Standards.	-	Free

FEDERAL SPECIFICATIONS

The specifications listed below are issued by the Federal Specification Executive Committee, Washington, D. C., and are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices indicated.

<u>Title</u>	<u>Series</u>	<u>Price</u>
Acoustic-Materials; (for) plastic application	SS-A-111	5 ¢
Acoustical-Units; prefabricated - - - - -	SS-A-118	5 ¢
Duck, Cotton; fire, water, and weather-resistant - - - - -	CCC-D-746	5 ¢
Fire-Alarm-Systems; electric, hand-operated, positive, non-interfering type - - - - -	W-F-391	5 ¢
Fire-Alarm-Systems; electric, hand-operated, shunt-type - - - - -	W-F-396	5 ¢

<u>Title</u>	<u>Series</u>	<u>Price</u>
Fire-Extinguishers; chemical, hand, carbon-tetrachloride type - - - - -	O-F-351	5 ¢
Fire-Extinguishers; chemical, hand, soda-and-acid type - - - - -	O-F-355a	5 ¢
Fire-Extinguishers; hand, portable, foam-type	O-F-361	5 ¢
Fire-Extinguishing Liquid; carbon-tetrachloride base. - - - - -	O-F-380	5 ¢
Hose; fire, cotton, rubber-lined - - - - -	ZZ-P-451a	5 ¢
Hose; fire, linen, unlined - - - - -	JJ-H-571	5 ¢
Hose; gasoline, rubber-metal - - - - -	ZZ-H-466b	5 ¢
Hose; gasoline, wire-stiffened - - - - -	ZZ-H-471	5 ¢
Matches; safety (full size, in boxes) - - - -	EE-M-101b	5 ¢
Paulins and Covers; duck (Tarpaulins) - - - -	K-P-146	5 ¢
Safes; insulated - - - - -	AA-S-81	5 ¢
Tile; asphalt - - - - -	SS-T-306	5 ¢

ARTICLES PUBLISHED IN OUTSIDE JOURNALS

The articles listed below are in chronological order. The name of the journal or of the organization publishing the article is given in abbreviated form, with address in parentheses, together with the volume number (underscored), page, and year of publication, in the order named. The Bureau cannot supply copies of these journals, or reprints from them, and it is unable to furnish information as to their availability or price. They can usually be consulted at technical libraries. A very limited supply of reprints of those articles preceded by an asterisk (*) is available for distribution, and copies will be sent free upon request to the Bureau.

To avoid repetition, the addresses of several of the journals are given below:

Journal of the American Ceramic Society, 2525 North High Street, Columbus, Ohio.

Proceedings of the American Society for Testing Materials, 260 South Broad Street, Philadelphia, Pennsylvania.

Building Officials Conference of America, Post Office Box 1043,
New Britain, Connecticut.

The Clay-Worker, T. A. Randall and Company, Publishers, 211 Hud-
son Street, Indianapolis, Indiana.

Quarterly and Proceedings of the National Fire Protection Associ-
ation, 60 Batterymarch Street, Boston, Massachusetts.

Safety Engineering, 75 Fulton Street, New York, New York.

Proceedings of the Sand-Lime Brick Association, Saginaw, Michigan.

* Fire tests of concrete columns. W. A. Hull. Proc. Am. Concrete
Inst. (American Concrete Institute, 7400 Second Boulevard,
Detroit, Michigan) 14, 138 (1918); *15, 89 (1919); *16, 20
(1920).

Gives progress reports of fire tests reported in full in
Technologic Paper T272.

Lessons from fire tests. S. H. Ingberg. Clay-Worker 77,
657 (1922)

Reviews results of fire tests and their application to fire
resistive constructions.

* Methods for making absorption determinations for hollow build-
ing tile. Harry D. Foster. J. Am. Ceram. Soc. 5, 788 (1922).

Gives absorption obtained by immersion of clay tile up to
72 hours and boiling at atmospheric pressure and reduced pres-
sure for periods up to 5 hours.

* Investigation of causes of U. S. Treasury roof fire. Nolan D.
Mitchell. Quar. Nat. Fire Protection Assn. 16, 255 (1923).

