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INDUSTRIAL STANDARDIZATION



NATIONAL INDUSTRIAL CONFERENCE BOARD, Inc.

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PREFACE

THE principle of standardization, as it is expressed in the products, processes and practices of industry and trade, is now generally recognized as a fundamental characteristic of our modern economic system. Although standardization is an old and universal idea, reflected in many aspects of social life in all periods of human history, its intensive application in the modern machine industries is a distinctive feature of the economic development of the past generation. The rapid industrial growth of the last two decades, particularly in the United States, may be said to be based largely upon the partly unconscious, partly deliberate, extension and refinement of industrial standardization; and the influence of this process is felt today in every aspect of American business life.

So pervasive is the application of the principle that, except for a few groups especially concerned with it, we have come to take it for granted and have failed to appreciate its significance, the extent and manner by which it is being systematically advanced, its relation to industry, to government and to the public, and the problems to which it has given rise. Despite the constant discussion of certain of its aspects and the mass of literature bearing upon its technical phases, it is singular that there is so little general or popular understanding of the industrial standardization movement and that there has not so far been available in any single volume a clear and comprehensive exposition of the movement as a whole. It is the purpose of the present study to supply this need.

In addition to presenting a simple and clear statement of the nature and meaning of standardization, this volume has a two-fold object: first, to present a concise but comprehensive description of the working structure of the industrial standardization movement as it is expressed in the standardization work of individual concerns, engineering societies,

trade associations and national and international standards organizations; and, second, to examine, in the light of available evidence, the authenticity of the numerous economic advantages claimed for standardization by its advocates, and to discuss some of the economic and social problems involved in the progressive extension of the standardization principle.

As regards the first of these objectives, the study reveals the phenomenal growth, in all the great industrial countries, particularly during and since the war, of a technique of standardization which plays a basic and necessary part in machine industry. There has been much confusion, overlapping of functions, working to cross purposes, conflicts of interests, and misunderstandings; but, at the same time, there has been gradually evolving from this chaos a cooperative method of handling problems of industrial organization and processes, which has great significance for the student of politics as well as the economist.

The second task has been more difficult. Tangible facts regarding the achievements and economies of standardization are few and far between. A considerable part of the available data had to be set aside as of dubious authenticity or as irrelevant. There are questions regarding the effects of standardization which can not be answered, even tentatively, by an appeal to evidence, and in many such cases the discussion has necessarily consisted of a statement of the questions that will need to be answered before an evaluation of economic advantages and disadvantages can be made. Yet, despite these difficulties, the cumulative evidence points unmistakably to the conclusion that industrial standardization is one of the significant and far-reaching methods for increasing industrial efficiency, to the benefit, if properly used, of all interests concerned. It is clear, too, that the achievements in the past are but guide-posts to possibilities in the future.

Special acknowledgments for aid in the preparation of this volume are due to the officers and staff of the American Standards Association and to several corporations, particularly the Bell Telephone System, the Westinghouse Electric and Manufacturing Company and the Detroit Edison Com-

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pany, which supplied the Conference Board with valuable material concerning their own standards work.

In the preparation of its studies the National Industrial Conference Board avails itself of the experience and judgment of the business executives who compose its membership, and of recognized authorities in special fields, in addition to the scientific knowledge and equipment of its Research Staff. The publications of the Board thus finally represent the result of scientific investigation and broad business experience, and the conclusions expressed therein are those of the Conference Board as a whole.

The present investigation was made, and this volume was prepared, under the supervision of the Conference Board's Staff Economic Council, by Mr. Robert A. Brady of the Conference Board's Research Staff.

MAGNUS W. ALEXANDER,
President.

New York City

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APPENDIX A

SPECIFICATIONS FOR MATERIALS¹

"(1) A specification for material should contain the fewest possible restrictions consistent with obtaining the material desired.

"(2) The service which the material is to perform, in connection with reasonably feasible possibilities in its manufacture, should determine the limitations of a specification.

"(3) All parties whose interests are affected by a specification should have a voice in its preparation.

"(4) The one who finally puts the wording of the specification into shape should avoid making it a place to show how much he knows, as well as a mental attitude of favor or antagonism to any of the parties affected by it.

"(5) Excessively severe limitations in a specification are suicidal. They lead to constant demands for concessions, which must be made if work is to be kept going, or to more or less successful efforts at evasion. Better a few moderate requirements rigidly enforced, than a mass of excessive limitations which are difficult of enforcement, and which lead to constant friction and sometimes deception.

"(6) There is no real reason why a specification should not contain limitations derived from any source of knowledge. If the limitations shown by physical test are sufficient to define the necessary qualities of the material, and this test is simplest and easiest made, the specification may reasonably be confined to this. If a chemical analysis or a microscopic examination, or a statement of the method of manufacture, or information from all four, or even other sources, are found useful or valuable in defining limitations, or in deciding upon the quality of material furnished, there is no legitimate reason why such information should not appear in the specifications. Neither the producer nor the consumer has a right to arrogate to himself the exclusive right to use information from any source.

"(7) Proprietary articles and commercial products made by processes under the control of the manufacturer can not, from the nature of the case, be made the subject of specifications. The very idea of a specification involves the existence of a mass of common knowledge in regard to any material, which knowledge is more or less available to both producer and consumer. If the manufacturer or producer has opportunities which are not available to the consumer, of knowing how the variation of certain constituents in his product will affect that product during manufacture, so also does the consumer, if he is philosophic and is a student, have

¹ Dr. Charles B. Dudley, "The Making of Specifications for Materials," presidential address, delivered before the American Society for Testing Materials in 1903, and reprinted in "The Life and Work of Charles B. Dudley," New York, 1927.

opportunities not available to the producer, of knowing how the same variation of constituents in the product will affect that product in service, and it is only by the two working together, and combining the special knowledge which each has, that a really valuable specification can be made.

“(8) A complete workable specification should contain the information needed by all those who must necessarily use it in obtaining the material desired. On railroads this may involve the purchasing agent, the manufacturer, the inspector, the engineer of tests, the chemist, and those who use the material. A general specification may be limited to describing the properties of the material, the method of sampling, the amount covered by one sample, and such description of the tests as will prevent doubt or ambiguity.

“(9) Where methods of testing or analysis or inspection are well known and understood, it is sufficient if the specification simply refers to them. Where new or unusual tests are required, or where different well-known methods give different results, it is essential to embody in the specification sufficient description to prevent doubt or ambiguity.

“(10) The sample for test representing a shipment of material should always be taken at random by a representative of the consumer.

“(11) The amount of material represented by one sample can best be decided by the nature of the material, its importance, and its probable uniformity, as affected by its method of manufacture. No universal rule can be given.

“(12) The purchaser has a right to assume that every bit of the material making up a shipment meets the requirements of the specification, since this is what he contracted for and expects to pay for. It should make very little difference, therefore, what part of the shipment the sample comes from, or how it is taken. Average samples made up of a number of subsamples are only excusable when the limits of the specification are so narrow that they do not cover the ordinary irregularities of good practice in manufacture.

“(13) Retests of material that has once failed should only be asked for under extraordinary conditions, and should be granted even more rarely than they are asked for, errors in the tests of course excepted.

“(14) Simple fairness requires that when it is desired that material once fairly rejected should nevertheless be used, some concession in price should be made. On the other hand, where a consumer buys material on specifications, it is equally unfair that he should ask from the producer any guarantees covering the behavior of the material in service. Furthermore, it almost goes without saying that where materials are for use in places involving the safety of life and property, rejected material should never be used.

“(15) Where commercial transactions are between honorable people, there is no real necessity of marking rejected material to prevent its being offered a second time. If it has failed once, it will probably fail a second time, and if return freight is rigidly collected on return shipments, the risk of loss is greater than most shippers will care to incur. Moreover, it is so easy for the consumer to put an inconspicuous private mark on

rejected material, that it is believed few will care to incur the probable loss of business that will result from the detection of an effort to dispose of a rejected shipment by offering it a second time. In this connection it may be said that those sub-employees of producers who pride themselves on working off rejected material on consumers may in reality be doing their employers a very serious injury.

