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A BIBLIOGRAPHY RELATING TO SOIL ALKALIES

Compiled with Special Reference to the Deleterious Action of Soil Alkalies, and Various Other Chemical Agents on Cement and Concrete

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WORD AND PHRASE ABBREVIATIONS

Abs.....	Abstract.	Jour.....	Journal.
Ag.....	Agriculture.	Min.....	Minutes.
An.....	Annual.	Munic.....	Municipal.
Ass'n.....	Association.	Proc.....	Proceedings.
Bd.....	Board.	Pt.....	Port.
Bul.....	Bulletin.	Rpt.....	Report.
Col.....	Column.	Sect.....	Section.
Concl.....	Conclusions.	Ser.....	Series.
Disc.....	Discussions.	Soc.....	Society.
Ed. Comment.....	Editorial Comment.	Suppl.....	Supplement.
Eng.....	Engineer, Engineering.	Tech.....	Technical.
Exten. Abs.....	Extensive Abstract.	Trans.....	Transactions.
Exc.....	Excerpts.	U. S. D. A.....	U. S. Department of Agriculture.
Inst.....	Institute.	U. S. G. S.....	U. S. Geological Survey.
Int.....	International.		

ABBREVIATIONS FOR NAMES OF PERIODICALS CITED

Am. Cer. Soc. Trans.....	American Ceramic Society. Transactions.
Am. Chem. Soc. Jour.....	American Chemical Society. Journal.
Am. Contr.....	American Contractor.
Am. Port Auth. Proc. & Papers.....	American Port Authorities, Proceedings and Papers.
Ann. des. P. et Chs.....	Annales des Ponts et Chaussées.
A. P. C. M. Bul.....	Association of American Portland Cement Manufacturers. Bulletin.
A. P. C. M. Min.....	Association of American Portland Cement Manufacturers. Minutes.
A. Ry. E. A. Bul.....	American Railway Engineering Association. Bulletin.
A. Ry. E. A. Proc.....	American Railway Engineering Association. Proceedings.
A. Ry. E. & M. W. A. Bul.....	American Railway Engineering and Maintenance of Way Association. Bulletin.
A. S. C. E. Proc.....	American Society of Civil Engineers. Proceedings.
A. S. C. E. Trans.....	American Society of Civil Engineers. Transactions.
A. S. M. E. Jour.....	American Society of Mechanical Engineers Journal.
A. S. T. M. Proc.....	American Society for Testing Materials. Proceedings.
A. W. W. A. Proc.....	American Water Works Association. Proceedings.
Ariz. Sta. Bul.....	Arizona Agricultural Experiment Station Bulletin.
Balt. Eng. Club Jour.....	Baltimore Engineering Club Journal.
Bet. u. Eis.....	Beton und Eisen.
Calif. Sta. Bul.....	California Agricultural Station. Bulletin.
Calif. Sta. Rpt.....	California Agricultural Station. Report.
Can. Cem. & Conc. Rev.....	Canadian Cement and Concrete Review.
Can. Eng.....	Canadian Engineer.
Can. Eng. Inst. Jour.....	Canadian Engineering Institute. Journal.
Cement.....	Cement.
Cem. Age.....	Cement Age.
Cem. & Eng. N.....	Cement and Engineering News.
Cem. Era.....	Cement Era.
Chem. Abs.....	Chemical Abstracts.
Chem. Eng.....	Chemical Engineer.
Chem. & Met. Eng.....	Chemical and Metallurgical Engineering (Met. and Chem. Eng. up to 1918).
Chem.-Zeit.....	Chemiker-Zeitung.
Ciment.....	Ciment.
Colo. Sta. Bul.....	Colorado Agricultural Experiment Station. Bulletin.
Concrete.....	Concrete.
Conc. Cem. Age.....	Concrete-Cement Age.
Conc. & Const. Eng.....	Concrete and Constructional Engineering.
Conc. Eng.....	Concrete Engineering.
Contract Rec.....	Contract Record.
Dinglers Polytech. Jour.....	Dinglers Polytechnisches Journal.
Dom. Eng.....	Domestic Engineering.
Engineer.....	Engineer.
Engineering.....	Engineering.
Eng. & Contr.....	Engineering and Contracting.
Eng. Mag.....	Engineering Magazine.
Eng. N.....	Engineering News.
Eng. N. Rec.....	Engineering News Record.
Eng. Rec.....	Engineering Record.
Exper. Sta. Rec.....	Experiment Station Record (U. S. D. A.).
Franklin Inst. Jour.....	Franklin Institute. Journal.
Gesundheits-Ingenieur.....	Gesundheits-Ingenieur.
Harvard Eng. Jour.....	Harvard Engineers Journal.

Iowa Sta. Bul.....	Iowa Agricultural Experiment Station. Bulletin.
Idaho Eng. Soc. Jour.....	Idaho Engineers Society. Journal.
Idaho Sta. Bul.....	Idaho Agricultural Experiment Station. Bulletin.
Inst. Civil Eng. (Lond.) Min. & Proc.	Institution of Civil Engineers, London. Minutes and proceedings.
Int. A. T. M. Proc.....	International Association for Testing Materials. Proceedings.
Off Rpts.....	Official reports.
Non. Off. Papers.....	Nonofficial papers.
Int. Eng. Cong. Trans.....	International Engineering Congress. Transactions.
Int. Marine Eng.....	International Marine Engineering. (Now Marine Engineering and Shipping Age.)
Jour. Ag. Research.....	Journal of Agricultural Research (U. S. D. A.).
Jour. Ind. & Eng. Chem.....	Journal of Industrial and Engineering Chemistry.
Lond. Chem. Soc. Jour.....	London Chemical Society. Journal.
Met. & Chem. Eng.....	Metallurgical and Chemical Engineering. (Chem. & Met. Eng. after 1918.)
Mich. Sta. Bul.....	Michigan Agricultural Experiment Station. Bulletin.
Mitt. Kgl. Matpr.....	Mitteilungen aus dem Koniglichen Materialprüfungsamt zu Berlin-Lichterfelde-West.
Mont. Sta. Bul.....	Montana Agricultural Experiment Station. Bulletin.
Munic. Eng.....	Municipal Engineering.
N. A. Cem. Users Proc.....	National Association of Cement Users. Proceedings.
N. Mex. Sta. Bul.....	New Mexico Agricultural Experiment Station. Bulletin.
N. Y. (city) Pub. Imp. Div. Rpt.	New York (City) Board of Estimates and Appropriations. Division of Public Improvements. Report.
N. Y. (city) Water Supply Bd. An. Rpt.	New York (City) Board of Water Supply Annual Report.
Ohio Sta. M. Bul.....	Ohio Agricultural Experiment Station Monthly Bulletin.
Philippine Jour. Sci.....	Philippine Journal of Science.
Portland Cem. Ass'n Min.....	Portland Cement Association. Minutes.
Prof. Mem.....	Professional Memoirs. (United States Army.)
Pub. Rds.....	Public Roads.
Pub. Wks.....	Public Works.
Rel. Rec.....	Reclamation Record.
Russ. Jour. Exper. Landw.....	Russisches Journal fur Experimentelle Landwirtschaft. (Zhurnal Opuitnoi Agronomia.)
Ry. Age Gaz.....	Railway Age Gazette.
Ry. Eng.....	Railway Engineer.
St. Louis Eng. Club Jour.....	Engineers Club of St. Louis (Mo.). Journal.
Sci. Am.....	Scientific American.
Sci. Am. M.....	Scientific American Monthly.
Sci. Am. S.....	Scientific American Supplement.
Soc. Chem. Ind. Jour.....	Society of Chemical Industries. Journal.
Soc. d'Encour. l'Ind. Nat. Bul.....	Societe d'Encouragement pour l'Industrie Nationale. Bulletin.
Stadt. Tiefb.....	Der Stadtische Tiefbau.
Surveyor.....	Surveyor and Municipal and County Engineer.
Ton. Zeit.....	Tonindustrie-Zeitung.
U. S. Bur. Soils Bul.....	United States Department of Agriculture. Bureau of Soils. Bulletin.
U. S. Bur. Stand. Tech. Paper.....	United States Department of Commerce. Bureau of Standards. Technologic paper.
U. S. D. A. Bul.....	United States Department of Agriculture. Bulletin.
U. S. G. S. Bul.....	United States Department of Interior. Geological Survey. Bulletin.
Utah Sta. Bul.....	Utah Agricultural Experiment Station. Bulletin.

W. Soc. Eng. Jour.....	Western Society of Engineers. Journal.
Was. u. Abw.....	Wasser und Abwasser.
Waterpf. & Firepf.....	Waterproofing and Fireproofing.
Wis. Eng.....	Wisconsin Engineer.
Wis. Sta. Bul.....	Wisconsin Agricultural Experiment Station. Bulletin.
Wyo. Sta. Bul.....	Wyoming Agricultural Experiment Station. Bulletin.
Zeit. Ang. Chem.....	Zeitschrift fur Angewandte Chemie.

The references contained in this bulletin were compiled in connection with an investigation by the Bureau of Public Roads of the effect of soil alkalies on concrete drain tile. The bibliography is believed to be fairly complete in respect to articles published prior to 1924. The importance of the problem presented by the use of concrete structures in sea water and in soils containing various acids and alkalies has long been recognized. To one engaged in the study of any phase of the problem the literature extant is indispensable. Such a compilation necessarily requires considerable time and labor, and in order that the results of this search may be made accessible to as many as possible the bibliography is published as a bulletin.

EXPLANATORY NOTES

The references are arranged alphabetically by authors under each of the six headings. Each article is placed under the heading which most nearly describes its main content and those which fall under more than one heading are cross-indexed. The Roman numerals used in connection with authors' names indicate the headings under which the cross-indexed references appear. Plural authorship is cross-indexed in a like manner. At the end of the groups are lists of references, arranged alphabetically by titles, referring to articles the authorship of which is not indicated. These are also cross-indexed by Roman numerals. The abstract in each case refers to the first reference given under the title. The other references under a given title may or may not be of the same title, but are concerned with the same subject matter. Inclusive paging is not always given for these supplementary references.

I. SOIL ALKALINITY

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Outline of tests to determine effect of continuous water-logged condition upon nitrification of soils.
- AMES, J. W. *Some Alkali Soils in Ohio*. Ohio Sta. M. Bul. 1 (1916), p. 209-210.
Nontechnical discussion.
- BANCROFT, R. L. *Alkali Soils of Iowa*. Iowa Sta. Bul. 177 (1918), 22 p.
A study of conditions and methods for correction. Diagrammatic and tabular data.
- BEESON, J. L. *Physical Effects of Various Salts and Fertilizer Ingredients Upon a Soil as Modifying the Factors Which Control Its Supply of Moisture*. Am. Chem. Soc. Jour., v. 19 (1897), p. 620-649.
Experiments on rate of saturation, percolation, capillary rise, and evaporation as affected by salts. Tabular data.
- BERGE, R. *Emploi de la Chaux et des Craies Broyees Pour Corriger L'Acidite des Sols*. Academie d'agriculture (France), Comptes Rendus, v. 6 (1920), p. 934-9.
- BREAZEALE, J. F. *Formation of Black Alkali (Sodium Carbonate) in Calcareous Soils*. Jour. Ag. Research, v. 10 (1917), p. 541-589.
Extended technical discussion of formation of black alkali from sodium salts and calcium carbonate and retarding effects of various other salts. Action of black alkali on soil and vegetation. Results of laboratory tests. Much tabular data. Bibliography.
- BRIGGS, L. J. *Electrical Instruments for Determining the Moisture, Temperature, and Soluble Salt Content for Soils*. U. S. Bur. Soils Bul. 15 (1899), 35 p.
Detailed description of electric hygrometer, electric soil thermometer, and electrolytic soil bridge, their use and adjustments. Diagrammatic and tabular data. Illustrated.
- BRIGGS, L. J. and M. W. LAPHAM. *Influence of Dissolved Salts on the Capillary Rise of Soil Waters*. U. S. Bur. Soils Bul. 19 (1902), p. 5-18.
Laboratory tests on soil from James Island, S. C. Tabular data and drawings.
- BROWASH, A. H. See SHUTT, F. T., and A. H. BROWASH, I.
- BROWN, O. F., and R. A. HART. *Reclamation of Seeped and Alkali Lands*. Utah Sta. Bul. 111 (1910), p. 75-92.
Recommendations concerning drainage and subsequent treatment of alkali lands. Diagrams. Illustrated.
- BROWN, P. E. See STEVENSON, W. H., and P. E. BROWN, I.
- BURD, J. S. *Alkali and the Treatment of Alkali Lands (I and II)*. Idaho Sta. Bul. 44 (1904) and 51 (1905), 10 p. and 20 p.
Discusses origin, nature, effects of alkali in soil and water. Drainage as a reclamation measure. Tabular data.
- BUTT, N. I. See HARRIS, F. S., and N. I. BUTT.
- CAMERON, F. K. *Alkali*. "The Soil Solution" (Easton, Pa., 1911), p. 110-125.
General discussion of the origin and distribution of alkali. Drainage as a reclamation measure. Tabular data.
- *Formation of Sodium Carbonate, or Black Alkali, by Plants*. U. S. D. A. Rpt. 71 (1902), p. 61-70.
General discussion. Considers specific plants. Tabular data.
- and H. E. PATTEN. *Removal of Black Alkali by Leaching*. Amer. Chem. Soc. Jour., v. 28 (1906), p. 1639-1649.
Investigations and conclusions as to methods and success of such reclamation. Tabular data.
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A critical summary of existing knowledge and guide to important literature on the subject.
- COLE, L. H. *Alkali Deposits of Western Canada*. Can. Eng., v. 40 (1921), p. 460.
Discusses nature and distribution of alkali salts in waters and soils.
- CRAWLY, J. T. *Water-Holding Power and Irrigation of Hawaiian Soils. The Application of Nitrate of Soda. The Accumulation of Salt in Hawaiian Soils*. Hawaiian Planters, v. 21 (1902), p. 358-63. Abs., Exper. Sta. Rec., v. 14, p. 555.
Discusses irrigation, fertilization, and salt concentrations in Hawaiian sugar lands. Tabular data.
- DEAKIN, A. *Irrigated India*. (London, 1893), 322 p.
Narrative account of India: Its people, their activities, and in particular, the irrigation systems.
- DIMO, N. A. *Influence of Irrigation and of Increased Natural Humidity on the Process of Soil Formation and of the Transportation of Salts in the Soils and Subsoils of the Golodnoi (Hungary) Steppe*. Russ. Jour. Exper. Landw., v. 15 (1914), p. 136-138. Abs., Exper. Sta. Rec., v. 34, p. 16.
A study of the compositions of soils and waters.