Describes experiments to determine heat penetration from
tar heating kettle that caused ignition to temporary planking.

Fire resistance of concrete protected and reinforced concrete
building columns. S. H. Ingberg. Rock Products (Tradepress
Publication Corp., 205 West Wacker Drive, Chicago, Illinois)
26, No. 5, 120 (March 10, 1923).

Gives in brief results of fire tests of reinforced concrete
and concrete protected steel and cast iron columns.

* Capping for compression specimens. Harry D. Foster. J. Am.
Ceram. Soc. 6, 623 (1923).

Gives results of compression tests of hollow tile capped
with various materials and also as tested with ground ends.

* Effect of grog additions on fire resistance of hollow tile.
Harry D. Foster. J. Am. Ceram. Soc. 6, 748 (1923).

Gives results of fire tests of tile having various per-
centages of ground burned clay added in manufacture.

Fire tests of brick walls. S. H. Ingberg. Am. Archt. (F. W. Dodge Corp., 115 West 40th Street, New York, New York) 124, 307, 355 (1923).

Gives preliminary report on results with restrained and unrestrained walls tested to six hours. Later tests under load and to the ultimate of the heavier walls modify conclusions given.

Brick is proof against fire. Brick and Clay Rec. (Industrial Publications, Inc., 59 East Van Buren Street, Chicago, Illinois) 63, 617 (1923). Fire tests of brick walls. S. H. Ingberg. Clay-Worker 80, 450 (1923); Safety Eng. 46, 279 (1923); Quar. Nat. Fire Protection Assn. 17, 243 (1924).

Gives in briefer form the same material as the American Architect article.

The fire resistive properties of gypsum. S. H. Ingberg. Proc. Am. Soc. Testing Materials 23, part I, 254 (1923).

Describes molecular changes in gypsum due to heat and their significance from standpoint of heat insulation and shrinkage.

* Strength, absorption and freezing resistance of hollow building tile. H. D. Foster. J. Am. Ceram. Soc. 7, 189 (1924).

Gives results for clay tile from typical clays and producing districts.

* Factors affecting brick masonry strength. S. H. Ingberg. Proc. Am. Soc. Testing Materials 24, part II, 909 (1924).

Gives results of auxiliary strength tests of solid and hollow walls, made in connection with fire tests of larger walls.

Fire prevention and fire protection for storage warehouses. Nolan D. Mitchell. Proc. 35th Annual Meeting Am. Warehousemen's Assn. (American Warehousemen's Association, 222 West Adams Street, Chicago, Illinois) 445 (1925).

Describes structural factors involved in protection of warehouses.

Theatre safety curtains. Nolan D. Mitchell. Quar. Nat. Fire Protection Assn. 18, 366 (1925). The safety of theatre proscenium curtains. Nolan D. Mitchell. Safety Eng. 49, 63 (1925).

Gives results of fire tests of two steel curtains and four flexible or semi-rigid asbestos cloth curtains.

Portable equipment for transverse tests of brick. H. D. Foster. Clay-Worker 83, 234 (1925).

Describes apparatus for making crossbending tests of brick at the plant or on the job.

Fire tests of brick walls. S. H. Ingberg. Clay-Worker 83, 234 (1925).

Brief discussion of purpose and method of testing at the Bureau of Standards.

Thwarting the fire hazard. S. H. Ingberg. Philadelphia Public Ledger (Public Ledger Company, Independence Square, Philadelphia, Pennsylvania) 180, No. 38, Magazine Section, 6 (November 1, 1925).

An account of the fire resistance activities of the Bureau of Standards and their relation to improvement in structural conditions.

The fire resistance of gypsum partitions. S. H. Ingberg. Proc. Am. Soc. Testing Materials 25, part II, 299 (1925).

Gives results of tests conducted in this country and abroad on plastered and unplastered gypsum block partitions.

The nation's fire loss and its causes. S. H. Ingberg. Safety Eng. 51, 135 (1926).

Discusses main causes of fire under general headings: carelessness, ignorance, crime, and structural conditions.