“(16) All specifications in actual practical daily use need revision from time to time, as new information is obtained, due to progress in knowledge, changes in methods of manufacture, and changes in the use of materials. A new specification, that is, one for a material which has hitherto been bought on the reputation of the makers and without any examination as to quality, will be fortunate if it does not require revision in from six to ten months after it is first issued.

“(17) In the enforcement of specifications it is undoubtedly a breach of contract, legitimately leading to rejection, if the specified tests give results not wholly within the limits, and this is especially true if the limits are reasonably wide. But it must be remembered that no tests give the absolute truth, and where the results are near, but just outside of the limit, the material may actually be all right. It seems to us better, therefore, to allow a small margin from the actual published limit, equal to the probable limit of error in the method of testing employed, and allow for this margin in the original limits, when the specifications are drawn.

“(18) Many producers object to specifications on the ground that they are annoying and harassing, and really serve no good purpose. It is to be feared that the complaint is just in the cases of many unwisely drawn specifications. But it should be remembered that a good, reasonable specification, carefully worked out as the result of the combined effort of both producer and consumer, and which is rigidly enforced, is the best possible protection which the honest manufacturer can have against unfair competition.

“(19) Many consumers fear the effect of specifications on prices. Experience seems to indicate that after a specification has passed what may be called the experimental stage, and is working smoothly, prices show a strong tendency to drop below figures prevailing before the specification was issued.

“(20) A complete workable specification for material represents a very high order of work. It should combine within itself the harmonized antagonistic interests of both the producer and the consumer; it should have the fewest possible requirements consistent with securing satisfactory material; it should be so comprehensive as to leave no chance for ambiguity or doubt; and, above all, it should embody within itself the results of the latest and best studies of the properties of the material which it covers.”

APPENDIX B

LIST OF MANUFACTURERS DOING ORGANIZED WORK ON STANDARDS¹

PUBLISHED STANDARDS

1. Baldwin Locomotive Works
2. General Motors Corporation

NON-PUBLISHED INTERNAL AND SOMETIMES CONFIDENTIAL

3. Allis-Chalmers Manufacturing Company
4. American Laundry Machine Company
5. American Telephone and Telegraph Company
6. Browne and Sharpe Manufacturing Company
7. Burroughs Adding Machine Company
8. Carnegie Steel Company
9. Chrysler Motor Company
10. Cincinnati Milling Machine Company
11. Cleveland Twist Drill Company
12. Commonwealth Power Corporation of Michigan
13. Consolidated Machine Tool Corporation of America
14. Continental Motor Company
15. Crane Company
16. Crompton and Knowles Loom Works
17. Cutler Hammer Manufacturing Company
18. De la Vergne Machine Company
19. Detroit Edison Company
20. Dexter Folder Company
21. Edison Phonograph Company
22. Fairbanks, Morse and Company
23. Ford Motor Company
24. Gleason Works
25. Gray and Davis
26. Illinois Watch Company
27. Ingersoll-Rand Company
28. International Harvester Company
29. Johansson Inc., C. E.
30. Jones and Lamson Machine Works
31. Kimberly Clark Company
32. Link Belt Company
33. Metropolitan Life Insurance Company (as to office furniture only)
34. Montgomery Ward and Company
35. Morgan Construction Company
36. National Aniline and Chemical Company
37. National Cash Register Company
38. National Time Recording Company
39. National Twist Drill and Tool Company
40. Niles Bement Pond Company (including Pratt and Whitney)
41. Packard Motor Car Company
42. Remington Arms Company

¹ Incomplete list from files of the American Standards Association.

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43. Republic Flow Meter Company
44. Royal Typewriter Company
45. Sangano Electric Company
46. Singer Manufacturing Company
47. Spicer Manufacturing Company
48. Splittorf Electric Company
49. Stuart-Warner Speedometer Corporation
50. Studebaker Corporation
51. U. S. Gypsum Company
52. Waltham Watch Company
53. Waukesha Motor Company
54. Western Electric Company (subsidiary of American Telephone and Telegraph Company)
55. Westinghouse Electric and Manufacturing Company
56. White Dental Manufacturing Company, S. S.
57. White Motor Company
58. Wright Aeronautical Company

APPENDIX C

NATIONAL STANDARDIZING BODIES

Australia: Australian Commonwealth Engineering Standards Association

Austria: Oesterreichischer Normenausschuss für Industrie und Gewerbe.

Belgium: Association Belge de Standardisation.

Canada: Canadian Engineering Standards Association.

Czechoslovakia: Československá Normalizační Společnost.

Denmark: Den danske Standardiseringskommission.

Finland: Finlands Standardiseringskommission.

France: Association Française de Normalisation.

Germany: Deutscher Normenausschuss.

Great Britain: British Engineering Standards Association.

Holland: Hoofdcommissie voor de Normalisatie in Nederland.

Hungary: Magyar Ipari Szabványosító Bizottság.

Italy: Comitato Generale per l'Unificazione nell'Industria Meccanica.

Japan: Japanese Engineering Standards Committee.

Norway: Norges Industriforbunds Standardiseringskontor.

Poland: Polski Komitet Normalizacyjny.

Roumania: Roumanian Standards Committee.

Russia: Standards Committee, U. S. S. R.

Sweden: Svenska Industriens Standardiseringskommission.

Switzerland: Schweizerische Normalien-Vereinigung.

United States: American Standards Association.

APPENDIX D

THE DEVELOPMENT OF A TYPICAL STANDARDS PROJECT UNDER AMERICAN STANDARDS ASSOCIATION PROCEDURE¹

REVIEW OF DEVELOPMENT OF THE WORK ON "BOLT, NUT AND RIVET PROPORTIONS"

April 15, 1920:

Proposal received from the Swiss national standardizing body to the effect that an international standard be set up on "Widths across flats of bolt heads and nuts." This proposal was also sent to England, France, Germany, Holland, Sweden and Belgium.

June 5, 1920:

The Swiss proposal was referred by the American Standards Association (then A. E. S. C.) to the American Society of Mechanical Engineers and the Society of Automotive Engineers as the bodies most competent to advise on the attitude to be taken by American industry. The suggestion was made that either a new sectional committee be formed to deal with the project or that it be referred to a sub-committee of the sectional committee on "screw threads" already in existence.

September 22, 1920:

Acceptance of joint sponsorship by the American Society of Mechanical Engineers.

December 16, 1920:

Acceptance of joint sponsorship by the Society of Automotive Engineers.

March 16, 1922:

Organization meeting of the sectional committee, where it was decided to enlarge the scope of the work so as to cover "Bolt, nut and rivet proportions."

June 5, 1923:

List of personnel of sectional committee submitted by the joint sponsors to the American Standards Association for approval.

July 23, 1923:

Special committee on personnel appointed by the American Standards Association.

September 4, 1923:

Submission of report by the special committee recommending approval of the personnel provided an engineer representing the electric

¹ Prepared by the American Standards Association.

railway track construction be added. The report also recommended that the scope be broadened to include "standardization of dimensions, material and nomenclature of all rivets, bolts, nuts and screws except wood screws, but not including standardization of thread forms."

September 13, 1923:

Report of special committee referred by Executive Committee to Main Committee.

October 11, 1923:

Approval of personnel and scope by the American Standards Association.

After the organization meeting on March 16, 1922, work had been started. By January, 1929, five standards established by the above sectional committee had been approved by the American Standards Association as follows:

- B 18a-1927 Small rivets.
- B 18b-1927 Wrench head bolts and nuts and wrench openings.
- B 18e-1928 Round unslotted head bolts.
- B 18f-1928 Plow bolts.
- B 18g-1928 Tinnners', Coopers' and belt rivets.

In the case of the standard on "Wrench head bolts and nuts and wrench openings," the further development was as follows:

November 17, 1925:

Publicity given to draft standard on "Wrench head bolts and nuts and wrench openings" by sending proof sheets to thirty publications located in various parts of the country.

May, 1926:

Publication of draft standard in *S. A. E. Journal* and *Mechanical Engineering* (American Society of Mechanical Engineers' publication).

August 26, 1926:

Draft standard approved by letter ballot of sectional committee.

November 11, 1926:

Draft standard submitted by sectional committee to joint sponsors.

December 6, 1926:

Formalities for approval of draft standard by joint sponsors completed.

December 31, 1926:

Submission by joint sponsors of draft standard to American Standards Association for approval.