DORSEY, C. W. *Alkali Soils of the United States*. U. S. Bur. Soils Bul. 35 (1906), 196 p.

Review of literature and summary of information to date on origin, nature, distribution, and treatment of soil alkali. Maps and tabular data.

— *Reclamation of Alkali Land in Salt Lake Valley, Utah*. U. S. Bur. Soils Bul. 43 (1907), 28 p.

Describes alkali conditions and methods of reclamation. Tabular data. Illustrated.

— *Reclamation of Alkali Soils*. U. S. Bur. Soils Bul. 34 (1906), 30 p.

Origin, accumulation, and effects of soil alkali. Prevention of accumulation, and physical and chemical methods of reclamation. Illustrated.

— *Reclamation of Alkali Soils at Billings, Montana*. U. S. Bur. Soils Bul. 44 (1907), 21 p.

Describes alkali conditions and methods of reclamation.

FORBES, R. H. *River Irrigating Waters of Arizona—Their Character and Effects*. Ariz. Sta. Bul. 44 (1902), 68 p.

Study of contents and value of irrigating waters. Diagrammatic and tabular data. Illustrated.

GARDNER, F. D., and J. STEWART. *Soil Survey in Salt Lake Valley, Utah*. U. S. D. A. Rpt. 64 (1899), p. 77-113.

Reports investigation of soil and waters with respect to alkali conditions. Diagrammatic and tabular data. Illustrated.

GAUDECHON, H. See MUNTZ, A., and H. GAUDECHON, I.

GEDROITS, K. K. *Colloidal Chemistry in the Soils*. Russ. Jour. Exper. Landw. 13 (1912), p. 363-420. Abs., Exper. Sta. Rec., v. 28, p. 516.

Study of colloidal substances and soluble salts in soils.

GRAVES, J. E. See STEWART, R., and J. E. GRAVES, I.

GRAVES, J. E., and C. T. HIRST. *Composition of the Irrigation Waters of Utah*. Utah Sta. Bul. 163 (1918), 43 p.

A study of salts found in waters of Utah with suggestions as to irrigation methods. Diagrams and tabular data. Illustrated.

HARRIS, F. S. *Movement of Soluble Salts with the Soil Moisture*. Utah Sta. Bul. 139 (1915), p. 119-124.

Discusses alkali accumulations as due to movement of salts in solution; evils of over-irrigation. Tabular data. Diagrams.

— *Soil Alkali*. (New York and London, 1920), 246 p.

General treatise on origin, distribution, effects and treatment of alkali soils. Discusses physical, chemical and biological aspects, reclamation and cropping. Tabular data. Illustrated.

HARRIS, F. S., and N. I. BUTT. *Effect of Irrigation Water and Manure on the Nitrates and Total Soluble Salts*

of the Soils. Jour. Ag. Research, v. 8 (1917), p. 333-359.

Experimental investigations in Utah and deductions. Bibliography. Diagrams and tables.

HARRIS, F. S., and J. S. ROBINSON. *Factors Affecting the Evaporation of Moisture from the Soil*. Jour. Ag. Research, v. 7 (1916), p. 439-461.

Experimental investigations and results, with bibliography. Tables and diagrams.

HART, R. A. *Drainage of Irrigated Farms*. U. S. D. A., Farmers' Bul. 805 (1917), 31 p.

Discusses need and benefits of draining irrigated lands. Describes methods of design and installation.

— *Drainage of Irrigated Land*. U. S. D. A. Bul. 190 (1915), 34 p.

Discusses need, methods, design, construction, maintenance and cost.

See also BROWN, C. F., and R. A. HART, I.

HEADDEN, W. P. *Alkalies in Colorado (including nitrates)*. Colo. Sta. Bul. 239 (1918), 58 p.

Formation, nature, effects, and differences of "white" and "black" alkalies and nitrates.

— *"Black Alkali" in the San Luis Valley*. Colo. Sta. Bul. 231 (1917), 15 p.

Discusses effects on agriculture of detrimental amounts of "black alkali" in San Luis Valley, Colo. Suggests gypsum treatment of soil as remedy.

— *Colorado Irrigation Waters and Their Changes*. Colo. Sta. Bul. 82 (1903), 77 p.

Extensive investigations and analyses of ground and surface waters. Much tabular data.

— *Fixation of Nitrogen*. Colo. Sta. Buls. 155 (1910), 48 p.; 178 (1911), 96 p.; and 186 (1913), 47 p.

Discusses the formation, nature and effects of nitre, often mistaken for "black alkali."

— *Soil Study, III. The Soil*. Colo. Sta. Bul. 65 (1901), 55 p.

Colorado soil study. Special reference to soluble salts.

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Physical and chemical aspects of ground water in Colorado. Alkali effects discussed. Tabular data.

HILGARD, E. W. *Lakes of the San Joaquin Valley*. Calif. Sta. Bul. 82 (1889), 4 p.

Study of salt content.

— *Quality of Irrigation Water*. Soils. (New York, 1911), p. 246-253.

Discusses allowable concentration of soluble salts and precautions in use for irrigation. Concerns effects on vegetation only.

— *Soils*. (New York, 1911), 593 p.

General treatise on soils; their origin, nature, properties and relations to physical laws and life.

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- HILGARD, E. W. and R. H. LOUGHRIDGE, *Distribution of Salts in Alkali Soils*. Calif. Sta. Rpt. (1894-95), p. 37-72.
Discusses nature, formation, transportation, and effects of various alkali salts in soils and waters as affected by natural forces, and agricultural methods. Many diagrams and tables. Results of field investigations.
- HILGARD, E. W., and others. *Alkali and Alkali Soils*. Calif. Sta. Rpt., (1893-94), p. 140-156.
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- HILL, E. G. *Analysis of Reh, the Alkali Salts in Indian Usar Land*. Lond. Chem. Soc. Proc., v. 19 (1903), p. 58-60. Abs., Exper. Sta. Rec., v. 14, p. 1056.
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- HISSINK, D. J. *Influence of Various Salt Solutions on the Permeability of Soils*. Chemisch Weekblad, v. 4 (1907), p. 663-670. Abs., Chemisches Zentralblatt (1907), II, No. 26, p. 2071. Abs., Lond. Chem. Soc. Jour., v. 92 (1907), part 2, p. 984. Abs., Exper. Sta. Rec., v. 20, p. 16.
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- KING, F. H. *Investigations in Soil Management*. (Madison, Wis., 1904), 168 p.
Discussion and conclusions of investigation of (1) Effects of manure soil dressing on crop yield and soluble salt content; (2) Movements of soluble salts in soils; and (3) Absorption of soluble salts by soil types. Tabular and diagrammatic data. Illustrated.
- . *Principles and Conditions of the Movements of Ground Water*. U. S. G. S. 19th An. Rpt. (1897-98), part 2, p. 59-286.
Discussion of ground-water movement in its various physical aspects with results and conclusions of extensive laboratory and field experimental investigations. Diagrammatic and tabular data. Illustrated.
- KNIGHT, W. C., and E. C. SLOSSON. *Alkali*. Wyo. Sta. Bul. 49 (1901), p. 75-79.
Short discussion of sources and nature of various salts.
- KOLOTOV, G. I. *Movement of Salts in Semi-arid Soils*. Russ. Jour. Exper. Landw., v. 12 (1911), p. 832-833. Abs., Exper. Sta. Rec., v. 28, p. 421.
Examination discussed.
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- KOSSOVITCH, P. S. *Water-raising Capacity of Soils*. Russ. Jour. Exper. Landw., v. 11 (1910), p. 734.
- KRAVKOV, S. *On the Movement of Water and Salt Solutions in Soils*. Journal für Landwirtschaft, v. 48 (1900), p. 209-222. Abs. Exper. Sta. Rec., v. 12, p. 620.
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- LEATHER, J. W. *Investigations on Usan [Alkali] Land in the United Provinces*. Allahabad, India, Govt. (1914), 88 p. Abs., Exper. Sta. Rec., v. 33, p. 419.
An investigation of soil and waters with respect to origin, accumulations and movement of alkali salts. Conclusions regarding effects of irrigation and methods of reclamation. Tabular and diagrammatic data. Illustrated.
- LIPMAN, C. B. *New Experiments on Alkali Soil Treatment*. Univ. Calif. Publications in Agricultural Sciences, v. 1 (1915), p. 275-282.
Preliminary report on laboratory experiments with various chemical treatments. Tabular data. Illustrated.
- LOUGHRIDGE, R. H. See HILGARD, E. W., and R. H. LOUGHRIDGE, I.
- LOUGHRIDGE, R. H., and C. H. SHINN. *Reclamation Tests with Gypsum in Alkali Soils*. Calif. Sta. Rpt. (1891-92), Part 1, p. 80-90.
Describes experiments at Tulare Station. Tabular data.
- MACKIE, W. W. *Reclamation of White-ash Lands Affected with Alkali at Fresno, Calif.* U. S. Bur. Soils Bul. 42 (1907), 47 p.
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- MANN, H. H., and V. A. TAMHANE. *Salt Lands of the Nira Valley (India)*. Bombay Presidency, Dept. Ag. Bul. 39 (1910), 35 p.
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- MCCOOL, M. M., and C. E. MILLAR. *Soluble Salt Content of Soils and Some Factors Affecting It*. Mich. Sta. Tech. Bul. 43 (1918), 47 p.
Occurrence and movement of soluble salts as affected by natural forces. Diagrammatic and tabular data.
- MCOWEN, P. *Brak Land in Relation to Irrigation and Drainage*. Agricultural Journal (Cape of Good Hope) v. 22 (1903), p. 573-81.
Discusses alkali lands of South Africa and chemical treatment, drainage and reduction of evaporation as corrective measures. Tabular data.
- MEANS, T. H. *Rapid Method for the Determination of the Amount of Soluble Mineral Matter in a Soil*. Am. Jour. of Sci., v. 7 (1899), p. 264-266.
Description of electrical soil bridge and its use.
- . *Reclamation of Alkali Lands in Egypt*. U. S. Bur. Soils Bul. 21 (1903), 48 p.
Rather detailed description of Egyptian reclamation work as adapted to similar work in United States of America. Tabular and diagrammatic data. Illustrated.
- See also WHITNEY, M., and T. H. MEANS, I.

- MILLAR, C. E. See MCCOOL, M. M., and C. E. MILLAR, I.
- MILLER, D. G. *Seepage and Alkali Problem in the Grand Valley, Colo.* U. S. Bur. of Public Roads, mimeographed report, March, 1916.
This report deals with the practical phases of the problem of reclaiming lands that have become nonproductive due to alkali.
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- NOYES, H. A. *Soil Acidity, the Resultant of Chemical Phenomena.* Jour. Ind. and Eng. Chem., v. 11 (1919), p. 1040-1049.
Describes laboratory experiments on cause of soil acidity. Considerable technical detail. Tabular and diagrammatic data.
- O'BRIEN, D. *Alkali Soils of Colorado.* Colo. Sta. Bul. No. 9 (1889), 12 p.
Discusses nature and effects of salts and reclamation by drainage.
- PAGNOUL, A. *Moisture and Absorptive Power of Soils.* Terres Arables du Pas-de-Calais, Arras (1894), p. 128. Ex. Abs., Exper. Sta. Rec., v. 6 (1894), p. 118.
Part of a detailed report on the investigation of 97 soils of the Pas-de-Calais.
- PATTEN, H. E. See CAMERON, F. K. and H. E. PATTEN, I.
- PEGLION, D. V. *Saline Soil of the Lower Valley of the Po (Italy).* Atti della Reale Accademia Economico-Agraria Dei Georgofili di Firenze, v. 5, ser. 3 (1906), No. 1, p. 59-64. Abs., Exper. Sta. Rec., v. 18, p. 215.
Nature and concentration of alkali soil salts in Italy.
- PERKINS, A. J. *Progress Report Concerning Reclamation of Salt Patch at Berri State Experimental Orchard.* Jour. Dept. Ag. So. Australia, v. 27 (1923), No. 4, p. 325-343.
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- VISSOTSKI, G. *Soils Zones of European Russia in Connection with the Salt Content of the Subsoils and with the Character of the Forest Vegetation*. Pochvovedenie (Pedologie), v. 1 (1899), p. 19-26. Abs., Exper. Sta. Rec., v. 12, p. 925.
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Discusses leaching, cropping, and manuring as causes. Lime as a remedy.