The fire resistance of clay hollow load-bearing wall tile. H. D. Foster. Proc. 12th Annual Meeting Building Officials Conference, 103 (1926).

Gives results of fire tests and their application to building code requirements.

The structural factor in fire prevention. S. H. Ingberg. Proc. 12th Annual Meeting Building Officials Conference, 126 (1926).

Analyzes fire loss causes with particular reference to the structure as a preventive.

Discussion of specification requirements for common brick. Christian O. Christenson. Am. Archt. (F. W. Dodge Corporation, 115 West 40th Street, New York, New York) 130, 23 (1926).

Gives all available test data on clay brick and discusses their bearing on specification requirements.

Compressive strength and deformation of structural steel and cast iron shapes at temperatures up to 950°C. S. H. Ingberg and P. D. Sale. Proc. Am. Soc. Testing Materials 26, part II, 33 (1926).

Describes equipment and gives temperature-strength and temperature-deformation curves for rolled steel and hollow round cast iron.

Fire tests of office occupancies. Quar. Nat. Fire Protection Assn. 20, 243 (1927). Fire intensity tests by the Bureau of Standards. Safety Eng. 53, 29 (1927).

Illustrated description of burning-out tests with wood and metal furniture.

The seasonal variation in the fire loss. Ruth L. Morgan. Safety Eng. 54, 131 (1927); J. Am. Insurance (American Mutual Alliance, 919 North Michigan Avenue, Chicago, Illinois) 5, No. 1, 13 (January 1928).

Outlines variation in the general fire loss and portions of it attributed to specific causes.

Bases for specification and building code requirements for building brick. S. H. Ingberg. Proc. 23rd Annual Convention Sand-Lime Brick Association, 78 (1927).

Summarizes results of tests and their application to specification requirements particularly as they concern sand-lime brick.

Severity, duration and control of exposure. (Part of committee report). Proc. 31st Annual Meeting Nat. Fire Protection Assn., 295 (1927).

Gives conclusions relative to equivalent durations for fires in office and record room occupancy.

Fire resistance in dwelling construction. S. H. Ingberg. Proc. and Papers 32nd Annual Convention Nat. Assn. Mutual Insurance Companies (National Association of Mutual Insurance Companies, 2105 North Meridian Street, Indianapolis, Indiana) 99 (1927). Fire resistant dwelling construction. S. H. Ingberg. J. Am. Insurance (American Mutual Alliance, 919 North Michigan Avenue, Chicago, Illinois) 6, No. 7, 23 (July 1929).

Describes details contributing to the fire resistance of the different building types such as interior and exterior finishes, fire stopping and chimney construction.

Cigarettes and cigars, fire hazard tests. P. D. Sale and F. M. Hoffheins. Quar. Nat. Fire Protection Assn. 21, 237 (1928).

Gives account of a testing method developed to gauge the fire hazard of discarded cigarettes and cigars, and modifications applied to them to decrease the hazard.

Matches, fire hazard tests. P. D. Sale. Quar. Nat. Fire Protection Assn. 21, 331 (1928).

Gives results of tests made to determine the burning time required for useful purposes and the reduction in fire hazard obtainable by coating the match stem so that flaming ceases after a given length is consumed.

Fire resistance of sand-lime and concrete brick walls. Proc. 24th Annual Convention Sand-Lime Brick Assn. 15 (1928).

Reprint of Letter Circular LC-229.

The severity of building fires. S. H. Ingberg. Proc. 14th Annual Meeting Building Officials Conference of America, 87 (1928); Safety Eng. 56, 57, 103 (1928). Tests of the severity of building fires. S. H. Ingberg. Quar. Nat. Fire Protection Assn. 22, 43 (1928). The severity of fires in buildings. S. H. Ingberg. Archt. Forum (Time, Inc., 160 Maple Street, Jersey City, New Jersey) 50, 775 (1929).

Describe tests made to obtain information on the intensity and duration of fires with office and record storage occupancies, and give results in the form of equivalent exposure for given periods of the standard furnace test.