January 4, 1927:

Special committee on approval of standard appointed by Chairman of the American Standards Association.

January 8, 1927:

Report of special committee submitted to American Standards Association recommending approval of draft standard as a Tentative American Standard.

February 3, 1927:

Standard ordered to letter ballot of Main Committee of American Standards Association with recommendation for approval as a Tentative American Standard.

February 9, 1927:

Letter ballot sent out by American Standards Association office.

February 24, 1927:

Letter ballot completed and found favorable. Standard approved.

May 16, 1927:

Copies of standard off the press.

APPENDIX E

SIMPLIFIED PRACTICE RECOMMENDATIONS¹

PROPOSED, APPROVED AND ACCEPTED BY INDUSTRIAL GROUPS UNDER
AUSPICES OF THE DIVISION OF SIMPLIFIED PRACTICE OF THE
DEPARTMENT OF COMMERCE. REVISED TO AUGUST 1, 1928.

S.P.R. No.	Item	Reduction in Varieties		Per Cent Reduction
		From	To	
1	Vitrified Paving Brick (6th revision)	66	5	92
2	Beds, Springs, and Mattresses	78	4	95
*3	Metal Lath	125	24	81
4	Asphalt (1st revision)	102	10	90
5	Hotel Chinaware	700	214	69
6	Files and Rasps	1,351	475	65
7	Rough and Smooth Face Brick	75	2	97
	Common Brick	44	1	98
8	Range Boilers	130	13	90
*9	Woven Wire Fencing	552	69	87
	Woven Wire Fence Packages	2,072	138	93
10	Milk Bottles and Caps (1st revision)			
	Bottles	49	4	92
	Caps	10	1	90
11	Bed Blankets (sizes)	78	12	85
12	Hollow Building Tile (1st revision)	36	20	44
*13	Structural Slates for Plumbing and Sanitary Purposes	827	138	83
*14	Roofing Slates (descriptive terms, thicknesses and sizes)	98	48	51
15	Blackboard Slates (slab heights and sizes)	251	52	79
*16	Lumber (2nd revision)	Standard nomenclature, grades and sizes for soft-wood lumber		
17	Forged Tools (1st revision)			
	Tool Heads	665	361	46
	Eye Sizes	120	10	91
18	Builders' Hardware (1st revision) ²			
	Items	6,948	5,130	26
	Finishes	100	29	71
*19	Asbestos Mill Board (sizes, thicknesses) (1st revision)	21	4	81
	Asbestos paper (sizes, widths, weights of rolls) (1st revision)	72	16	78

¹ National Bureau of Standards, mimeographed list, Washington, Aug. 1, 1928.

* Revised.

² These figures are the average reduction in catalog items in 1922 of four leading manufacturers of builders' hardware, as result of simplification.

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SIMPLIFIED PRACTICE RECOMMENDATIONS¹—(Continued)

S.P.R. No.	Item	Reduction in Varieties		Per Cent Reduction
		From	To	
*20	Steel Barrels and Drums	66	24	64
21	Brass Lavatory and Sink Traps	1,114	76	93
22	Paper ² . . . . .	..	..	..
23	Plow Bolts	1,500	840	44
24	Hospital Beds			
	Lengths	33	1	97
	Widths	34	{ 1 standard } { 2 specials }	91
	Heights	44	1	98
25	Hot Water Storage Tanks	120	14	88
26	Steel Reinforcing Bars (cross-sectional areas)	32	11	66
27	Cotton Duck (1st revision)	460	86	81
*28	Sheet Steel (1st revision)	1,819	261	85
29	Eaves Trough and Conductor Pipe	21	16	24
30	Terne Plate (weights)	9	7	22
31	Loaded Shells (2nd revision)	4,076	768	81
32	Concrete Building Units (length, width and height of blocks, tile and brick)	115	14	88
33	Cafeteria and Restaurant China-ware	700	243	65
34	Warehouse Forms	Thousands	15	..
*35	Steel Lockers	65	17	74
36	Milling Cutters	944	570	40
*37	Commercial Forms	Thousands	3	..
38	Sand Lime Brick (length, width and height)	14	3	79
39	Dining Car Chinaware	700	276	61
40	Hospital Chinaware	700	279	60
41	Insecticides and Fungicides (packages)	38	22	42
42	Paper Grocers' Bags	6,280	4,700	25
*43	Paint and Varnish Brushes	480	143	70
44	Box Board (thicknesses)	244	60	75
45	Grinding Wheels (1st revision)	715,200	254,400	64
46	Tissue Paper			
	Roll Tissue	13	3	77
	Shoe Tissue	21	6	71
47	Cut Tacks and Small Cut Nails			
	Sizes	421	182	57
	Packing Weights	423	121	71
48	Shovels, Spades and Scoops (1st revision)	5,136	2,178	57
49	Sidewalk Lights			
	Sizes	120	6	95
	Styles	80	5	94
	Shapes	10	2	80
50	Bank Checks, Notes, Drafts, etc.	Thousands	One size for each instrument	..

¹ National Bureau of Standards, mimeographed list, Washington, Aug. 1, 1928.

² Original total not known.

* Revised.

SIMPLIFIED PRACTICE RECOMMENDATIONS¹—(Continued)

S.P.R. No.	Item	Reduction in Varieties		Per Cent Reduction
		From	To	
*51	Die Head Chasers (for self-opening and adjustable die heads) ².....	..	..	75
52	Staple Vitreous China Plumbing Fixtures.....	441	58	87
53	Steel Reinforcing Spirals.....	7	4	43
54	Sterling Silver Flatware.....	190	61	68
55	Tinware, Galvanized, and Japanned Ware.....	1,154	873	24
*56	Carbon Brushes and Brush Shunts ⁴.....	..	..	..
57	Wrought Iron and Wrought Steel Pipe, Valves, and Pipe Fittings			
	Sizes of Valves and Fittings....	20,000	19,238	4
	Sizes of Pipe.....	62	49	21
*58	Classification of Iron and Steel Scrap.....	Specification for scrap		
59	Rotary Cut Lumber Stock for Wire-bound Boxes			
	Lengths.....	102	6	94
	Widths.....	65	6	91
	Thicknesses.....	9	6	33
60	Packing of Carriage, Machine, and Lag Bolts ⁵.....	..	18	..
61	White Glazed Tile and Unglazed Ceramic Mosaic ⁵.....	..	..	..
62	Metallic Cartridges.....	348	256	26
63	Metal Spools (for annealing, handling and shipping wire) ².....	..	6	..
66	Brake Lining (automobile) ³.....	..	37†	..
67	Roller Bearings ⁴.....	..	172†	..
68	Flashlight Cases (metal and fiber) ..	25	14	44
69	Packing of Razor Blades.....	2 systems	reduced to 1	50
70	Salt Packages.....	35	19	46
72	Solid Section Steel Windows.....	42,877	2,244	95
73	One-piece Porcelain Insulators.....	272	210	23
74	Hospital and Institutional Cotton Textiles.....	575	26	95
75	Composition Blackboard			
	Colors.....	3	1	66
	Widths.....	18	8	55
	Lengths.....	90	13	86
76	Ash Handles (grades) ³.....	..	..	..
77	Hickory Handles (grades) ³.....	..	..	..

¹ National Bureau of Standards, mimeographed list, Washington, Aug. 1, 1928.² Original total not known.⁴ Increments of increase in dimensions, and dimensional tolerances for carbon brushes, sizes of holes or slots in terminals for flexible shunts, and size and specifications for cable for brush shunts.⁵ Shapes, patterns, dimensions, grade nomenclature, grade marks, grade specifications, and certifications of grades, for white glazed tile and unglazed ceramic mosaic.

* Revised.

† Society of Automotive Engineers Standards.