WEIR, W. W. *Preliminary Report on Kearney Vineyard Experimental Drain*. Calif. Sta. Bul. 273 (1916), p. 103-124.

Description of design, construction, operation, and results of clay tiledrain system in reclaiming a quarter section of land impregnated with alkali through irrigation. San Joaquin Valley, Calif. Illustrations, tables, and diagrams.

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Discusses hydrogen ionization and its relation to soil acidity. Describes field color measurements. Color chart.

WHITNEY, M., and T. H. MEANS. *Alkali Soils of the Yellowstone Valley*. U. S. Bur. Soils Bul. 14 (1898), 39 p.

Origin, nature, and concentration of soluble salts investigated. Over-irrigation discussed as a cause and underdrainage as remedy. Tabular and diagrammatic data. Illustrated.

EDITORIALS, ANONYMOUS ARTICLES, ETC. *Alkali Investigations [At the California Station]*. Calif. Sta. Rpt. (1922), p. 50, 53.

Gives area in California affected by alkali.

II. ALKALI SOIL SALTS

EFFECTS ON MORTAR AND CONCRETE AND MEASURES FOR PREVENTION

ABRAMS, D. A., and J. E. FREEMAN. *Inspection of Concrete in the Winnipeg District and Conference on Field Tests of Concrete in Alkali Soils*. Portland Cem. Ass'n. Minutes, Appendix A (Sept., 1920), 33 p.

Describes deterioration of Winnipeg aqueduct, inspection of same, and of concrete sewers in Winnipeg and plans for organized field investigation. General discussion of alkali action on concrete in western Canada. Bibliography.

AMERICAN RAILWAY ENGINEERING ASSOCIATION. See III.

ANDERSON, A. O. *Relation of Portland Cement to Iowa's Drainage Development*. Cem. Age, v. 8 (1909), p. 210-214.

Describes tests on solubility of cement tile in water. Tabular data.

ANDERSON, G. G. *Effect of Alkali on Concrete*. A. S. C. E. Trans., v. 67 (1910), p. 572-630. Exc., Cem. Age, v. 10 (1910), p. 268.

General discussion of ill effects of various salts, acids, and gases upon concrete, the causes and methods of prevention. Discussions by Rudolph Hering, Richard L. Humphrey, and others. Considerable technical detail. Numerous accounts of tests, inspections, and specific cases in practice.

ANDERSON, G. G., and others. *Irrigation*. A. S. C. E. Trans., v. 62 (1909), p. 1-66.

General discussion of irrigation. Includes descriptions of concrete structures and alkali effects in western United States.

BARNETT, M. R. See IV.

BARTHOLOMEW, T. See III.

BATES, P. H. *What Properties and Methods of Making Concrete Require Further Investigation*. Concrete, v. 23 (1923), p. 11-14, 37.

Three classes of conditions listed, one of which treats of products subject to a solution of salts, especially sulfates.

BATES, P. H., and others. *Action of the Salts in Alkali Water and Sea Water on Cements*. U. S. Bur. Stand. Tech. Paper 12 (1912), 157 p. Abs., Franklin Inst. Jour., v. 175 (1913), p. 65-67. Abs., Eng. Rec.,

v. 67 (1913), p. 691-692. Abs., Eng. N., v. 70 (1913), p. 50-51. Abs., Munic. Eng., v. 45 (1913), p. 58-59. Abs., Met. & Chem. Eng., v. 11 (1913), p. 442-443. Abs., Jour. Ind. & Eng. Chem., v. 5 (1913), p. 1026. Abs., Ry. Age Gaz., v. 55 (1913), p. 514. Exc., Conc. Cem. Age, v. 3 (1913), p. 71.

Full report on laboratory experiments and field tests (in sea water) covering 3½ years. Physical and chemical tests on mortar specimens and fresh cements. Tabular and diagrammatic data. Illustrated.

BAUCHERE, A. See III.

BEBB, E. C. *Progress in Investigation of Alkali Action on Concrete*. Rcl. Rec., v. 12 (1921), p. 224-227. Abs., Concrete, v. 19 (1921), p. 107.

Reviews Government investigation (see Wig and others—"Durability of Cement Drain Tile and Concrete in Alkali Soils"), and discusses generally the results observed, 1917-1921. Illustrated.

BIED, J. See III.

BISHOP, W. See IV.

BLACKIE, A. G. *Causes of Disintegration of Concrete*. Can. Eng. Inst. Jour., v. 1 (1918), p. 200 (5 col.). Eng. and Cont., v. 50 (1918), p. 503. Can. Eng., v. 35 (1918), p. 231.

Comparison of results and conclusions of investigations by United States Bureau of Standards, Wyoming University, and city of Winnipeg on action of alkali on concrete. Tabular data.

BLEININGER, A. V. *Manufacture of Hydraulic Cements*. Ohio Geological Survey Bul. 3, 4th ser. (1904), p. 364-365.

Effects of salts on cements. Discusses addition of puzzolan as protection against sea water and notes results of experiments with acids on puzzolan cement.

BLOUNT, B. See III.

BROWN, F. W. *Action of Alkali Water on Cement*. Cement, v. 9 (1908), p. 93 (4 col.). Abs., Chem. Abs., v. 2 (1908), p. 2612.

General discussion.

- BROWN, W. L. *Concrete in Alkali Soils*. Conc. Cem. Age, v. 2 (1913), p. 291 (4½ col.). Cem. & Eng. N., v. 25 (1913), p. 209-210.
Describes failure of 10-inch pipe line in California. Discusses alkali soil as cause. Comments by L. T. Bachman.
- BURCHARTZ. See IV.
- BURCHARTZ, H., and J. V. WROCHEM. See VI.
- BURDICK, R. T. *Cement Drain Tile in New England*. Rural N. Y., v. 76 (1917), p. 7 (½ col.).
Discusses clay versus cement tile.
- BURKE, E. See TANNATT, E. T., and E. BURKE. II.
- BURKE, E., and R. M. PINCKNEY. *Action of Alkali Salts upon Portland Cement*. Jour. Ind. & Eng. Chem., v. 3 (1911), p. 317-321. Abs., Chem. Abs., v. 5 (1911), p. 2420.
Discusses with considerable detail the effects of various salts. Describes laboratory experiments with results and conclusions. Tabular data.
- BURKE, E., R. M. PINCKNEY and E. T. TANNATT. *Effect of Alkali on Portland Cement*. Mont. Sta. Bul. 81 (1910), 131 p. Prelim. Rpt., same, Bul. 69 (1908). Abs., Eng. N., v. 60 (1908), p. 101. Abs., Eng. Rec., v. 58 (1908), p. 11. Ed. comment, Eng. & Contr., v. 2 (1908), p. 2438. Ed. comment, Cem. Age, v. 8 (1909), p. 467.
Laboratory tests of cement and mortar specimens in salt solutions. Discussion of tests and deductions. Tabular and diagrammatic data. Illustrated.
- CHACE, W. G. *Alkali Soils of Prairie Provinces Cause Decay of Concrete Structures*. Contract Rec., v. 34 (1920), 538 (5 col.). Concrete, v. 17 (1920), Mill Sect., p. 44-45. Disc., Contract Rec., v. 34 (1920), p. 844.
Notes failures in western Canada and United States. Discusses briefly sewer and aqueduct disintegration at Winnipeg. Describes tests of preventative measures. Illustrated.
- COUGHLAN, R. R., and R. A. HART. *Protection of Concrete Against Alkali*. Conc. Cem. Age, v. 7 (1915), p. 33 (2 col.).
Rich mix as protection.
- CUSHMAN, A. S. *Alkali Protection*. A. P. C. M. Min., May, 1912, p. 15, 32; May, 1913; Dec., 1913.
- DAWSON, A. S. *Concrete in Alkali Soils and Waters*. Can. Eng., Inst., Jour., v. 3 (1920), p. 476 (15 col.). Eng. & Contr., v. 54 (1920), p. 388. Can. Eng., v. 39 (1920), pp. 474 and 500. Abs., Chem. Abs., v. 15 (1921), p. 156.
Summarizes origin of alkalies and the causes and nature of attack on concrete. Notes conditions in practice. Discusses field tests and conclusions to date by Calgary branch of Eng. Inst. of Canada. Suggests preventative features. Discussions by B. S. McKenzie and C. J. Mackenzie.
- DAWSON, A. S. *Report of Calgary Committee on Deterioration of Concrete in Alkali Soils*. Can. Eng. Inst. Jour., v. 4 (1921), p. 490-492.
Results secured since 1918 summarized.
- . *Tests of Concrete in Alkali Soil*. Eng. & Contr., v. 56 (1921), p. 403-404.
Abstract of paper presented to Engineering Institute of Canada giving results of experiments with concrete blocks and cylinders.
- DAY, W. H. *Cement Tile Experiments at the Ontario Agric. College*. Can. Eng., v. 20 (1911), p. 759-762.
Describes investigation of cost of manufacture and yield of cement tile. Also strength and porosity tests and tests of solubility of tile of various mixes subjected to distilled and natural waters. Tabular data.
- DEVAL. See IV.
- DIECKMAN, G. P. See SIMS, C. E., and G. P. DIECKMAN. II.
- D'ROHAN, W. *Chemical Destruction of Concrete Structures and the Search for a Panacea*. Concrete, v. 9 (1916), Mill Sect., p. 11-14.
General discussion, with current opinions. Suggestions as to remedial measures.
- . *Protection of Concrete Structures from Alkali and other Destructive Agents*. Eng. & Contr., v. 39 (1913), p. 570-571. (Ed. comment, p. 566). Abs., Chem. Abs., v. 7 (1913), p. 246.
Discusses action on concrete of alkali water and rain water. Tests with distilled water. Use of puzzolan and slag cement.
See also III.
- DYCKERHOFF, A. *Tests of Concrete in Marsh Water*. Cement, v. 17, p. 66-67. Chem. Zeit., v. 36, p. 464. Abs., Chem. Abs., v. 6 (1912), p. 1832.
Tests of concrete of four different sands. Also permeability tests with various waterproofing materials.
- ELLIOTT, G. R. B. *Are Concrete Tile Durable?* Wis. Sta. Bul. 323 (1920), p. 39. Abs., Exper. Sta. Rec., v. 45 (1921), p. 289.
Notes disintegration in acid and peat soils. Specifications for cement tile.
- ENDEL. *Lectures on Recent Cement investigations*. Zement, (1921), No. 42, p. 527-529; No. 43, p. 542; No. 45, p. 571-572; No. 47, p. 598-599; No. 48, p. 640-641; No. 49, p. 621-625; No. 50, p. 635-638; No. 51, p. 650-651; No. 52, p. 654-660; (1922), No. 1, p. 3-6.
- ENDELL, K. See IV.
- ENGINEERING INST. OF CANADA. *Observations of Concrete Failures in Alkali Soils*. Can. Eng. Inst. Jour., v. 1 (1918), p. 203 (7 col.). Can. Eng., v. 35 (1918), p. 233 and 235.
Committee report. Chemical analyses of soils and concretes where disintegration has occurred. General conclusions as to action taking place, and methods of preventing. Outline plan of future investigations by committee.

ERDAHL, B. F. *Effect of Alkali water on Concrete*. Concrete, v. 17 (1920), Mill Sect., p. 23-24. Abs., Chem. Abs., v. 14 (1920), p. 2979. Disc., Concrete v. 17 (1920), Mill Sect., p. 53-54.

Discusses physical and chemical aspects of action.

— *New Weapon to Fight Alkali*. Concrete, v. 19 (1921), p. 181.

Discusses a patented soluble compound for preventing alkali action on concrete.

EWERS, C., and others. *Is Cement Tile Durable?* Rural N. Y., v. 75 (1916), p. 146 (1½ col.).

Experiences and opinions of users pro and con.

FERET, E. *Prolonged Tests of Strength and Decomposition of the Principal Types of Hydraulic Binders: Answer*. Ann. des P. et Chs. (1922), pt. 4, July and Aug., p. 5-33.

FERGUSON, L. R. See WIE, R. J., and L. R. FERGUSON. III.

FIELD, F. C., and others. *Calgary Committee Conducting Experiments with Concrete in Alkali Soil*. Can. Eng., v. 35 (1918), p. 233-234. (Ed. comment, p. 235).