Fire resistance of building materials and construction. S. H. Ingberg. Archt. Forum (Time, Inc., 160 Maple Street, Jersey City, New Jersey) 49, 601 (1928); Proc. 18th Annual Meeting Am. Inst. Refrigeration (American Institute of Refrigeration, 750 7th Avenue, New York, New York), 45, (1929); Ice and Refrigeration (Nickerson and Collins, Publishers, 435 North Waller Avenue, Chicago, Illinois) 76, 486 (1929). Fire resistance tests of building materials and construction. S. H. Ingberg. Safety Eng. 58, 13 (1929).

Outline the significance of fire resistance as incorporated into the building itself, and review results of fire resistance tests conducted at the National Bureau of Standards.

Fire resistance tests with particular reference to wall constructions. S. H. Ingberg. Proc. 25th Annual Convention Sand-Lime Brick Assn., 37 (1929).

Describes and gives summary of fire resistance tests of columns, walls, partitions, and theatre curtains, fire tests of roofing materials, fire endurance tests of safes, strength of steel at high temperatures, severity of fires, and miscellaneous fire hazard tests.

Fire test of brick joisted buildings. Quar. Nat. Fire Protection Assn. 22, 62 (1928).

Describes and gives results of observations during intentional burning down of two old buildings in Washington, D. C.

Tests of stability at elevated temperatures of nitrocellulose x-ray film. Proc. of a Board of the Chemical Warfare Service: The Disaster at the Cleveland Hospital Clinic, Cleveland, Ohio on May 15, 1929 (Government Printing Office, Washington, D. C.), 46 (1929).

Gives results of tests made at the request of the Chemical Warfare Service on the stability of x-ray film at temperatures from 120 to 260°C.

Fire resistance requirements in building codes. S. H. Ingberg. Quar. Nat. Fire Protection Assn. 23, 153 (1929).

Discusses the basic purpose of fire resistance requirements and data available on which they can be used.

Safeguarding the storage of photographic, motion picture and x-ray films. Clement R. Brown. Safety Eng. 58, 65 (1929); Fire Protection (National Underwriters Company, 222 East Ohio Street, Indianapolis, Indiana) 94, No. 9, 14 (September 1929); Radiology (Radiological Society of North America, 607 Medical Arts Building, Syracuse, New York) 14, 454 (1930).

Discuss the hazards and make recommendations for safe storage in properly constructed vaults and cabinets.

Influence of mineral composition of aggregates on fire resistance of concrete. S. H. Ingberg. Proc. Am. Soc. Testing Materials 29, part II, 824 (1929).

Subdivides concrete aggregates into four main divisions determined by the fire effects on the concrete.

Spontaneous heating and ignition as a problem of commerce.

H. C. Dickinson. Report of Conference on Spontaneous Heating and Ignition of Agricultural and Industrial Products (United States Department of Agriculture), 6 (1930); Safety Eng. 61, 25 (1931).

Outlines the subject from the standpoint of spoilage and fire hazards and suggests the general remedy of avoiding the inducing conditions.

Research at the Bureau of Standards on spontaneous heating and ignition. S. H. Ingberg. Report of Conference on Spontaneous Heating and Ignition of Agricultural and Industrial Products (United States Department of Agriculture), 21 (1930); Safety Eng. 59, 256 (1930). When may spontaneous ignition occur? S. H. Ingberg. Fire Eng. (Case-Shepperd-Mann Publishing Corporation, 24 West 40th Street, New York, New York) 83, 357 (1930).

Summary of the Bureau's studies on celluloid, x-ray film, coroa, jute, textiles, and miscellaneous materials.

Gauging the severity of building fires. S. H. Ingberg. Proc. 26th Annual Convention Sand-Lime Brick Assn., 81 (1930).

Describes burning-out tests conducted to establish relation between severity of building fires and exposure in the standard fire test.

Record protection and office equipment. S. H. Ingberg. Quar. Nat. Fire Protection Assn. 24, 410 (1931).

Describes fire tests with different types of furniture and shelving and gives results in point of protection afforded the contained records.

Construction, equipment and maintenance of buildings in their relation to protection of records. S. H. Ingberg, et al. (Committee Report). Proc. 35th Annual Meeting Nat. Fire Protection Assn., 227 (1931).