RECOMMENDATIONS IN PROCESS OF ACCEPTANCE

S. P. R. No.	Item	Reduction in Varieties		Per Cent Reduction
		From	To	
64	Vegetable Shortening Containers...	35	11	69
65	Lead Pencils.....	..	..	..
71	Turnbuckles.....	248	115	54
78	Iron and Steel Roofing.....	..	..	..
79	Malleable Foundry Refractories...	188	15	92
80	Folding and Portable Wooden Chairs ^a.....	..	..	..
81	Binders' Board.....	718	10	98
82	Hollow Metal Doors ^a.....	..	45	..
83	Kalamein Doors. ^a.....	..	36	..
84	Composition Books.....	86	41	52
85	Adhesive Plaster			
	Rolls.....	3	2	33
	Spools			
	Widths.....	8	5	38
	Lengths.....	23	13	43
86	Surgical Gauze (construction).....	15	7	53
87	Forms for Concrete Ribbed Floor Construction (widths).....	7	2	71
88	Floor Sweeps.....	11	6	45
89	Coated Abrasive Products.....	8,000	1,976	75.3
90	Hacksaw Blades.....	..	..	75
92	Ply and Yarn Goods of Hard Fiber Cordage.....	1,304	391	70
93	Tags, Paper.....	..	..	..
94	Fire Engines.....	..	..	..
95	Skid Platforms.....	..	..	..
96	Ice Cake Sizes.....	..	..	..

^a Original total not known.

^a Elimination estimated by industry as 20% in portable chairs and 19% in folding chairs.

RECOMMENDATIONS IN PROCESS OF REVISION

S.P.R. No.	Item
3	Metal Lath
9	Woven Wire Fencing
13	Structural Slate
14	Roofing Slate
16	Lumber
19	Asbestos Paper and Asbestos Millboard
20	Steel Barrels and Drums
28	Sheet Steel
30	Roofing Terns (formerly "terneplate")
35	Steel Lockers
37	Invoice Forms
43	Paint and Varnish Brushes
51	Die Head Chasers (for self-opening and adjustable die heads)
56	Carbon Brushes and Brush Shunts
58	Classification of Iron and Steel Scrap

COMMERCIAL STANDARDS IN PROCESS OF ACCEPTANCE

Chain-Link Fence and Chain-Link Fabric.
Stoddard Solvent.
Clinical Thermometers.
Staple Porcelain Plumbing Fixtures.

APPENDIX F

PROCEDURE FOR THE ESTABLISHMENT OF RECOGNIZED SPECIFICATIONS AS "COMMERCIAL STANDARDS"¹

"(1) Industry has long sensed the need for the wider application and use of specifications developed and approved by nationally recognized organizations. To assist these bodies and also the producers and users concerned, in securing this result, the Bureau of Standards of the Department of Commerce has formulated a general procedure under which nationally recognized specifications may be printed as official publications of the Department of Commerce and promulgated as 'Commercial Standards.'

"(2) The first step in the procedure is a specific request from some part of industry for the services of the Bureau of Standards looking toward the promulgation of a commercial standard. This service will be extended only upon specific request. Following such request, a preliminary canvass is made to determine the consensus of opinion regarding advantages and benefits of promulgating such commercial standards and probable amount of cooperation which may be expected.

"(3) If there is ample prospect of full cooperation, a preliminary conference is arranged to survey available standards or to delegate the work of making such a survey. Occasionally this survey may be unnecessary, when it is demonstrated that a given specification is so generally acceptable that it logically forms the basis for consideration as the commercial standard in its field.

"(4) In the event a survey is necessary, a committee appointed by industry obtains data on present adherence to the various standards in the field, present production and demand for various sizes and qualities, and recommends a given specification limiting grades, qualities, sizes, etc., as a tentative standard to serve as a basis for consideration at the general conference.

"(5) Acting upon the recommendations of the preliminary conference or the survey committee, agenda are prepared for a general conference of industry including producers, distributors and organized consumers. Said agenda are then referred to the proper technical division of the Bureau of Standards for review to insure compatibility with present trend or progress in the art, or with recommendations resulting from research or tests, as well as recommendations supported by various technical societies. When this review has been completed and adjustments made as circumstances

¹National Bureau of Standards, Commercial Standards Unit, mimeographed, Washington, 1927.

warrant, the agenda are then submitted to the committee of industry for review and the authorization to call a general conference of all interests.

"(6) Following such authorization, the Bureau of Standards then forwards the agenda to all known manufacturers, distributors and organized consumers, with an invitation to attend a conference at a specific time and place, usually Washington, D. C. This general conference considers what action is feasible and desirable concerning the recommended standard, revises objectionable details, if any, and recommends adoption of the amended standard.

"(7) The Bureau of Standards then disseminates the recommendations of the general conference with requests for written acceptances from each unit of the whole industry including manufacturers, distributors and organized consumers. Upon receipt of signed acceptances representing a satisfactory majority of production, or consumption of a commodity by volume, the recommendations are published in uniform style as "Commercial Standards," and issued to all interested groups.

"(8) A certification plan is employed in connection with commercial standards by which manufacturers may certify to the consumer that their product is made in accordance with the commercial standard, thus assuring the small consumer that goods purchased will be made in accordance with the specification, without the necessity of his employing laboratory tests to prove the fact.

"(9) Provision for regular revision is made by the appointment of a standing committee to consider periodically any necessity for revision of the commercial standard in order that each may be kept constantly compatible with progress in the art.

"(10) Broadly speaking, the aim is to continue the same character of cooperative service in this field that is being rendered in simplification. The Commercial Standards Unit does not propose to act as a standardizing body nor will it engage in the preparation of specifications. The chief mission is to get behind a standard or a specification which any industry or its related groups may want to promulgate on a nation-wide basis; to determine its eligibility for promulgation; to publish and broadcast it in the event the prerequisites, including a satisfactory majority acceptance, have been met; to facilitate the application of the certification plan for the assurance and convenience of the small purchaser, and to provide a means for controlled periodical revision."

APPENDIX G

PUBLICATIONS OF AMERICAN MARINE STANDARDS COMMITTEE¹

(To August 1, 1928)

A. M. S. C. Serial No.	Title or Subject
	Organization of the American Marine Standards Committee, Its Constitution and Rules
	Stability and Loading of Ships (out of print)
1.	Glass for Air Ports and Fixed Light
2.	Mooring Bits—Cast Iron
3.	Fixed Lights for Ships Type A—Pressed Steel Frame Type B—Cast Brass Frame Type C—Cast Brass Finished Frame
4.	Rigging Screws for Ships Rigging Screws with Spliced Rope Rigging Screws with Sockets
5.	Ship Fittings for Decks and Rigging Chain Plates Wire Rope Sockets Solid Thimbles for Wire Rope Open Thimbles for Wire Rope Pad Eyes and Links
6.	Cargo Handling Gear for Ships Railroad Iron Sling Chain Sling
7.	Kinds and Sizes of Hose for Ship Equipment
8.	Specification for $\frac{3}{4}$ " and 2" Flexible Metallic Hose
9.	Specification for $2\frac{1}{2}$ " Double-Jacketed Cotton Rubber-Lined Fire Hose
10.	Specification for $2\frac{1}{2}$ " Unlined Linen Fire Hose
11.	Instructions for Care and Maintenance of Steel Hulls
12.	General Instructions for Operation, Care and Upkeep of Scotch Type Marine Boilers
13.	Kinds and Sizes of Mattresses and Pillows and Woolen, Linen and Cotton Articles for Ship Equipment
14.	Kinds and Sizes of Glassware for Ship Equipment
15.	Kinds and Sizes of Silverware for Ship Equipment
16.	Distinctive Markings for Piping
17.	Specification for $2\frac{1}{2}$ " Single-Jacketed Cotton Rubber-Lined Fire Hose
18.	Essential Machinery Spare Parts, Accessories and Supplies for Sea-going Ships
19.	Equipment and Methods for Safety on Ships
20.	General Instructions for Operation, Care and Upkeep of Water Tube Marine Boilers
21.	Condenser Tube Ferrules and Tube Sheets
22.	Specifications for Pressure and Vacuum Gauges for Ships

¹U. S. Bureau of Standards, mimeographed, Washington, August 1, 1928.