Committee report Calgary branch of Eng. Inst. of Canada concerning failures of concrete in alkali soils. Outline of tests planned.

FINLAYSON, J. N. *Report of Manitoba Committee on Deterioration of Concrete in Alkali Soils*. Can. Eng. Inst. Jour., v. 4 (1921), p. 492-494.

Observations on concrete structures near Winnipeg and results of laboratory tests.

FISK, A. J. *Effect of Alkali Water on Cement Mortars*. Eng. N., v. 64 (1910), p. 168. Cem. Age, v. 11 (1910), p. 199. Cem. & Eng. N., v. 22 (1910), p. 378-379. Abs., Chem. Abs., v. 4 (1910), p. 3127.

Describes limited tests at Wisconsin University laboratory on effect of mixing and curing mortar specimens with alkali water.

FORTIER, S. *Concrete Lining as Applied to Irrigation Canals*. U. S. D. A. Bul. 126 (1914), 86 p.

Design, construction, and operation. Extensive tables of seepage data for unlined and hydraulic data of lined canals. Precautions against alkali and temperature effects. Numerous descriptions of projects. Tabular data. Illustrated.

FREEMAN, J. E. See ABRAMS, D. A., and J. E. FREEMAN, II.

FURLONG, I. *Alkali Attack on Concrete Roads and Building Brick*.

Eng. N. Rec., v. 89 (1922), p. 64-67. Contribution from United States Bureau of Standards relating to tests in Glenn County, Calif.

GARY, M. See IV.

GOFFETTE, J. L. See III.

GOLDRICH. *Action of German Bog Soils on Cement*. Chem.-Zeit., v. 34, p. 419.

GREENE, J. F. *Concrete in Western Canada*. Can. Eng., v. 34 (1918), p. 342-344.

General discussion of concrete disintegration in western Canada. Review of alkali-concrete investigations and suggestions for further tests.

— *Effect of Alkali Soils on Concrete*. Eng. & Contr., v. 49 (1918), p. 465-466.

Discusses occurrence, causes, and prevention with special reference to western Canada. (Abs. of paper before Winnipeg section of Canadian Soc. C. E.)

GREENMAN, R. S. See IV.

HAND, G. H. *Alkali-Corroded Steel Water Main Protected by Concrete*. Concrete, v. 19 (1921), p. 95-96.

Two-inch reinforced concrete shell placed on 33-inch steel water pipe to protect from alkali action. Southern California. Illustrations.

HART, R. A. *Effect of Alkali on Concrete*. A. S. C. E. Trans., v. 67 (1910), p. 587-591. Office of Experiment Stations (U. S. D. A.) An. Rpt., 1910.

Discussion of a paper of same title by G. G. Anderson. Describes laboratory tests made at Utah University on specimens gauged with and exposed to waters with various salt contents. Also tests of a waterproofing mixture. Tabular data.

See also COUGHLAN, R. R., and R. A. HART, II. WATERBURY, L. A., R. A. HART, J. W. MARTIN, and F. C. MAGRUDER, II.

HEADDEN, W. P. *Destruction of Concrete by Alkali*. Colo. Sta. Bul. 132 (1908), 6 p. Munic. Eng., v. 37 (1909), p. 112.

Laboratory experiments with discussion and tabular data.

HEISE, C. A. See IV.

HERING, R. *Effect of Alkali on Concrete*. A. S. C. E. Trans., v. 67 (1910), p. 592-597.

Discussion of paper of same title by G. G. Anderson. Discusses action of salts, acids, and gases. Reference to numerous examples of failure and resistance. Tabular data.

HERMANN, Dr. *Behavior of Hydraulic Binders in Waters Containing Sulphates; Protection Against the Disintegration of Concrete*. Ton. Zeit., No. 85 (July 22, 1922). HEUBLEIN, O. See TILLMAN, J. and O. HEUBLEIN, IV.

HOOL, G. A. and N. C. JOHNSON. See III.

HUMPHREY, R. L. See III.

HUMPHREY, R. L. and J. S. SEWELL. See III.

JEWETT, J. Y. *Cement and Concrete Work of the U. S. Reclamation Service with Notes on the Action of Alkali Waters*. A. S. T. M. Proc., v. 8 (1908), p. 480-493. Abs., Cem. Age, v. 7 (1908), p. 18. Abs., Chem. Abs., v. 3 (1909), p. 2365-2367.

Brief outline of activities and methods of United States Reclamation Service in cement testing and concrete construction. Short review of experience with alkali-affected concrete and available information on such action.

See also VI.

- JOHNSON, N. C. See HOOL, G. A., and N. C. JOHNSON, III.
- JOINT COMMITTEE (ENG. SOCIETIES). See III.
- KLEINSCHMIDT, H. S. *Alkali and Concrete Pipe*. Concrete, v. 19 (1921), p. 81.
Cites cases of successful use of cement tile in alkali soils of Utah.
- . *Use of Concrete in Alkaline Soils*. Concrete, v. 21 (1922), p. 148-149.
Further results of observations on concrete tile in alkaline soil in Utah.
- LE CHATELIER, H. See III.
- LIBERTON, P. T. *Concrete in Drainage and Irrigation*. Am. Soc. Ag. Eng. Trans., v. 7 (1913), p. 135-145.
Discusses manufacture and requirements of cement tile, alkali effects, and use of cement tile in drainage. Discussed by several authorities. Diagram.
- LIPPINCOT, J. B. See VI.
- LOTT, H. C. *Effect of Alkali on Concrete*. Eng. N. Rec., v. 89 (1922), p. 577.
Letter written from Basrah, Mesopotamia, giving opinion based on observations.
- MACKENZIE, C. J. *Concrete Mixtures in Alkali Soils*. Can. Eng. Inst. Jour., v. 3 (1920), p. 176 (9 col.). Can. Eng., v. 38 (1920), p. 344-346.
Reviews known facts and theories as to disintegration and its prevention. Outlines field and laboratory tests carried out by the Eng. Inst. of Canada.
- . *Deterioration of Concrete in Alkali Soils*. Can. Eng. Inst. Jour., v. 6 (1923), No. 2, p. 57-63.
Report of special committee of Engineering Institute of Canada.
- MAGRUDER, F. C. See WATERBURY, L. A., R. A. HART, J. W. MARTIN, and F. C. MAGRUDER. II.
- MARKUS, O. See IV.
- MARTIN, J. W. See WATERBURY, L. A., R. A. HART, J. W. MARTIN, and F. C. MAGRUDER. II.
- MCCRORY, S. H. *Effect of Alkali Upon Concrete*. Pub. Rds., Oct., 1920, p. 23-25. Pub. Wks., v. 50 (1921), p. 390-392.
Discusses action on concrete of various soluble salts in soil water. Suggests preventative measures. Tabular data. Illustrated.
- . *Effect of Alkali Upon Concrete*. Cem. & Eng. N., v. 34 (1922), p. 17-18.
Contains recommendations as to aggregates, proportioning, and placing concrete to minimize harmful effects of alkali.
- McKENZIE, B. S. *Deterioration of Concrete*. Can. Eng. Inst. Jour., v. 1 (1918), p. 150 (6 col.).
Discusses deterioration of plain and reinforced concrete foundations and sewers in alkali soils of Winnipeg district. Chemical analyses of soils and waters.
- McVAY, C. B. *Portland Cement Drain-tile and Their Importance in Reclamation Work*. Concrete, v. 8 (1908), No. 4, p. 24-25.
Discusses efficiency, cost, and durability.
- MEADE, R. K. *Action of Various Substances on Cement Mortars*. A. S. T. M. Proc., v. 13 (1913), p. 813-820. Abs., Eng. N., v. 70 (1913), p. 21-23. Abs., Eng. R., v. 68 (1913), p. 20-21. Abs., Conc. Cem. Age, v. 3 (1913), p. 59.
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Describes field investigations and tests of tile failures in alkali soil. Water and soil analyses. Tabular data, conclusions. Illustrated.
- . *Report of Concrete - Alkali Investigations in Minnesota, 1919-1920*. Minnesota. Dept. of Drainage and Waters (July, 1921), 74 p. Abs., Eng. N. Rec., v. 88 (1922), p. 967. Abs., Cem. & Eng. N., v. 34 (1922), p. 17.
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- MORRISON, H. C. See NEWBERRY, S. B., and A. C., and H. C. MORRISON, II.
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Discusses action of ground water.

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Describes tests showing injury to concrete by continuous percolation.
- NEWBERRY, S. B. and A. C., and H. C. MORRISON.** *Integral Waterproofing for Concrete.* St. Louis Eng. Club Jour., v. 2 (1917), p. 297-302.
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Technical discussion of action and preventative measures.
- ORTON, E., JR., and others.** *Use of Cement in Sewer Pipe and Drain-tile Construction.* A. P. C. M. Bul. 19 (1908), 43 p. Disc., Cem. Era, v. 6 (1908), p. 164-165.
Opinions pro and con, concerning efficiency of concrete pipe for sewers and drains. Concrete versus clay. Mainly a defense of concrete.
- PETRY, V.** See IV.
- PIERCE, G.** *Destructive Action of Alkali upon Concrete.* Mining Science, v. 63 (1911), p. 130 (4 col.). Abs., Chem. Abs., v. 5 (1911), p. 1503.
Discusses action and describes a new low-lime-high-silica "alkali-proof" cement manufactured in Colorado. Tabular data of composition, strength, tests, etc. Illustrated.
- PINCKNEY, R. M.** See BURKE, E. and R. M. PINCKNEY, II. BURKE, E., R. M. PINCKNEY, and E. T. TANNATT, II.
- PINKERTON, P. W.** *Second Rebuilding of Waterworks, Montrose, Colo.* Eng. N., v. 73 (1915), p. 883-884.
Describes failure due to alkali of wood-stave conduit.
- POTTER, C. J.** See VI.
- PULVER, H. E.** See IV.
- RAMSOWER, H. C.** *Cement Drain Tile.* Sci. Am., v. 120 (1919), p. 30.
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- RICHARDSON, R. D.** See IV.
- RODT, V.** See IV.
- ROHLAND, P.** *Action of Magnesium Salts on Concrete and Reinforced Concrete.* Zeitschrift des Vereins deutscher Ingenieure, v. 56, p. 1720-1721. Abs., Chem. Abs., v. 7 (1913), p. 544.
Discusses action, and trass admixture as preventative.
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See also IV.
- SARTORI, A.** *Action of Sulphates on Concrete.* Chem. Zeit., v. 39 (1915), p. 957.
- SCHICK, E.** *Destruction of Concrete by Constituents of the Soil.* Ton. Zeit., v. 36, p. 358. Abs., Chem. Abs., v. 6 (1912), p. 1833.
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- SCHIFFNER.** See IV.
- SCHLICK, W. J.** *Investigations of Test Methods for Determining the Durability of Concrete Drain-tile in Alkali Soils.* Iowa State College, Progress report, March, 1922.
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Summary of results of several years' study at the Wyoming station.
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Brief outline of the chemical changes occurring during the manufacture of cement and the manner in which alkali salts disintegrate concrete.
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Discusses acids and salts which may prove injurious. Suggests method for analyzing swamp water.
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- TOCH, M. See IV.
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Describes installation of irrigating system and precautions to prevent deterioration.
- WALTER, R. F. *Condition of Pure Iron Pipe Siphon in Alkali Soils.* Eng. Rec., v. 70 (1914), p. 614.
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- WATERBURY, L. A., R. A. HART, J. W. MARTIN, and F. C. MAGRUDER. *Symposium on the Protection of Concrete Against Alkali.* Conc. Cem. Age, v. 6 (1915), p. 89-92.
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Eng. & Contr., v. 47 (1917), p. 249-250. Concl., Can. Eng., v. 35 (1918), p. 231. Concl., Rel. Rec., v. 8 (1917), p. 146-148. Noted, Rel. Rec., v. 7 (1916), p. 68-69. Noted, Eng. & Contr., v. 45 (1916), p. 257. Noted, Eng. N., v. 71 (1914), p. 480.

Detailed description of tests (1913-1917) on cement tile and concrete blocks in alkali soils and waters in 11 widely scattered western localities. Tabular data of chemical and physical tests and manufacture of specimens. Record and discussion of results. Numerous illustrations, diagrams, and tables.

See also VI.

WILLARD, E. V. See MILLER, D. G., and E. V. WILLARD, II.

WILLIAMS, G. M. *Behavior of Concrete Exposed to Alkaline Conditions*. A. S. T. M. Proc., v. 23 (1923), pt. 2, p. 205-210. Abs., Eng. & Contr., v. 60 (1923), p. 288-290. Abs., Eng. N. Rec., v. 91 (1923), p. 56-57.

Review of past experiments with summary. Discussion by E. E. Butterfield and R. J. Wig.

— *Disintegration of Concrete in Alkali Soils*. Contract Rec., v. 35 (1921), p. 805 (7 col.).

General discussion of nature of action. A review and summary of results and conclusions by American investigators. General conclusions by the author.