Defines protection obtainable by means of superior building construction, furniture and equipment, and prevention of accumulations.

Recent tests of materials of interest to the building official. S. H. Ingberg. Proc. 17th Annual Meeting Building Officials Conference of America, 62 (1931).

Summary, with bibliography, of the Bureau's studies of the fire resistance of building materials and construction, tests of fire protection equipment, and fire-hazard tests of various materials. Also describes the activities of the Federal Fire Council.

Fire protection of valuable records. S. H. Ingberg. Proc. 5th All Ohio Safety Congress (The Industrial Commission of Ohio, Columbus, Ohio), 629 (1932); Safety Eng. 63, 271 (1932) and 64, 23 (1932).

A review of essentials of record classification from the standpoint of retention and procedure for destruction of use-less records.

Fire exposure conditions for vaults and portable record containers, S. H. Ingberg, et al. (Part of committee report). Proc. 36th Annual Meeting Nat. Fire Protection Assn., 316 (1932) and Proc. 37th Annual Meeting, 204 (1933).

Outlines fire severity to be expected in fire resistive and non-fire resistive buildings as determined by type of construction and concentration of combustibles in building contents, members and trim.

Gypsum-encased steel columns subjected to fire tests. Nolan D. Mitchell. Eng. News-Rec. (McGraw-Hill Publishing Company, Inc., 99 North Broadway, Albany, New York) III, 195 (1933).

A brief report on tests given more fully in Bureau of Standards Research Paper RP563.

Fire hazard tests with cigarettes. F. M. Hoffheins. Quar. Nat. Fire Protection Assn. 27, 132 (1933).

Gives results of tests with lighted cigarettes on grass and forest floor materials and of cigarettes with paper tips that presented a lower hazard.

Structural conditions as they affect the work of a fire department. S. H. Ingberg. Blue Legion (National Fraternal Association of Firemen and Policemen, 601 13th Street, N. W., Washington, D. C.) 1, No. 7, 3 (October 1933).

Outlines the effect of the principal types of building construction on the hazard of fire within them, the exposure to surrounding buildings, and the danger to fire fighting forces.

Heating and ignition tests with jute. W. L. Obold, F. M. Hoffheins S. H. Ingberg, and L. H. James. Monograph, (National Fire Protection Association, 60 Batterymarch Street, Boston, Massachusetts) (1934).

Gives results of research to determine susceptibility to spontaneous heating and ignition from microbial growths and from animal and vegetable oils spread on the fiber, conducted in cooperation with the Bureau of Chemistry and Soils and the Marine Underwriters.

* Methods for calculating the volumetric composition of fluid mixtures. S. H. Ingberg. Physics (Prince and Lemon Streets, Lancaster, Pennsylvania) 5, 64 (1934).

Gives methods for computing concentrations from additions made under conditions of free, partial, or no efflux from the receiving container, with applications to the use of inert gas for fire extinguishment.

* Computing volumetric components of fluid mixtures. S. H. Ingberg. Chem. and Met. Eng. (McGraw-Hill Publishing Company, Inc., 99 North Broadway, Albany, New York) 42, 317 (1935).

A briefer treatment of material in preceding article with some applications.

Methods of testing wood treated with fire retardants. C. R. Brown. Proc. Am. Soc. Testing Materials 35, part II, 674 (1935).

Gives results and comparisons of the fire-tube and the flame-penetration tests with untreated and chemically treated wood.

The nation's fire loss. S. H. Ingberg. Building Standards Monthly (R. C. Colling and Associates, 124 West 4th Street, Los Angeles, California) 5, No. 1, 6 (January 1936) and No. 2, 3 (February 1936).

Outlines main causes of the fire waste and possibilities of prevention through improvements in building construction, finish, equipment, and fire zoning.

Automatic fire alarm systems. S. H. Ingberg and A. C. Hutton. Safety Eng. 75, 35 (1938).

Brief description of systems and thermo-sensitive elements.

Carbon dioxide fire tests. Quart. Nat. Fire Protection Assn. 33, 275 (1940).

Report of the Federal Fire Council giving results of fire tests with carbon dioxide as an extinguishing medium for fires in buildings.