A. M. S. C. Serial No.	Title or Subject
23.	Mooring Bitts—Cast Steel
24.	Fire Hose Racks for Ships Metal Rack—Pocket Type Metal Rack—Saddle Type Wooden Rack
25.	Pilot Ladder
26.	Tubular Steel Cargo Booms 5 Tons Capacity 10 Tons Capacity 15 Tons Capacity 20 Tons Capacity 30 Tons Capacity
27.	Couplings for Propeller Shafting Flanged Couplings Loose Couplings for Inboard Shafts
28.	Propeller Shaft Details Tail Shafts and Stern Tube Bearings Propeller Keys Propeller Nuts Stern Tube Stuffing Boxes
29.	Ship Propeller Details Hubs for Built-up Propellers with Recessed Blades Fairwater Caps for Built-up Propellers with Recessed Blades
30.	Propeller Hub Studs, Nuts and Lock Screws
31.	Packing Gland for Propeller Hubs (optional method)
32.	Fire Clay Refractories for Marine Service
33.	Life Boat Sizes and Capacities Narrow Type Wide Type
34.	Marine Glue for Seams of Ship Docks—Specification
35.	Insulation of Piping and Machinery on Ships—General Specifications
36.	Magnesia Molded Pipe Covering and Blocks—Specification
37.	Magnesia Asbestos Plaster—Specification
38.	Asbestos Millboard—Specification
39.	Hair Felt for Insulation—Specification
40.	Cotton Duck for Insulation Coverings—Specification
41.	Metallic Packing for Condenser Tubes—Specification
42.	Ship Propeller Details Hubs for Built-up Propellers, with Flush Facings Fairwater Caps for Flush Faced Propeller Hubs
43.	Rubber Air Hose—Specification
44.	Rubber Steam Hose—Specification
45.	1½" Water Hose, Rubber Covered—Specification
46.	2½" Water Suction Hose, Smooth Bore—Specification
47.	Oil Suction and Discharge Hose, Rubber Covered—Specification
48.	Scupper Valves—Sizes 3", 4", 5" and 6"
49.	Cargo Boom Fittings Boom Steps, Bracket Type, for 5, 10 and 15 Ton Booms Boom Steps, Deck Type, for 15, 20 and 30 Ton Booms
50.	Fittings for Tubular Steel Cargo Booms Heel Fittings for 5, 10, 15, 20 and 30 Ton Booms Caps of Double Pin Type for 5, 10, 15, 20 and 30 Ton Booms Caps of Single Pin Type for 5, 10, 15, 20 and 30 Ton Booms

APPENDIX H

FEDERAL SPECIFICATIONS USED IN THE BUREAU OF STANDARDS CERTIFICATION PLAN¹

Specifi- cation No.	Commodities Covered
23	Large Tungsten Filament Incandescent Electric Lamps
26	White Floating Soap
27	Liquid Soap
28	Soap Powder
29	Salt Water Soap
30	Automobile Soap
31	Chip Soap
32	Ordinary Laundry Soap
33	Grit Cake Soap
34	Scouring Compounds for Floors and Soap Scouring Compound
35	Hand Grit Soap
36a	Fire Extinguishing Liquid (Carbon Tetrachloride Base)
37	Leather Belting (Vegetable Tanned)
52a	Wood Screws
55	Cutout Bases
57	Flexible Non-Metallic Tubing
58	Dry Cells (Being Revised)
62	Snap Switches
65	Rubber Covered Wires and Cables for Ordinary Purposes
80	Coal Tar Pitch for Roofing
81	Coal Tar Saturated Rag Felt for Roofing and Waterproofing
82	Surfacing Materials for Bituminous Built-up Roofing
83	Coal Tar Pitch for Waterproofing and Damp-proofing
84	Asphalt for Mineral Surfaced Roofing
85	Asphalt for Waterproofing and Damp-proofing
86	Asphalt Saturated Rag Felt for Roofing and Waterproofing
87	Asphalt Primer for Roofing and Waterproofing
88	Asphalt for Insurfaced Built-up Roofing
123	Flat Glass for Glazing Purposes
124	Hand Chemical Fire Extinguisher (One Quart Carbon Tetrachloride Type)
127a	25% Rag Blotting Paper, White and Colored
128a	Desk Blotting Paper, Colored
129a	Chart Paper
130a	Mimeograph Paper
131a	50% Rag Mimeograph Paper
132a	Wood Manila Wrapping Paper
133a	Rope Manila Wrapping Paper
175	Knife Switches
177a	Kraft Wrapping Paper
178a	Sulphite Manila Wrapping Paper
179	No. 1 Grade Blue-Print Paper (Sensitized and Unsensitized)
180	No. 2 Grade Blue-Print Paper (Sensitized and Unsensitized)
181	No. 3 Grade Blue-Print Paper (Sensitized and Unsensitized)
182a	Paper, Brown Process (Sensitized and Unsensitized)

¹ U. S. Bureau of Standards, mimeographed, Washington, Feb., 1928.

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Specifi- cation No.	Commodities Covered
183	Upholstery Leather
184	Lace Leather (Vegetable Tanned)
191	Brush, Blacking Dauber
192	Brush, Casting
193	Brush, Clothes Scrubbing
194	Brush, Cuspidor
195a	Brush, Dauber, Long Paddle
196	Brush, Deck Scrubbing
197	Brush, Hand Floor Scrubbing
198	Brush, Hair, Military
199	Brush, Radiator Dusting
200	Brush, Shaving
201	Brush, Sidewalk
202	Brush, Tooth
203	Brush, Window
204	Broom, Rattan Push
205	Broom, Rattan (Upright)
206	Broom, Scrubbing
207	Broom, Wire Push
208a	Duster, Counter
213	Hand Chemical Fire Extinguisher (Soda and Acid Type)
214	Asphalt Prepared Roofing
241	Sole Leather (Vegetable Tanned)
242	Wrought Iron Pipe (Welded) (Black and Galvanized)
244	Milled Toilet Soap
245	Powdered Soap (For Laundry Use)
246	Liquid Soap (For Laundry Use)
275	Road Oil for Hot Application (Type OH-1-25)
276a	Asphalt for Use in Road and Pavement Construction
277	Petroleum Asphalt for Joint Fitter (Squeegee or Pouring Method) (Type PAF-1-25)
279	Tars for Cold Application
280	Refined Tar for Hot Application (Type TH-1-25)
281	Tar for Use in Repair Work
282	Refined Tar for Construction
287	Tubing, Copper, Seamless and Pipe, Copper, Seamless Standard Iron Pipe Size
291	Friction Tape
292	Rubber Insulating Tape
294	Asphalt-saturated Woven Cotton Fabric for Waterproofing
295	Asphalt-saturated Rag Felt for Flashings
296	Slate-surfaced, Asphalt-prepared Roofing and Shingles
297	Wire Rope
311	Rigid Conduit, Enameled
312	Rubber Gloves for Electrical Workers (For Use in Connection with Apparatus or Circuits Not Exceeding 3,000 Volts to Ground)
314	Railroad Track Scales
319	100% Rag Bond Paper, White
320	50% Rag Bond Paper, White and Colored
321	100% Rag Ledger Paper, White
322	75% Rag Ledger Paper, White and Colored
323	100% Rag Manifold Paper, White and Colored
324	Lithograph-finish Map Paper
325	50% Rag Lithograph-finish Map Paper
326	75% Rag Lithograph-finish Map Paper
327	Blotting Paper, White and Colored
328	Sulphite Bond Paper, White and Colored

Specifi- cation No.	Commodities Covered
329	Sulphite Writing Paper, White and Colored
330	100% Rag Heavy Ledger Paper, White
331a	50% Rag Manifold Paper, White and Colored
332	Brooms, Whisk
333a	Brooms, Corn
336	Builders' Hardware
342a	Pipe, Brass, Seamless, Iron Pipe Size, Standard and Extra Strong
343a	Cast Iron Soil Pipe and Fittings, Coated and Uncoated
347	Lap Welded and Seamless Steel Boiler Tubes
349	Lap Welded Charcoal Iron Boiler Tubes
362	Liquid Measuring Devices, Retail Type
363	Burglar Resisting Safes
380	Cement, Asphalt Plastic
394	General Specifications for Paper (Test Methods)
396	Brush, Calcimine
397	Brush, Dust, Ceiling and Wall
398	Brush, Fiber Garage
399a	Brush, Flat Fitch
400	Sweep, Floor, Hair
401a	Brush, Glue, Round
402	Brush, Glue, Flat
403	Brush, Lacquering, Flat Camel Hair
404	Brush, Marking
405	Brush, Mottling, Camel Hair
406a	Brush, Sash Tool, Oval
407	Brush, Hand Scrub, White Tampico
411	Tableware, Silver Plated
423	Roofing, Prepared, Asphalt and Asbestos, Slate-surfaced
424	Roof Coating, Asphalt Fibrous
425	Paper, Carbon, Black, Light Weight (For Typewriter Use)
426	Paper, Carbon, Black, Standard Weight (For Typewriter Use)
484a	Paper, Manifold, 50% Rag, White and Colored, Unglazed
511	Brooms, Metal Case
512	Brushes, Flowing, Badger Hair
513	Brushes, Flowing, Camel Hair
514	Brushes, Flowing, Fitch or Skunk Hair
515	Brushes, Paint, Flat Metal Bound, High Grade
516	Brushes, Paint, Flat Metal Bound, Medium Grade
517	Brushes, Radiator Bronzing
518	Brushes, Roof, Knotted Style, Three Knots
519	Brushes, Stencil (Flag Ends Cut)
520	Brushes, Stencil (Flag Ends Preserved)
521	Brushes, Varnish, Flat (High Grade)
522	Brushes, Varnish, Flat (Medium Grade)
523	Brushes, Wall Stippling
524	Brushes, Whitewash
525	Dusters, Painters,' Flat
526	Dusters, Painters,' Round