— *Durability of Cement Drain Tile and Concrete in Alkali Soils*. U. S. Bur. Stand. Tech. Paper No. 214 (1922), p. 463-494. Abs., Eng. N. Rec. v. 89 (1922), p. 181.

Third progress report of cooperative experiments.

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Outline of investigations in progress in field and laboratory.

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Report to Engineering Institute of Canada outlining investigations.

WINTER, O. B., and H. H. MUSSELMAN, *Durability of Concrete Drain Tile (I and II)*. Mich. Sta. (Special) Bul. 75 (1915) (I), 13 p. Mich. Sta. (Special) Bul. 82 (1917) (II), 12 p. Abs., Exper. Sta. Rec., v. 39 (1918), p. 393. Mich. Ag. Bd. An. Rpt. (1916), p. 349-359.

Describes failures in Michigan soils. Laboratory experiments on effects of various solutions seeping through tile walls. Impermeability tests on mortars of certain proportions. Tabular results with discussion. Illustrated.

WITT, J. C. *Effect of Calcium Sulphate on Cement*. Concrete, v. 16 (1920), Mill Sect., p. 32-35.

Laboratory tests of time of setting, soundness and normal consistency with various percentages of the sulphate. Tabular data.

WITT, J. C. *Effect of Sulphide on Cement*. Philippine Jour. Sci., v. 11-A (1916), p. 273-288.

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— *Some Generalizations on the Influence of Substances on Cement and Concrete*. Philippine Jour. Sci., v. 13-A (1918), 20 p. Abs., Exper. Sta. Rec., v. 42 (1920), p. 581.

Tests for effects on tensile strength and initial set of gauging with solutions of various salts. Includes a bibliography with short abstracts. Tabular data.

— *Some Generalizations on the Influence of Substances on Cement and Concrete*. Philippine Jour. Sci., v. 21 (1922), No. 4, p. 365-371.

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WITT, J. C., and F. D. REYES. *Effect of Calcium Sulphate on Cement*. Philippine Jour. Sci., v. 12-A (1917), p. 133-143. Abs., Chem. Abs., v. 12 (1918), p. 616-617.

Ninety-day laboratory tests for effects of gypsum and plaster of Paris on tensile strength and time of setting. Also of carbon dioxide and sodium carbonate which may be formed during storage. Tabular data.

EDITORIALS, ANONYMOUS ARTICLES, Etc. *Alkali Action on Concrete*. Rel. Rec., v. 7 (1916), p. 68-69. Abs., Eng. & Contr., v. 45 (1916), p. 257. Abs., Eng. Rec., v. 73 (1916), p. 316. Abs., Conc. Cem. Age, v. 8 (1916), p. 205. Abs., Chem. Abs., v. 10 (1916), p. 1419.

Short discussion of action and preventative measures. Cases cited.

— *Alkali from Plaster as a Danger to Concrete*. See IV.

— *Alkali Damages Part of Winnipeg Concrete Aqueduct*. Eng. N. Rec., v. 84 (1920), p. 1097-1098. Concrete, v. 19 (1921), p. 205.

Describes method for subdraining an 8-foot alkali-affected reinforced concrete aqueduct by uncovering and underfilling with gravel in which are placed tile drains.

— *Alkali Soil Experiences in Minnesota*. Can. Eng., v. 43 (1922), p. 445.

Reference to report of department of drainage and waters of State of Minnesota for years 1919-20.

— *Alkali Soils, the Effect on Concrete*. Eng. N., v. 60 (1908), p. 101-102.

Editorial comment on conditions in western United States.

— *Calcium Aluminum Sulphate, Effect on Concrete*. Eng. & Contr. v. 52 (1919), p. 755.

Discusses formation, action and means of preventing destructive effects.

EDITORIALS, ANONYMOUS ARTICLES, ETC.—(Cont.) *Calcium Aluminum Sulphate as a Destroyer of Concrete*. Conc. & Const. Eng., v. 14 (1919), p. 685. Abs., Chem. Abs., v. 13 (1919), p. 2748.

Discusses nature of action and methods of preventing.

— *Destructive Agents and Protective Treatments*. Concrete, v. 22 (1922), p. 73, 74.

Report of committee E-6 of American Concrete Institute Convention at Cincinnati, Jan. 22 to 25, 1923.

— *Drain tile in Alkali Soils: Discussion*. A. P. C. M. Min., June, 1908, p. 16.

— *Drain tile Tests Show Concrete Affected by Alkali*. Eng. N. Rec., v. 89 (1922), p. 181.

Report of observations of test tile placed in alkali soil in 1913.

— *Effect of Soil Alkalis on Concrete Tile in Southwestern Minnesota*. Eng. & Contr., v. 58 (1922), p. 262–263.

Summary and conclusions of results of investigations in Minnesota in 1919–20 with concrete drain tile.

EDITORIALS, ANONYMOUS ARTICLES, ETC.—(Cont.) *German Concrete Society (Berlin), Meeting of*. Chem. Zeit., v. 32 (1908), p. 394. Abs., Chem. Abs., v. 2 (1908), p. 2139.

Includes note on preventing action of carbonic acid in ground water by coating concrete with "Inertol."

— *Impregnated Concrete Pipes*. Sand og cement (Danish), November, 1920.

Describes Danish patent on process for impregnating concrete pipes as substitute for glazed stone-ware pipes.

— *Investigations of Effect of Alkali on Concrete Drain tile not Convincing*. Concrete, v. 19 (1921), p. 107–108.

Comment on cooperative report of Bureau of Standards, Reclamation Service, et al., as published in Reclamation Record for May, 1921.

— *Sulphuric Acid and Carbonic Acid, Action on Concrete*. See IV.

— *Water, Gas Tar and Coal Tar, How to Use on Concrete*. See VI.

III. SEA WATER

EFFECTS ON MORTAR AND CONCRETE AND MEASURES FOR PREVENTION; SEA-WATER STRUCTURES OF CONCRETE.

ABERTHAW CONSTRUCTION CO. *Aberthaw Tests of Concrete in Sea-water*. Aberthaw Construction Co. (Boston). Report, 1920, 36 p. Exten. Abs., Eng. N. Rec., v. 86 (1921), p. 121–123. Exten. Abs., Eng. & Contr., v. 55 (1921), p. 290. 1916 results, A. S. C. E. Trans., v. 81 (1917), p. 645–675; disc., p. 676–708. 1916 results, Eng. & Contr., v. 47 (1917), p. 74–75, 199. 1913 results, Aberthaw Construction Co. Report, 1913. 1913 results, Eng. N., v. 70 (1913), p. 1023. 1913 results, Eng. Rec., v. 69 (1914), p. 344. 1913 results, Eng. & Contr., v. 41 (1914), p. 516–518. 1913 results, Balt. Eng. Club Jour., v. 5 (1915–16), No. 6, p. 2–10. 1913 results, Chem. Abs., v. 8 (1914), p. 412, 1665. 1911 results, Eng. Rec., v. 64 (1911), p. 229–231. 1910 results, Cem. Age, v. 13 (1911), p. 155–157. 1910 results, Conc. Cem. Age, v. 4 (1916), p. 273–274. Outlined, Cem. Age, v. 8 (1909), p. 147–150. Noted, Pub. Wks., v. 50 (1921), p. 374.

One, four, and eleven year results of continuous tests on 24 piers of reinforced concrete of various proportions and cements, conducted at United States navy yard, Charlestown, Mass., to determine chemical and mechanical effects of sea water upon concrete. Detailed report on chemical and physical tests of concrete materials, methods of manufacture and curing specimens, operation of tests and results to date. Excellently illustrated tabular description of manufacture and behavior of each specimen.

ALAYENE, M. R. *Alumina Cement*. Concrete, v. 20 (1922), p. 73–75. Abs., Science et Industrie, Nov. 3, 1921.

A mixture of limestone or lime and bauxite. Unaffected by sulphurous and sea waters.

ALEXANDER, M. P. *Experimental Researches on Hydraulic Mortars*. Ann. des P. et Chs., 6th ser. mem., v. 20 (1890), p. 277–431 (in French). Abs., Eng. N., v. 25 (1891), p. 40–41.

Experiments on porosity and permeability of mortars of various composition. Results of seepage of soft and sea waters, and of long exposure to sea water in walls. Tabular data illustrated.

ALLEN, K. See TUTTLE, A. S., K. ALLEN, and W. T. CARPENTER. III.

AMERICAN RAILWAY ENGINEERING ASSOCIATION. *Disintegration of Concrete and Corrosion of Reinforcing Metal*. A. Ry. E. & M. W. A. Bul., v. 15 (1914), No. 163, p. 564–568.

Discusses action of sea and alkali waters and protection of reinforcing.

— *Use of Concrete in Sea Water*. A. Ry. E. A. Bul., v. 22, No. 233 (1921), p. 546–549.

Report of committee on masonry. Conclusions and recommendations concerning the making and placing of plain and reinforced concrete sea-water structures.

ASSOCIATION RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. *Action of Sea Water on Concrete*. Conc. Eng., v. 2 (1907), p. 139–140.

- Cem. Era, v. 5 (1907), p. 328. Abs., Chem. Abs., v. 2 (1908), p. 582.
- Committee report. Presents opinions and experiences of various engineers and observations by the committee. Special reference to frost action and methods of placing concrete.
- ATWOOD, W. G., and A. A. JOHNSON. *Disintegration of Cement in Sea Water*. A. S. C. E. Proc., v. 49, Aug., 1923, p. 1038-1064.
- Ancient structures, later scientific developments, results secured by foreign investigators, the use of puzzolan additions in the United States, "alca" cement, conclusions. Bibliography. Discussions September, October, November, and December, 1923, by the following: B. B. Jeanneret, A. H. Rhett, I. Hiroi, Theodore Belzner, N. C. Johnson, W. M. Black, A. D. Flinn, B. A. Howes, T. H. Wiggins, Robert Ridgway, R. H. Gaines, J. R. Slattery, Kenneth Allen, J. C. Riedel, C. R. Harte, Chandler Davis, A. H. White, E. G. Walker, E. F. Cykler, Albert Moyer, J. Y. Jewett, Richard Grun, J. O. Draffin, C. A. Newhall, E. de Castro, and R. Feret.
- BAFFREY, R. *Use of Reinforced Concrete in Sea Water*. N. A. Cem. Users Proc., v. 7 (1911), p. 383-400.
- General discussion with numerous descriptions of successful and unsuccessful cases. Discussions. Illustrated.
- BAKENHUS, R. E. *Action of Sea Water on Concrete Specimens at Boston Navy Yard*. Eng. & Contr. v. 47 (1917), p. 74-75.
- A short description of tests on reinforced concrete piers in sea water, by Aberthaw Construction Co., at Charlestown (Mass.) Navy Yard. Tables showing scheme of tests and results up to January, 1916. (For full report to 1920, see Aberthaw Construction Co.)
- BAKENHUS, R. E., et al. *Tests of Concrete Specimens in Sea Water at Boston Navy Yard*. A. S. C. E. Trans., v. 81 (1917), p. 645-708.
- A complete and detailed description of the tests up to January, 1916, on reinforced concrete piers in sea water made at Charlestown (Mass.) Navy Yard by Aberthaw Construction Co. Includes, mostly in tabular form, all physical and chemical tests of concrete materials and sea water; full account, with contract and specifications, of manufacture, curing and testing of specimens; detailed description of progressive results to date and classification of specimens with respect to durability as affected by the nature and proportions of ingredients. One illustration. Discussions by various engineers citing practical related experience and describing similar tests, with tabulations and illustrations. For 1920 results, see "Aberthaw Construction Company."
- BARKER, R. See VI.
- BARTHOLOMEW, T. *Destruction of Concrete by Sea and Alkali Water*. Mining Science, v. 62 (1910), p. 206.
- Reviews some current opinions and notes, some points to be observed in preventing action and examining damage.
- BATES, P. H., and others. See II.
- BAUCHERE, A. *Tests of Decomposition of Cement Mortars by Sea Water and Waters Containing Sulphates*. Int. A. T. M. Non-Off. Papers (1906), B4, f. and e, 4 p. (French. Abs. in English).
- Laboratory tests on mortars of various composition in sea and sulphate waters. Tabular data. Results and conclusions.
- BAYKOFF, A. See CZARNOMSKI, W., and A. BAYKOFF, III.
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- BIED, J. *Experiments on Decomposition of Mortars by Sulphate Waters*. Int. A. T. M. Proc., 5th Cong. (1909) Paper XI-1, 10 p. Ton. Zeit., v. 33, (1909), p. 1227.
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- BLOUNT, B. *Probable and Presumptive Life of Concrete Structures Made from Modern Cements*. Int. Eng. Cong. Trans. (1915), v. 5, p. 223-240. Abs. Chem. Abs., v. 9 (1915), p. 3345. Abs. Can. Eng., v. 31 (1916), p. 15.
- General discussion of causes of concrete failures. Special reference to sea water, salt solutions, acids, and electrolysis. Suggestions for preventative measures.
- BOYDEN, H. C. *Concrete for Salt Water Works*. Engineer, v. 131 (1921), p. 384.
- Discusses impermeability of concrete as a preventative of deterioration and suggests methods of securing it.
- BROWN, H. P. See VI.
- BURCHARTZ, H. See VI.
- BURCHARTZ, H., and J. V. WROCHEM. See VI.
- BURR, E. *Preservation of Reinforced Concrete in Sea Water*. Can. Eng., v. 23 (1912), p. 349-352. Abs. Chem. Abs., v. 6 (1912), p. 2988.
- General discussion, suggestions, and current opinions.
- CANDLOT, E. *Influence of Sea Water on Mortars*. Eng. Rec., v. 36 (1897), p. 557-558.
- Reviews results and conclusions of 40 years of investigation in France by various engineers.
- *Materials Capable of Resisting Sea Water*.
- Paper delivered at meeting of the French and Belgian members of the International Association of the Materials of Construction April 25, 1903.
- CAREY, A. See KYLE, J., and A. CAREY. VI.
- CAREY, A. E. *Carey on Portland Cement*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 107 (1891-92), p. 57, 60, 69.
- Short discussion of action of sea water on concrete and results of experiments on gauging with sea water and exposure to it. Tabular data.