APPENDIX I

USE OF LABELS BY NATIONALLY RECOGNIZED ORGANIZATIONS¹

Among the agencies that are engaged in activities relating to the formulation of specifications, or the establishment of quality standards, manufacturing in conformity therewith and taking steps to insure compliance therewith are the following that make use of labels or their equivalent for this purpose:

American Corn Millers' Federation has adopted a symbol to be licensed by the federation to all millers who will agree to conform to its specifications for corn meal.

American Gas Association has established a gas appliance testing laboratory and permits manufacturers of appliances approved by the laboratory as complying with the association's safety requirements to attach to the appliance the official approved seal of the association.

American Institute of Steel Construction (Inc.) permits its members who adhere to its code of standard practice to use the institute's symbol as a label for their commodities.

American Petroleum Institute grants to manufacturers the right to place its official monogram on certain standardized equipment upon certifying that the material so marked complies with the Institute's specifications.

American Society of Mechanical Engineers permits manufacturers to place the A. S. M. E. symbol on a boiler complying with the requirements and tests of its boiler construction code.

Arkansas Soft Pine Bureau permits member mills to use the registered symbol of the association with stock grade marked in accordance with American Lumber Standards.

Associated Factory Mutual Fire Insurance Companies permits manufacturing firms to use the association's identification mark of approval on devices specifically approved by the association as to both design and construction.

Associated General Contractors of America enters into agreement with manufacturers in accordance with which concrete mixers complying with A. G. C. standards carry the name plate indicating this fact.

Associated Tile Manufacturers has adopted a color scheme for grade marking and issuing certificates to accompany packages of white glazed tile and unglazed ceramic mosaic manufactured to comply with the simplified practice recommendation relating to this group of commodities.

Better Bedding Alliance of America was organized chiefly to encourage the truthful labeling of the filling contents of bedding and the discouragement of any misrepresentation of the product.

¹ National Bureau of Standards, mimeographed, Washington, 1928.

Canners League of California secured the adoption of a law requiring all canned peaches, pears, apricots, and cherries of a grade below certain approved standards to be marked with the word "seconds" embossed on the top of the can.

Commission on Standardization of Biological Stains issues certificates in the form of labels to be attached to bottles containing stains submitted to it and found to comply with its specifications.

Concrete Products Association issues certificates of quality to its members when it is found that their products meet the requirements of the American Concrete Institute standards.

Glycerine Producers' Association permits members that follow the association's formula in manufacturing radiator glycerine to use the association's seal as a label to indicate the quality of their radiator glycerine.

Heating and Piping Contractors' National Association has adopted a national insignia and certificate and also a boiler plate for the identification of heating plants complying with its specifications.

Interstate Cotton Seed Crushers' Association dismisses from membership any of its members found guilty of misbranding or adulteration.

Malleable Iron Research Institute issues to manufacturers of products conforming to its specifications certificates which permit them to use the trade-mark of the Institute in advertising their products.

Maple Flooring Manufacturers' Association permits member firms to use the association's trade-mark on maple, beech or birch flooring guaranteed by the association to comply with its grades and standards.

National Association of Finishers of Cotton Fabric licenses its members to use the association's label showing that goods to which it is applied comply with the association's requirements for fastness to light and washing.

National Retail Lumber Dealers Association permits its member companies to issue to purchasers certificates, underwritten by the association, guaranteeing that the material delivered conforms in grading with nationally adopted manufacturer's standards, and in quantity exactly with the invoice rendered.

Northern Hemlock and Hardwood Manufacturers Association has adopted a system of branding and grade marking whereby a member firm is assigned an identifying number and is licensed to use the association's brand to show that its lumber is graded in accordance with American Lumber Standards.

Paperboard Industries Association grants to its members the privilege of using its insignia in connection with the certificates used by manufacturers showing that boxes bearing these certificates conform to all construction requirements of the Consolidated Freight or the Official Express Classification.

Periodicals, such as *Good Housekeeping Magazine*, *Modern Priscilla*, and *Popular Science Monthly*, have set up specifications for various lines of commodities and issue the equivalent of certificates of approval in the form of labels for trade-brand articles meeting these specifications.

Pipe Nipple Standards Corporation (not a manufacturing firm but made

up of representatives of manufacturers) licenses manufacturers to use its registered trade-mark stamped on goods to identify pipe nipples manufactured to comply with its standards.

Porcelain Plumbing Fixture Manufacturers (advisory committee to the Bureau of Standards) issues labels certifying compliance with the commercial standards for porcelain plumbing fixtures.

Society for Electrical Development has inaugurated a so-called "red-seal plan" for identifying a house that is properly and adequately wired in accordance with approved specifications.

Southern Pine Association employs a staff of inspectors to visit the plants of its member firms who are permitted to place the mark of the grader on all lumber they make.

Steamboat Inspection Service of the Department of Commerce permits manufacturers to identify by labels, or advertising, devices built to comply with its requirements.

Tissue Paper Manufacturers' Association authorizes its members to use the official label and seal of the association in guaranteeing packages of tissue paper to be in accordance with the simplified practice recommendation for this commodity.

Underwriters' Laboratories, maintained by the National Board of Fire Underwriters, have prepared definite specifications relating to design details and performance characteristics of certain appliances and devices and licenses manufacturers receiving the required inspection and testing service to identify goods meeting its specifications by means of stamps, labels, or other markings.

Vitreous China Plumbing Fixtures Manufacturers (advisory committee to the Bureau of Standards) authorizes manufacturers to employ labels for grade marking products complying with the simplified practice recommendations for this group of commodities.

APPENDIX J

ADVANTAGES OF STANDARDIZATION REPORTED BY THE DETROIT EDISON COMPANY¹

STANDARDIZATION OF PACKING

- (1) *Requisitioning Department* (Construction, Operating, Underground, Electrical, etc.).
 - (a) The *correct* packing for a given service specifically covered, preventing the evils attendant in ordering the wrong material.
 - (b) Standard descriptions enable subordinates to order material thereby sparing plant executives from routine work.
 - (c) The packing selected is based on a decision of all the plant engineers, eliminating the personal element.
 - (d) The danger of drawing on shelf worn and stale packings eliminated owing to rapid turnover of a few brands.
 - (e) Because of the reduced variety of brands, smaller stocks and quicker turnovers are effected.

- (2) *Purchasing Department*
 - (a) Requisitions received uniformly written, there being no question of what is wanted.
 - (b) Having eliminated a large number of miscellaneous brands, the remaining are ordered in larger quantities, thereby permitting "quantity purchase" savings.

Our annual purchases of packing are, roughly, \$5,000. Standardization will enable us to make a saving of between \$800 and \$1,000.

- (3) *Stores Department*
 - (a) Fewer orders
 - (b) Fewer items
 - (c) Less bookkeeping
 - (d) Less handling
 - (e) Reduced stocks
 - (f) Faster turnover
 - (g) Practical elimination of obsolete packing.

Conclusions

The standardization of packings brings to the user the correct material, in a fresh condition, with a minimum expenditure of energy and loss of time and at the lowest price.

¹ From material supplied by courtesy Detroit Edison Company, 1928.