- CARPENTER, W. T. See TUTTLE, A. S., K. ALLEN and W. T. CARPENTER. III.
- CAY, W. D. *Durability of Portland Cement in Sea Water*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 100 (1889-90), p. 85-88.
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- COIGNET, *Action of the Sea*. A. S. C. E. Trans., v. 1 (1868-1871), p. 110-115.
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- COLLIER, B. C. See VI.
- CRARY, A. P. *Some Experiences with Concrete in the Republic of Panama*. Eng. N., v. 73 (1915), p. 214-216.
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Discussion of past and present design and methods of construction of quay walls, docks, etc. Numerous descriptions and diagrams of such works. Illustrated.
- DEBRAY, P. See DURAND-CLAYE, L., and P. DEBRAY. III.
- DEFORGE. See LOMBARD and DEFORGE, III.
- DODWELL, C. E. W. *Effect of Sea Water on Concrete Structures*. Can. Eng., v. 39 (1920), p. 279-280. Eng. & Contr., v. 54 (1920), p. 281-282.
Discusses deterioration of concrete piers in sea water at Annapolis Royal, Nova Scotia, after 3½ and 5 years exposure. Illustrated.
- D'ROHAN, W. *The Effect of Sea Water, Alkali Water, and Sewage on Portland Cement and Methods for Counteracting same*. Eng. & Contr., v. 34 (1910), p. 52-55 (Ed. comment, p. 45).
General discussion and opinions of various engineers.
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Results of analyses of mortars after action by sea water, and permeability tests of unexposed parts of docks. Also comparative tests of magnesium sulphates and chlorides acting on mortars. Tabular data.
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- EVERETT, H. A. *Fallacy of Concrete Ships*. Int. Marine Eng., v. 23 (1918), p. 61-62.
Challenges claims of superiority for concrete ships and discusses comparative merits. Reference to deteriorating action of sea water.
- FAIJA, H. *Effect of Sea Water on Portland Cement*. London Society of Engineers. Trans., 1888, p. 49-62.
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GASSIER. See VI.

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General discussion of materials, methods of construction, durability, and cost. Reference to requirements of concrete used and lasting qualities of vessels.

HAMBLOCH, I. A. See VI.

HARRISON, J. L. *Concrete in Sea Water*. Concrete, v. 15 (1919), p. 198-200.

Discusses nature of action and deductions from investigations made in Philippine Islands. Considers impermeability of highest importance. Illustrated.

HARRISON, J. L. *Effect of Sea Water on Some of the Concrete Structures in the Philippine Islands*. Eng. & Contr., v. 47 (1917), p. 580-582.

Describes disintegration in several sea-water concrete structures. Tabular data. Illustrated.

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Discussion of damaging effects as investigated in the Philippine Islands, and deductions therefrom. Illustrated.

Limestone Aggregate in Sea Water. Concrete, v. 11 (1917), p. 88.

Notes failure of wharf in Philippine Islands constructed of concrete with coral aggregate.

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Describes corrosion of steel in Philippine Island structures; discusses possible causes and makes deductions from results of his investigations. Illustrated.

HIROI, I. See VI.

HODGDON, F. W. *Sea Water Disintegration at Boston*. Eng. Rec., v. 63 (1911), p. 655-656.

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HORTON, C. C. *Efficiency and Cost of Concrete for the Preservation of Piles Exposed to Sea Water*. N. A. Cem. Users Proc., v. 6 (1910), p. 169-171. Short discussion of various methods and some cost data.

HOUGH, N. G. *Hydrated Lime in Boston Navy Yard Concrete Specimen*. Eng. & Contr., v. 47 (1917), p. 199.

Objects to conclusions regarding hydrated lime in Aberthaw concrete-sea water tests.

See Aberthaw Construction Company, III.

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Discusses chemical action and methods of preventing disintegration. Notes various structures and failures. Describes various tests and conclusions.

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Short review of tests on concrete exposed to sea water and alkali water and on waterproofing compounds. 1909-10.

HUMPHREY, R. L., and J. S. SEWELL. *Application of Reinforced Concrete to Hydraulic Works*. Permanent Int. Ass'n. of Navigation Congresses, 12th Cong. (1912), Reports Nos. 30 and 28. Abs. Eng. N., v. 67 (1912), p. 1029-1031. Disc., Eng. N., v. 68 (1912), p. 29.

General discussion of reinforced concrete as used in harbor and inland works in United States of America, including a study of destructive agencies. Illustrated.

INSTITUTION OF CIVIL ENGINEERS (LONDON). *Deterioration of Structures in Sea Water*. 1st Report of Committee (1920), 279 p. Disc. Conc. & Const. Eng., v. 15 (1920), p. 392. Abs. Contract Rec., v. 34 (1920), p. 585. Abs. Concrete, v. 17 (1920), Mill Sect., p. 57. Abs. Eng. & Contr., v. 53 (1920), p. 733. Abs. Engineering, v. 109 (1920), p. 584.

General report on deterioration of structural materials in sea water. Numerous descriptions of concrete sea water works with discussion on effects of destructive agencies and remedial suggestions. Excellent diagrams and illustrations.

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Microscopic study of structural processes in the setting of cement. Special reference to action of sea water on concrete. Discussions. Illustrated.

—. *Old Treatise Emphasized Same Points*. Eng. N. Rec., v. 80 (1918), p. 264, 267.

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KASAI, S. See VI.

KELLEY, W. F., and R. PICKWELL. *Alexandria Graving Dock, Belfast. Construction of a Concrete Graving Dock at Newport, Mon.* Inst. Civil Eng. (Lond.) Min. & Proc., v. 111 (1892-93), p. 75-128.

Two papers with extensive discussion and correspondence. Discuss the construction, maintenance and behavior of these docks, with results of inspections, opinions, and experiences of many engineers with respect to durability of concrete structures in sea water.

KINIPPLE, W. R., J. KYLE, and others. *Concrete Work for Harbors*. ("Concrete Work Under Water," "Columbo Harbor Works, Ceylon,"). Inst. Civil Eng. (Lond.) Min. & Proc., v. 87 (1886-87), p. 65-240.

Six papers on concrete harbor works in various parts of the world, with extensive discussion and correspondence concerning them. Includes much detail as to design and structural methods, with opinions, observations and experiences of many engineers. Tabular data of cement tests, etc.

KLAUDY, J. See VI.

KYLE, J. See KINIPPLE, W. R., J. KYLE and others, III.

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—. *Causes of Destruction of Hydraulic Mortars*. "Experimental Researches in the Constitution of Hydrated Cements" (New York, 1905), p. 111-120.

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LJAMIR. See VI.

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MACKENZIE, W. B. *Disintegration of Concrete Exposed to Sea Water Between High and Low Tides*. Eng. N., v. 58 (1907), p. 472. Abs., Chem. Abs., v. 2 (1908), p. 172.

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MARKUS, O. See IV.

MATHEWS, E. R. *Action of Sea and Fresh Water on Cement and Concrete*. Surveyor, v. 35 (1909), p. 350-352. Engineering Digest, v. 5 (1909), p. 527-528. Abs., Chem. Abs., v. 3 (1909), p. 1676.

Discusses tests, results, and conclusions regarding action on neat cement and concrete of sea and fresh water when used in mixing and as a curing medium. Protective measures against destructive action of sea water. Opinions of authorities to date. Tabular data.

———. *Flood Prevention Works at Troon, Ayrshire, and the Action of Sea Water on Concrete*. Surveyor, v. 57 (1920), p. 329-332. Society of Engineers (London), Jour. & Trans., v. 11 (1920), p. 75-107. Eng. & Contr., v. 53 (1920), p. 739.

Design and construction of concrete sea wall and connected works. Describes compressive strength tests on concrete of various aggregates and on specimens mixed with sea water and exposed to air, tidal conditions, and immersion in sea water. Tabular data and diagrams.

———. *Notes on the Deterioration of Structures in Sea Water*. Conc. & Const. Eng., v. 15 (1920), p. 392-395. Abs., Chem. Abs., v. 14 (1920), p. 2695.

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MAYNARD. *Solution and Decomposition of Cements*. Ton. Zeit., v. 33 (1909), p. 1462. Abs., Chem. Abs., v. 4 (1910), p. 372.

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See also VI.

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Discusses alumina content of cement in relation to resistance to sea water.

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Technical discussion of the physical and chemical aspects. Recommendations as to composition and methods of making sea-resistant concrete. Tabular data.

———. *Resistance of Cement to Sea Water*. Soc. d'Encour. l'Ind. Nat. Bul. (1897), p. 818.

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MICHAELIS, W., Jr. See VI.

MOLLER, M. *Use of Reinforced Concrete Beside the Sea*. Int. A. T. M. Proc., 5th Cong. (1909), Paper XI₃, 3 p.

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MONCRIEFF, J. M. *Discussion on White Star Dock at Southampton*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 195 (1913-14), p. 78.

Describes increase in size in sea-water dock during 22 years.

MURALT, M. DE. *Remarks Concerning the Effect of Sea Water on Reinforced Concrete*. Cement, v. 13 (1912), p. 124-126. Abs., Chem. Abs., v. 7 (1913), p. 1087.

General discussion of sea-water action and the composition, making and placing of concrete to resist it. Reference to specific cases and tests.

NEWBERRY, S. B. See VI.

NITZSCHE, H. See II.

- O'HARA, J. M. *Action of Sea Water on Portland Cement*. Eng. Rec., v. 61 (1910), p. 677-678. Cem. & Eng. N., v. 22, p. 288-290. Ex. Abs., Chem., Abs. v. 4 (1910), p. 2562. Disc., Eng. Rec., v. 61 (1910), p. 741. Discusses accelerated tests on cement and mortar specimens in sea water; also normal 12-month tests. Tables and diagram of results.
- OWENS, J. S. *Attrition of Concrete Surfaces by Sea Action*. Eng. & Contr., v. 53 (1920), p. 356-357. Discusses physical aspects of wear of concrete structures located on ocean foreshores. Suggests preventative measures.
- OWENS, J. S., and F. J. WOOD. *Reinforced Concrete Sea Defenses*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 189 (1911-12), p. 292-309. Ex. Abs., Eng. N., v. 69 (1913), p. 668. Describes construction of reinforced groynes and sea walls on Sussex coast. Recommendations drawn from this experience are made concerning the design of such structures.
- PAGON, W. W. See VI.
- PATCH, DAN. *Water Content Affects Wear of Concrete Test Pieces*. Eng. N. Rec., v. 86 (1921), p. 373. Comments based on investigations of Abertaw Construction Co.
- PICKWELL, R. See KELLEY, W. F., and R. PICKWELL, III.
- POIRSON, L. *Effect of Sea Water on Cements*. Ciment, 1910, part 6-7. ———. *Studies of the Chemical Influence of Sea Water upon Portland Cement*. Zentralblatt Hydraulische Zemente (translation from Ciment, 1910, Nos. 6 and 7). Abs., Chem. Abs., v. 5 (1911), p. 1328.
- POPE, A. *Concrete Wharf Exposed to Sea Water and Wave Action at Fort Williams, Me.* Prof. Mem., v. 8 (1916), p. 676-682. Describes construction, exposure, disintegration, and repair of wharf.
- POTTER, C. J. See VI.
- POULSEN, A. See VI.
- POULSEN, A., M. GARY and C. SCHNEIDER. *Influence of Sea Water on Cement and Concrete*. Conc. & Const. Eng., v. 5 (1910), p. 23-29. Eng. & Contr., v. 54 (1910), p. 51. Eng. N., v. 64 (1910), p. 3-4. Int. A. T. M. Proc., 5th Cong. (1909), Paper XI₄, Inst. Civil Eng. (Lond.) Min. & Proc., v. 193 (1912-13), Part III, p. 373. Cem. Age, v. 10 (1910), p. 184, 260. Describes 10-year Scandinavian and German tests of mortar and concrete blocks in sea water. Results and conclusions regarding cements, aggregates, and admixtures as affecting durability. Illustrated.
- PRICE, W. H. *Manora Breakwater, Kurrachee*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 43 (1875-76), p. 1-21. Discusses construction, maintenance, behavior, and repair of concrete breakwater of pre-set blocks with parts of foundation cast in situ. Extensive discussions.
- RAVIER, L. See VI.
- REBUFFAT. *Action of Sea Water on Cement*. Gazzetta Chimica Italiana, v. 31, p. 155. Chemisches Zentralblatt (1901), p. 927. ———. *True Formula of Calcium Sulpho-Aluminate*. Gazzetta Chimica Italiana, v. 32, p. 158.
- RHETT, A. H. *Porosity the Vital Point to Consider*. Eng. N. Rec., v. 80 (1918), p. 265, 267. Questions importance attached to carbonate of lime skin and abrasion by Wig and Ferguson in second of five articles on concrete in sea water. Suggests porosity as more important. Authors' reply. (See WIG, R. J., and L. R. FERGUSON, III.)
- ROCHEMONT, E. T. Q. de. *On Portland Cement Employed in the Works at Port of Haire Since 1870*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 107 (1891-92), p. 377-389. Results of tensile and compressive strength tests, covering 17 years, on cement briquettes gauged with and exposed to sea water. Effects of storage of cement. Tables and diagrams.
- RODT, V. See IV.
- SARTORI, A. See II.
- SAVILLE, C. M. *Action of Sea Water on Concrete Blocks, Cristobal, Canal Zone*. Harvard Eng. Jour., v. 9 (1911), p. 197-213. Abs., Chem. Abs., v. 5 (1911), p. 2421. Description of concrete blocks after 25 years' exposure to sea-wave action. Specifications under which blocks were made. Tabular data illustrated.
- SAVILLE, L. H. *Reasons for the Deterioration of Reinforced Concrete Structures Above Mean Tide Level*. Engineering, v. 112 (1921), p. 73-74; Discussion, p. 40-42. ———. *Reinforced Concrete in Sea Water Structures*. Can. Eng., v. 44 (1923), p. 162. Reference to second (interim) report of committee of the Institute of Civil Engineers on "Deterioration of structures exposed to sea water."
- SCHNEIDER, C. See GARY, M., and C. SCHNEIDER, III. POULSEN, A., M. GARY, and C. SCHNEIDER, III.
- SCHOTT, O. *American Portland Cement Concrete in Sea Water*. Chem. Zeit., v. 35, p. 276.
- SCHULJATSCHENKO. *Action of Sea Water on Portland Cement*. Ton. Zeit., v. 23, p. 917. ———. *Destruction of Cements by Sea Water*. Cement, v. 2 (1901), p. 291.
- SCHWARTZ. See VI.
- SEWELL, J. S. See HUMPHREY, R. L., and J. S. SEWELL, III.
- SHAW, A. L. See VI.

SHERTZER, T. B. *Further Examples of the Injury of Concrete Subject to Tidal Influence.* Eng. N., v. 60 (1908), p. 453. Abs. Chem. Abs., v. 3. (1909), p. 479. Abs. Cem. Age, v. 8 (1909), p. 53.

Discusses disintegration of concrete sea structures in Maine and New York. Describes tests on laboratory specimens made to ascertain cause.

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Description of investigation of concrete work at Aberdeen Harbor and general discussion of chemical deterioration of concrete in sea water. Discussion and correspondence by numerous engineers with accounts of many other tests and observations. Much technical detail. Tabulated data. Remedial measures.

SNOW, W. A. *Pronounced Reinforcement Corrosion Due to Sea Water or Electrolysis.* Eng. N. Rec., v. 87 (1921), p. 528-529.

SPANISH SEA-WATER COMMISSION. *Action of Sea Water on Cements.* Ann. des P. et Chs., v. 11 (1917), p. 253-254. Abs., Chem. Abs., v. 12 (1918), p. 617.

Discusses causes and nature of action and offers recommendations for preventing.

SPACKMAN, H. S. *Alumina-Cement—Its Development, Use and Manufacture.* Eng. N. Rec., v. 88 (1922), p. 831-834. Cem. & Eng. N., v. 34 (1922), p. 18-20.

Discusses alumina cement as used in France. Much greater resistance to sea water.

See also II.

SPREGELBURG. See II.

SQUIRE, H. E. *Some Observations on Concrete in Sea Water in San Francisco Harbor.* Eng. N. Rec., v. 80 (1918), p. 575-577.

Questions certain of Wig and Ferguson's conclusions regarding failure of concrete in sea water. Discusses relative values of calcium carbonate skin and density as protection. Also causes of reinforcement corrosion.

(See WIG, R. J., and L. R. FERGUSON, III.).

STANIFORD, C. W. *Tensile Tests of Cement Briquettes Exposed to Fresh River and Artificial Sea Water.* Eng. N., v. 67 (1912), p. 892. Abs., Chem. Abs., v. 6 (1912), p. 1830.

Tests covering one year with several brands of cement. Diagrams.

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Review of foreign and American practice in reinforced concrete dock construction, failures and causes, opinions of experts and general conclusions. Considers initial cost and repairs. Discussions.

See also VI.

THATCHER, E. *Effect of Sea Water Upon Portland Cement, Mortar and Concrete, and Upon Steel Embedded*

Therein. A. S. C. E. Trans., v. 61 (1908), p. 42-45. Cement, v. 8 (1908), p. 472-474. Abs., Chem. Abs., v. 2 (1908), p. 2007.

Review of current opinions and experiences of various American and European engineers of note.

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Exceptions taken to conclusions of Wig and Ferguson on effect of waterproofing compounds. Reply.

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Summary of rules for securing durable work.

TUTTLE, A. S., K. ALLEN, and W. T. CARPENTER. *Report on the use of Concrete in or near Sea Water.* N. Y. (City) Pub. Impr. Div. Rpt. (1921), 22 p. Abs., Eng. & Contr., v. 56 (1921), p. 487.

Reports conditions of Coney Island bathhouse. Experience, opinions, and suggestions of many engineers and concrete authorities on use of concrete in sea water. Chemical action discussed.

TUTTLE, M. C. *Concrete Test Specimens in Sea Water at Charlestown Navy Yard.* Eng. Rec., v. 64 (1911) p. 229.

1911 progress report on Aberthaw Construction tests of reinforced concrete piers in sea water at Charlestown. Tabulated data. Illustrated.

U. S. NAVY (Joint experimenters with Aberthaw Construction Co.) See ABERTHAW CONSTRUCTION CO., III.

VAN DER KLOES, J. A. *Action of Sea Water on Concrete.* De Ingenieur (The Hague), (1910), v. 25, p. 271-273.

VIENNOT. *Effect of Sea Water on Mortars.* Ton. Zeit., v. 21, p. 128.

WASON, L. C. *Tests of Concrete in Sea Water.* Eng. & Contr., v. 58 (1922), p. 293-295. Concrete, v. 21 (1922), p. 151-153. A. S. C. E. Trans. v. 86 (1923), p. 447-454; Discussion, p. 455-469.

Results of observations of piers in Boston Harbor.

WELLER, J. L. *Sea Water Concrete not Hopeless.* Eng. N. Rec., v. 80 (1918), p. 264, 267.

Questions conclusions in series of five articles by R. J. Wig and L. R. Ferguson on concrete in sea water. Author's reply.

(See WIG, R. J. and L. R. FERGUSON III.)

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Results of 20 years' experience and observation.

WIG, R. J., and L. R. FERGUSON. *Reinforced Concrete Failing*. A. S. T. M. Proc., v. 17 (1917), part 1, p. 290-299.

Discusses causes and nature of failure in sea water and suggests preventative measures. Notes effect on concrete of acids and alkalies and difficulty of prevention.

Series of five articles on *Concrete in Sea Water*. Eng. N. Rec., v. 79 (1917), p. 532, 641, 689, 737, 794. Disc., Eng. N. Rec., v. 80 (1918), p. 264-267, 575-576, 926.

Covers investigation which included personal examination of nearly every concrete structure in sea water in continental United States and many in Canada and Cuba, together with detailed information secured through American Consular officers regarding concrete structures in harbors in all parts of the world. (Compare with articles by HARRISON, J. L., III.)

1. *What is the trouble with Concrete in Sea Waters*. Eng. N. Rec., v. 79 (1917), p. 531, 532-535.

Introductory. Describes purpose, extent, and scope of investigation. Descriptive list of structures examined. Illustrations and map. Preceded by short editorial comment.

2. *Plain Concrete in Sea Water must be Protected*. Eng. N. Rec., v. 79 (1917), p. 641-645.

Discusses causes and nature of damage to plain concrete in sea water and precautions for preventing. Description of and comments on numerous observed failures. Well illustrated.

3. *Reinforced Concrete in Sea Water Falls from Corroded Steel*. Eng. N. Rec., v. 79 (1917), p. 689-693.

Discusses causes and nature of damage to reinforced concrete in sea water and preventative measures. Comments on specific observed cases. Illustrated.

4. *Selection of Materials for Sea Water Concrete*. Eng. N. Rec., v. 79 (1917), p. 737-741. Disc., Eng. N. Rec., v. 79 (1917), p. 1212.

Discusses effects of chemical constituents of cement, use of fresh and sea water, water-proofing compounds and various kinds of aggregate in making plain and reinforced concrete for sea-water structures. Numerous cases cited to verify conclusions. Illustrated.

5. *Good Workmanship necessary to make Sea Water Concrete Safe*. Eng. N. Rec., v. 79 (1917), p. 794-798.

Discusses necessity of reliable supervision and good workmanship in constructing sea-water concrete structures; proportioning of materials, quantity of water, care in mixing and placing concrete, construction joints, causes of failure, etc. General principles of successful construction. Cites verifying cases. Illustrated.

See also TOCH BROTHERS, R. J. WIG, and L. R. FERGUSON, III.

WIG, R. J., and others. See VI.

WILLIAMS, A. E. See VI.

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Describes making, placing, and theories of reinforced concrete piles and cylindrical supports and experience in their use in sea water.

WOOD, F. J. See OWENS, J. S., and F. J. WOOD, III.

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ZAMBONI. *Effect of Sea Water on Mortar Joints*. L'Industria, Oct. 15, 1899.

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Gives results of observations on piers immersed in sea water from 1909 to 1920.

Building Reinforced - Concrete Board Walk at Coney Island. Eng. N. Rec., v. 89 (1922), p. 229-230.

Rich concrete mix specified as protection against deterioration from sea water.

Calcium - Aluminum - Sulphate as a Destroyer of Concrete. See II.

Calcium - Aluminum - Sulphate; Effect on Concrete. See II.

Concrete Encased Steel at Kowloon, China. Inst. Civil Eng. (Lond.) Min. & Proc., v. 199, p. 133.

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Describes disintegration of docks at Charlestown (Mass.) Navy Yard. Illustrated.

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Summary of second (interim) report of a committee of Institution of Civil Engineers in which is contained a general discussion of concrete in marine structures.

Disintegration of Concrete by Sea Water, Alkali, Sewage, etc., what Are the Facts Respecting? Eng. & Contr., v. 33 (1910), p. 539-540.

Editorial review of opinions and known facts, including 2½ column quotation from R. Hering on action of sewage.

Floating Oil as a Protection of Concrete from Action of Sea Water. Eng. & Contr., v. 55 (1921), p. 88.

Describes occurrences and effect of a thick tar-like substance on concrete piers of Aberthaw Construction Co.'s test on concrete in sea water at Charlestown (Mass.) Navy Yard. Deposits originated from floating fuel oil.

EDITORIALS, ANONYMOUS ARTICLES, ETC.—Continued.

Heath Clay for Cement in Sea Water. See VI.

Impermeable Concrete for Marine Work, Notes on Methods for Securing. Eng. & Contr., v. 38 (1912), p. 201-202 (Ed. comment, p. 197).

Conclusions of three foreign engineers.

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Describes patented facing wall of hollow glazed tile. Illustrated.

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Observations at Boston, New York, Portsmouth, N. H., Mare Island, Calif. and Puget Sound Navy Yards. Contains tables and many illustrations.

Los Angeles Engineers Approve Concrete Sewer Pipe in Sea Water. Eng. N. Rec., v. 90 (1923), p. 825.

Results of inspection trip by Board of Public Works of Los Angeles.

Ocean Pier to be Scrapped Because of Concrete Disintegration. Eng. N. Rec., v. 84 (1920), p. 621-623. Abs., Chem. Abs., v. 14 (1919), p. 1746.

Disintegration of concrete of municipal pier, Santa Monica, Calif. Description of pier, its construction, and disintegration. Parts of condemnatory report by Board of Engineers. Illustrated.

Preservation of Steel Reinforcement in Concrete Structures. Eng. Rec., v. 57 (1908), p. 105.

Describes preserved condition of reinforced concrete building on New York beach.

EDITORIALS, ANONYMOUS ARTICLES, ETC.—Continued.

Sea Water, Concrete in. Eng. N., v. 58 (1907), p. 461.

Three short general discussions.

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Short review of some Scandinavian and German tests. Protective measures in concrete shipbuilding.