STANDARDIZATION OF FIREBRICK

(1) *Design*

- (a) Simplification of design: Fewer shapes to consider—hence more rapid progress on the board.
- (b) Simple designs are notoriously the strongest.
- (c) Requires less experienced designers when standard construction is pursued and hence reduction in expensive help.
- (d) Less danger of error.
- (e) Changes can be more readily effected.
- (f) When necessary, jobs may be rushed through without danger.
- (g) Checking of drawings becomes matter of routine rather than a feat.
- (h) Fewer drawings—hence lower drawing costs, fewer draftsmen and less materials.
- (i) Changes permissible without danger of shapes becoming obsolete.

(2) *Construction*

- (a) Simpler construction—hence more rapid progress in field and less intelligent help necessary.
- (b) Standardization of design permits transfer from one job to another without undue experience necessary to carry on.
- (c) Stronger construction—hence less maintenance and outage, with attendant reduction in operating costs.
- (d) Less material and fewer brickmasons required.
- (e) Danger of holding up of job, resulting from shortage of material, reduced.
- (f) Reduction in operating records.

(3) *Purchasing Department*

- (a) Fewer orders.
- (b) More carload shipments and hence savings in freight.
- (c) Material obtainable from stock, permitting quick shipments.
- (d) Fewer special shapes eliminate special high-priced molds, special firing and expensive material. Also, special shapes often turn out unsatisfactorily, delaying all departments.
- (e) Orders simplified.
- (f) Standard shapes, for a given weight, cost about $\frac{1}{3}$ that of special shapes.

(4) *Stores Department*

- (a) Stocks reduced at plants and warehouses.
- (b) Any overstocking in one locality can be adjusted promptly. This is hindered by special shapes.
- (c) Turnover improved.
- (d) Negligible scrapping of obsolete shapes and attendant losses.

(5) *Vendors*

- (a) Vendor is able to meet the demands of the customer promptly and completely.
- (b) Receives fewer complaints.
- (c) Leaves the customer satisfied because customer gets low price, car-lot shipments, and uniform product, *promptly*.

Conclusions

The standardization of the firebrick has resulted in eliminating practically 65% of the number of shapes of brick formerly purchased. It is too early to show savings due to quantity purchases, because of our present effort to reduce the large stocks. We believe that in some ways stronger construction has been made possible by the studying of details. The reduction of stocks, more frequent turnovers, fewer orders, car-lot shipments, etc., are factors that have more than justified the work put in on standardization of this item.

STANDARDIZATION OF PIPING

(1) *Requisitioning Department*

- (a) Terminology—The correct descriptions furnished enable the requisitioning departments to specify material so that:
 - (1) Correct material will be ordered.
 - (2) There will be no delay while buyer finds out the meaning of ambiguous descriptions.
 - (3) Many telephone calls eliminated.
- (b) Material—Savings that are effected through selection of “best” valve for each type of duty:
 - (1) Reduced maintenance charges.
 - (2) Uniformity of equipment in plant.
 - (3) Fewer replacement parts required.
 - (4) Lower unit costs due to concentrated purchase or larger quantities.

(2) *Stores Department*

- (a) Terminology—Uniformity in descriptions of identical materials will:
 - (1) Result in proper identification for posting, pass-out records, and checking with standard and surplus stock.
 - (2) Eliminate duplicate stock numbers for identical materials.
 - (3) Make possible the requisitioning of material by persons not familiar with the material itself.
 - (4) Eliminate many returns of material incorrectly ordered through inadequate descriptions.
- (b) Material—Standardization will:
 - (1) Eliminate items where several valves are used for the same purpose.
 - (2) Reduce the number of different parts required for repairs to various makes of valves.

(3) *Purchasing Department*

(a) Terminology—Uniformity will result in:

- (1) Fewer telephone calls to determine what material is wanted.
- (2) Much time saved which has been required for rewriting requisitions.
- (3) Positive identification of material in purchase records.
- (4) More rapid handling of orders all through Department because of complete, concise and uniform descriptions.

(b) Material—Standardization of valves permits greater concentration of purchases, which in turn, means fewer orders and lower prices.

OTHER STANDARDIZATION WORK

Sub-Committee No. 10—Stokers:

The principal saving that will be realized by decisions reached to date is by adoption of the two-piece tuyere. When this substitution is complete, we will replace in one year (using figures for 1926):

17,614 tuyere noses @ \$.603 ea. avg.....	\$10,600.00
Instead of	
17,614 tuyeres @ \$1.35 ea. avg.....	23,715.00
Yearly saving on this part alone.....	\$13,115.00

Item No. 2—Committee No. 7—Carbon Brushes:

This Committee has standardized all brushes that are carried in stock, reducing the total number of items in stock by approximately 25%. The Stores Department has been given the scale of discounts in order that in all cases the most economical quantity may be ordered. These two facts have assisted us in buying all our carbon brushes at from 10% to 20% under previous levels. This means a saving of approximately \$3,000.

Because of the large number of brushes that were discontinued and will have to be used up, the Committee has not yet attempted to go over the non-stock items. There are as many of these as there were stock-items, and if anything we should produce better results in this group.

Item No. 6—Sub-committee No. 12—Brooms, Brushes, Dusters, etc:

We have been able to cut down the types of the following items:

Brooms.....	13 to 6
Dusters.....	6 to 3
Marking brushes.....	6 to 1
Kalsomine brushes.....	5 to 1
Paint brushes.....	11 to 3
Sash tools.....	7 to 1
Varnish brushes.....	26 to 5

Such a reduction in types will make a considerable saving in the purchase of these items. However, at this time, we are unable to give an estimate of this saving in dollars and cents.

APPENDIX K

EXPENDITURES FOR STANDARDIZATION BY TECHNICAL SOCIETIES, TRADE ASSOCIATIONS, STATE AND FEDERAL GOVERNMENTS IN 1926¹

In an effort to determine the amount of money expended annually on standardization by technical societies, trade associations, and state and federal governments, a letter was prepared in which the following three questions were asked:

- (1) Approximately how much was spent by your organization in 1926 for Standardization, including such items as Executive Salaries, Office Expenses, Conducting Conferences, Publication, Research, Travel, etc.?
- (2) How much did your organization contribute to the work of other standardization agencies in 1926, in addition to the foregoing?
- (3) What would be your estimate of the amount expended by industrial companies and persons participating in your work in 1926, for salaries and traveling expenses not included in your budget for standardization?

Number of inquiries sent out.....	353
Number of replies received.....	243
Number reporting expenditures and stating amounts.....	91
Number reporting expenditures but giving no amounts....	31
Number of inquiries unanswered.....	110
Percentage of replies received.....	69

The same letter was sent to the secretary of the several states.

Number of inquiries sent out.....	43
Number of replies received.....	29
Number reporting expenditures and stating amounts.....	4
Number reporting expenditures but giving no amounts....	10
Number of inquiries unanswered.....	19
Percentage of replies received.....	60

The results of the survey are shown in the following table:

Group	Question I	Question II	Question III	Total
Trade Associations. . .	\$2,222,306.17	\$34,298.00	\$735,411.37	\$2,992,015.54
Technical Societies. . .	387,140.06	28,760.50	414,600.00	830,500.56
State Governments. . .	134,240.00	..	..	134,240.00
Federal Government. .	4,250,500.00	..	..	4,250,500.00
Total.	\$6,994,186.23	\$63,058.50	\$1,150,011.37	\$8,207,256.10

¹ U. S. Department of Commerce, unpublished.

TRADE ASSOCIATIONS REPORTING EXPENDITURES FOR
STANDARDIZATION IN 1926

American Electric Railway Association
American Foundrymen's Association
American Gas Association
American Institute of Steel Construction
American Malleable Castings Association
American Paper and Pulp Association
American Petroleum Institute
American Railway Association (including all divisions of the A. R. A.)
American Zinc Institute
Asphalt Association
Associated Factory Mutual Fire Insurance Companies
Associated General Contractors of America
Associated Knit Underwear Manufacturers of America
Association of American Steel Manufacturers
Association of Electragists, International
Association of Feed Control Officials of the United States
Association of Scientific Apparatus Makers of the United States of America
Automotive Electric Association
Bureau of Explosives
California Redwood Association
Canners League of America
Compressed Gas Manufacturers' Association
Concrete Reinforcing Steel Institute
Cover Paper Manufacturers' Association
Drill and Reamer Society, The
Glass Container Association
Gypsum Industries (now The Gypsum Institute)
Institute of American Meat Packers
International Association of Electrotypers of America
International Association of Milk Dealers
Interstate Cotton Seed Crushers' Association
Jute Twine Manufacturers' Association
Laundryowners' National Association
Machinery Builders' Society
Manufacturing Chemists' Association of the United States
Maple Flooring Manufacturers' Association
Milling Cutter Society
National Association of Cost Accountants
National Association of Dyers and Cleaners
National Association of Farm Equipment Manufacturers
National Association of Marble Dealers
National Association of Purchasing Agents
National Association of Wood Turners
National Building Granite Quarries Association
National Bureau of Casualty and Surety Underwriters

National Committee on Metals Utilization
 National Electric Light Association
 National Fertilizer Association
 National Hardwood Lumber Association
 National Lumber Manufacturers' Association
 National Machine Tool Builders' Association
 National Paving Brick Manufacturers' Association
 National Sand and Gravel Association
 National Terra Cotta Society
 National Veneer and Panel Association
 National Wholesale Grocers' Association of the United States
 Natural Gas Association of America
 New England Water Works Association
 North Carolina Pine Association, The
 Paperboard Industries Association
 Portland Cement Association
 Sand-Lime Brick Association
 Silk Association of America, The
 Southern Pine Association
 Southern Sash, Door and Millwork Manufacturers' Association
 Steel Founders' Society of America
 Tap and Die Institute, The
 Tissue Paper Manufacturers' Association
 Writing Paper Manufacturers' Association

**TECHNICAL SOCIETIES REPORTING EXPENDITURES FOR STANDARDIZATION
 DURING 1926**

American Chemical Society
 American Institute of Architects
 American Institute of Electrical Engineers
 American Institute of Mining and Metallurgical Engineers
 American Public Health Association
 American Railway Engineering Association
 American Society for Municipal Improvements
 American Society for Steel Treating
 American Society for Testing Materials
 American Society of Agricultural Engineers
 American Society of Civil Engineers
 American Society of Heating and Ventilating Engineers
 American Society of Mechanical Engineers
 American Standards Association
 Central Committee on Lumber Standards
 Electrical Safety Conference
 Illuminating Engineering Society
 Institute of Paint and Varnish Research
 National Board of Fire Underwriters
 National Fire Protection Association

National Safety Council
 Society of Automotive Engineers
 Underwriters' Laboratories

ASSOCIATIONS AND SOCIETIES REPORTING PARTICIPATION IN STANDARDIZATION, THE EXPENSES OF WHICH ARE BORNE BY THE MEMBERS

American Association of Woolen and Worsted Manufacturers
 American Bankers' Association
 American Paint and Varnish Manufacturers' Association
 American Specification Institute
 American Steel and Heavy Hardware Association
 American Vitrified China Manufacturers' Association
 American Waxed Paper Association
 American Wood Preservers' Association
 Association of Governmental Labor Officials of the United States and Canada
 Association of Iron and Steel Electrical Engineers
 National Association of Woolen and Worsted Spinners
 National Cannery Association
 National Electrical Manufacturers' Association
 National Varnish Manufacturers' Association
 Paint Manufacturers' Association of the United States
 Refrigerating Machinery Association
 United Typothetae of America

ASSOCIATIONS AND SOCIETIES REPORTING NO EXPENDITURES FOR STANDARDIZATION IN 1926

American Association for the Advancement of Science
 American Automobile Association
 American Boiler Manufacturers' Association
 American Bottlers of Carbonated Beverages
 American Bureau of Shipping
 American Dental Trades Association
 American Envelope Manufacturers' Association
 American Hotel Association of the United States and Canada
 American Institute of Chemical Engineers
 American Institute of Consulting Engineers
 American Institute of Marine Underwriters
 American Iron and Steel Institute
 American Management Association
 American National Retail Jewelers' Association
 American Short Line Railroad Association
 American Walnut Manufacturers' Association
 Armco Culvert and Flume Manufacturers' Association
 Artistic Lighting Equipment Association
 Asbestos Paper Manufacturers' Association

Asphalt Shingle and Roofing Association
 Associated Leather Goods Manufacturers of the United States of America
 Associated Metal Lath Manufacturers
 Associated Office Furniture Manufacturers
 Association of Dairy, Food and Drug Officials of the United States
 Association of Manufacturers of Wood Working Machinery
 Association of Wilton and Brussels Manufacturers of America
 Automotive Equipment Association
 Automotive Wood Wheel Manufacturers' Association
 Building Owners' and Managers' Association of San Francisco
 Bureau of Envelope Manufacturers of America
 Bureau of Railway Economics
 Cigar Manufacturers' Association of America
 Common Brick Manufacturers' Association of America
 Concrete Products Association
 Copper and Brass Research Association
 Cotton Thread Manufacturers' Association
 Eastern Clay Products Association
 Edible Gelatin Manufacturers' Research Society of America
 Electric Hoist Manufacturers' Association
 Elevator Manufacturers' Association of the United States
 Foundry Equipment Manufacturers' Association
 Glazed and Fancy Paper Manufacturers' Association
 Grain Dealers' National Association
 Grey Iron Founders' Association
 Hardwood Manufacturers' Institute
 Hollow Metal Door Society
 International Apple Shippers' Association
 International Association of Casualty and Surety Underwriters
 International Association of Industrial Accident Boards and Commissions
 International Railway Fuel Association
 Latch Needle Manufacturers of the United States
 Leather Belting Exchange
 Metal Bed and Spring Bed Institute
 Motor Cycle and Allied Trades Association
 National Association of Amusement Parks
 National Association of Fan Manufacturers
 National Association of Glue Manufacturers
 National Association of Ice Cream Manufacturers
 National Association of Lighting Equipment Dealers
 National Association of Manufacturers of Heating and Cooking Appliances
 National Association of Manufacturers of Pressed and Blown Glassware
 National Association of Steam Specialty Manufacturers
 National Association of Steel Furniture Manufacturers
 National Association of Waste Material Dealers
 National Association of Wool Fiber Manufacturers
 National Boiler and Radiator Manufacturers' Association
 National Federation of Construction Industries (dissolved)

National Federation of Implement Dealers' Association
 National Founders' Association
 National Hay Association
 National Industrial Conference Board
 National Lime Association
 National Paint, Oil and Varnish Association
 National Paper Box Manufacturers' Association
 National Petroleum Association
 National Piano Manufacturers' Association of America
 National Pipe and Supplies Association
 National Restaurant Association
 National Warm Air Heating and Ventilating Association
 Optical Manufacturers' Association (dissolved)
 Optical Society of America
 Plumbago Crucible Association
 Plywood Manufacturers' Association
 Power Transmission Association
 Road Machinery Manufacturers' Association
 Society of American Foresters, The
 Society of Gas Lighting

ASSOCIATIONS AND SOCIETIES UNABLE TO ESTIMATE EXPENDITURES FOR
STANDARDIZATION IN 1926

American Bureau of Welding
 American Concrete Institute
 American Corn Millers' Federation
 American Fruit and Vegetable Shippers' Association
 American Institute of Baking
 Asbestos Brake Lining Association
 Associated Cooperage Industries of America
 Association of Edison Illuminating Companies
 Association of Master Plumbers
 Association of Official Agricultural Chemists
 Atlantic Coast Shipbuilders' Association
 Heating and Piping Contractors' National Association
 National Aeronautic Association of the United States of America
 National Association of Brass Manufacturers
 National Association of Building Owners and Managers
 National Association of Cotton Manufacturers
 National Association of Mutual Casualty Companies
 National Association of Sheet and Tin Plate Manufacturers
 National Association of Wool Manufacturers
 National Automatic Sprinkler Association
 National Research Council
 National Retail Dry Goods Association
 National Retail Hardware Association
 Rice Millers' Association

Rubber Heel Club of America, The
Society of Gas Lighting
Steel Barrel Manufacturers' Institute
Sterling Silversmiths Guild of America
Structural Service Bureau
Technical Association of the Pulp and Paper Industry
Telephone Group

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