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Account of deterioration of concrete piers along southern California coast. Statement of conditions and general discussion. Illustrated. Also short discussion and tabulated statement of manufacture of and tests on concrete piers in sea water by Aberthaw Construction Co. at Charlestown (Mass.) Navy Yard.

Sea Water, Tests of the Effect on Concrete. Eng. N., v. 64 (1910), p. 319. Abs., Chem. Abs., v. 4 (1910), p. 3127.

Describes tests proposed at Panama Canal.

Sea Water, Tests on Concrete in. Eng. N., v. 64 (1910), p. 483. Abs., Chem. Abs., v. 5 (1911), p. 182.

Describes German tests using cements of various compositions. Summary of five-year results.

Tests on Sea Water Corrosion of Structural Materials. Eng. and Contr., v. 57 (1922), p. 530.

IV. OTHER INJURIOUS AGENTS

EFFECTS OF SEWAGE, ACIDS, OILS AND VARIOUS CHEMICALS ON MORTAR AND CONCRETE; MEASURES FOR PREVENTION

ABERTHAW CONSTRUCTION CO. See STONE and WEBSTER, ABERTHAW CONSTRUCTION Co., and others, IV.

ABRAMS, D. A. *Effect of Tannic Acid on Strength of Concrete.* Structural Mater. Research Lab., Lewis Inst. (Chicago), Bul. No. 7 (1920), 31 p. A. S. T. M. Proc., v. 20 (1920), Rpt. 1, p. 309-339. Exc., Ry. Age Gaz., v. 68 (1920), p. 1971. Exc., Eng. and Contr., v. 54 (1920), p. 277. Exc., Concrete, v. 17 (1920), p. 172. Exc. Pub. Wks., v. 50 (1921), p. 245.

Report on about 2,000 tests on concrete cylinders in the manufacture of which various amounts of commercial tannic acid were added to the sand. Full description of tests and results. Conclusions regarding effect on compressive strength with respect to percentage of acid, proportions of concrete materials, and age of specimens. Seven tables and 16 diagrams.

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Relates particularly to European conditions.

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Describes failures in Pasadena concrete sewers. Table containing information concerning concrete sewers in 44 American and Canadian cities. Illustrated.

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- ASCH, W. and D. *Action of Acids and Alkali on Cement. Portland Cements and Sea Water. "Silicates in Chemistry and Commerce."* (English ed., 1914), p. 189-198.
Highly technical study of chemical reactions.
- BACH, H. See HELBING, H., and H. BACH, IV.
- BARNETT, M. R. *Injury of Concrete by Water.* Inst. Civil Eng. (Lond.) Min. & Proc., v. 168 (1906-7), p. 153-180. Abs. Eng. Rec., v. 54 (1906), p. 658.
Discusses the deterioration of an English aqueduct of limestone concrete and the repair of the same. Illustrated.
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Describes investigation at four public institutions in Iowa, and conditions found. Discusses cause and effects of chemical action. Illustrations and tabular chemical data.
- BARTH, F. *Corroded Cement Tubes.* Stadt. Tiefb. v. 3, p. 43-47. Was. u. Abw., v. 5, p. 444. Abs., Chem. Abs., v. 6 (1912), p. 2831. Ton. Zeit., v. 36, p. 1081-1082. Abs., Chem. Abs., v. 6 (1912), p. 2988.
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Discusses use of bituminous paints, enamels, and mastics.
- BISHOP, W. *Cement Water Mains at Rahway, N. J.* A. W. W. A. Proc. (1910), p. 217-219.
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- BRARD (later modified by D'HERICART and THURY). *Test With Sodium Sulphate.* Annales de Chimie et de Physique, v. 38 (1828), p. 16.
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- BUCHANAN, R. E. See BARR, W. M., and R. E. BUCHANAN, IV.
- BURCHARD. *Effect of CaCl_2 on Portland Cement.* Mitt. Kgl. Matpr., v. 28, p. 338-343.
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Concrete Destroyed in Vacuum in Calveras Dam Culvert. Eng. N. Rec., v. 84 (1920), p. 1197–1198.

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V. WATERPROOFING OF CONCRETE

VARIOUS METHODS AND THE EFFECTS OF THEIR USE

ABRAMS, D. A. *Effect of Hydrated Lime and Other Powdered Admixtures in Concrete.* Structural Matter. Research Lab., Lewis Inst. (Chicago), Bul. No. 8 (1920), 74 p. A. S. T. M. Proc., v. 20 (1920), part 2, p. 149–203. Concl. Eng. N. Rec., v. 85 (1920), p. 55–56. Concl. Munic. Eng., v. 59 (1920), p. 50. Concl. Concrete, v. 17 (1920), Mill Sect., p. 42. Disc. A. S. T. M. Proc., v. 20 (1920), p. 204–218. Disc. Eng. N. Rec., v. 85 (1920), p. 1295. Abs., Chem. Abs., v. 14 (1920), p. 2695.

A report covering six investigations, including about 20,000 tests, with appendix covering further tests on 1,720 specimens. Effects of different percentages of the admixtures on mortars and concretes of various proportions and cements. Full description of tests and results. Conclusions regarding the following: Effect of powdered admixtures on tensile, compressive, and bond strengths; wear, plasticity, and yield, with respect to consistency, age, and proportions of mortar and concrete and kind and percentage of admixture. Waterproofing effects not considered. Eighteen diagrams and 32 tables.

See also HART, L. H., and D. A. ABRAMS, V.

ALEXANDER, M. P. See III.

AMERICAN RAILWAY ENGINEERING ASSOCIATION. *Waterproofing Masonry.* A. Ry. E. & M. W. A. Bul., v. 15 (1914), No. 163, p. 516–561.

Full discussion of various methods of waterproofing concrete, including specifications and requirements for many compounds.

ANDREWS, E. S. *Some Methods of Securing Impermeability in Concrete.* Conc. & Const. Eng., v. 16 (1921), p. 369–374.

Classification of methods for securing impermeability.

BAKER, I. L., and B. L. DOWLING. *Waterproofing with Alum and Soap.* Conc. Eng., v. 5 (1910), p. 34–35. The Technograph, 1908–9. Abs., Chem. Abs., v. 4 (1910), p. 956.

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- BOWMAN, S.** *Permeability of Concrete.* Soc. Chem. Ind. Jour., v. 38 (1919), p. 325-R. (4 col.).
Outline for investigating comparative merits of waterproofing agents, their effects on chemical and physical properties of concrete, and economic aspects of use.
- BOYDEN, H. C.** See III.
- BURGESS, J. H.** *Waterproofing Concrete.* Commonwealth Engineer, v. 8 (1921), p. 248-250, 306-307.
Gives results of permeability tests.
- BURTON, W. A.** *Tests of the Impermeability of Reinforced Concrete Pipe.* Iowa State College Eng. Exper. Sta. Bul., v. 4 (1908), No. 3, p. 20-34. Abs., Eng. Rec., v. 63 (1911), p. 257. Abs., Chem. Abs., v. 5 (1911), p. 1674. Abs., Cem. & Eng. N., v. 23 (1911), p. 155-156. Abs., Chem. Abs., v. 6 (1912), p. 282.
Student thesis. Tests of impermeability under pressure on mortar pipes, using clay, alum, soap, and reground cement as waterproofings. Tabular data. Diagrams. Illustrated.
- CABOT, S.** *Waterproof Cement.* Chem. Abs., v. 13 (1919), p. 2118.
Notes United States patent on waterproofing paste.
- CHAPMAN, C. M.** *Tests of Materials for Waterproofing Concrete.* Eng. Rec., v. 66 (1912), p. 701-702.
Suggestions regarding the testing of waterproofing materials for concrete.
- *Waterproofing with Water.* Eng. Rec., v. 62 (1910), p. 767-768. Abs., Chem. Abs., v. 5 (1911), p. 3141.
Discusses tests by Westinghouse, Church, Kerr & Co. on waterproofing effect of varying amounts of water in mixing concrete. Diagrams.
- CHRISTIAN, H. L.** See SMITH, R. B., and H. L. CHRISTIAN, V.
- DAVIS, J. L.** *Impermeability Tests on Concrete.* Eng. N., v. 68 (1912), p. 866-869. Conc. & Const. Eng., v. 8 (1913), p. 112-118. Abs., Chem. Abs., v. 7 (1913), p. 237. Compare Gardner, Chem. Abs., v. 6 (1912), p. 282. Compare Bates and Wig, Chem. Abs., v. 6 (1912), p. 1350.
Permeability and strength tests of mortars with hydrated lime, puzzolan, and other powdered admixtures. Tabulated results.
- *Waterproofing Concrete Structures.* Cement, v. 8 (1908), p. 445 (14 col.). Abs., Sci. Am. S., v. 65 (1908), p. 343. Abs., Chem. Abs., v. 2 (1908), p. 2137.
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Results of tests on "superement" (Portland cement ground with treated gypsum), showing strength and waterproof qualities.
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- DYCKERHOFF, A.** See II.
- DYCKERHOFF, R.** See VI.
- ELECTRO-CHEMICAL SUPPLY AND ENGINEERING Co.** See VI.
- ELMS, J. W.** *Experiments on the Permeability of Cement Mortars to Water Under Pressure.* Eng. Rec., v. 54 (1906), p. 467-468. Abs., Chem. Abs., v. 1 (1907), p. 232.
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VI. ALKALI-RESISTANT CONCRETE

SPECIAL INGREDIENTS AND METHODS FOR PRODUCING RESISTANCE TO ALKALI AND SEA WATER;
INCIDENTAL EFFECTS OF SAME

AMERICAN RAILWAY ENGINEERS' ASSOCIATION. *Prepare Specifications for Slag Aggregate.* A. Ry. E. A. Bul., v. 20 (1919), No. 215, p. 707, 712 (3½ col.).

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BARKER, R. *Essential Qualities and Application of Concrete to Timber Structures in Sea Water for the Purpose of Increasing their Permanency.* N. A. Cem. Users Proc., v. 6 (1910), p. 158-167.

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BATES, P. H. *Review of the Present Status of Iron Ore Cement.* N. A. Cem. Users Proc., v. 8 (1912), p. 566-77.

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CAREY, A. See KYLE, J., and A. CAREY. VI.

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Series of seven articles of from 3 to 7 pages each, comprising a collection of letters, papers, articles, and excerpts of same by various engineers and cement experts and containing opinions, observations, experiences, and results of tests by many authorities, as well as deductions, conclusions, and specific recommendations by the author regarding the composition and manufacture of sea-proof concrete.

POTTER, C. J. *Chemical Changes in Portland Cement Concrete, and the Action of Sea Water Thereon*. Soc. Chem. Ind. Jour., v. 28 (1909), p. 6 (8 col.) Ex. Abs., Chem. Abs., v. 3 (1909), p. 1581.

Laboratory and field tests in fresh and salt water showing superior resistance to salt solutions of mortars treated with carbon dioxide or made with "red cement." Discussion and tabular data.

POULSEN, A. *Diatom-Earth as Puzzolan for Cement*. Int. A. T. M. Proc., v. 2 (1912), No. 10, Paper No. 16, 11 p. Abs., Chem. Abs., v. 6 (1912), p. 2987.

Describes tests which show diatom-earth, properly used, to be beneficial to physical and chemical properties of sea-water concrete. Diagrammatic data.

- MAYNARD. *Puzzolan and Portland Cements in Sea Water*. Mitt. Kgl. Matpr. (1909), p. 239.
- . *Slag Cement and Sea Water*. Ton. Zeit., v. 30 (1906), p. 440.
- MEADE, R. K. See III.
- MICHAELIS, W. *Action of Sea Water upon Hydraulic Cement*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 129 (1896-97), p. 325-333.
Technical chemical discussion of sea-water action and of tests made with briquettes of various composition in artificial sea water. Recommendations as to composition of cement and use of puzzolan material, etc., to obtain sea-resistant concrete. Tabular data.
- . *Puzzolan Lime Mortars in Sea Water*. Ton. Zeit., v. 33, p. 1908.
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Discusses limits of fineness for Portland cement and superiority of iron-ore cement in this respect and others.
- . *Decomposition of Concrete in Sea Water*. Balt. Eng. Club Jour., v. 5 (1915-16), no. 3, p. 4 (3½ col.).
Letter relating German experience with iron-ore cement as resistant to sea water.
- . *Iron-Ore Cement*. Cem. & Eng. N., v. 23 (1911), p. 112-113.
Describes tests covering eight years, comparing behavior of Portland and iron-ore cements in sea water. Results and conclusions.
- POULSEN, A., M. GARY, and C. SCHNEIDER. See III.
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- REDGRAVE, G. R. *Manufacture and Properties of Slag-Cement*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 105 (1890-91), p. 215-230.
Discusses manufacture, physical and chemical properties, with tabular data on chemical analyses and physical tests.
- ROHLAND, P. See II.
- SCHNEIDER, C. See GARY, M., and C. SCHNEIDER, III. POULSEN, A., M. GARY, and C. SCHNEIDER, III.
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Discusses the origin and nature of tuff trass and its use with lime and Portland cement to obtain sea-proof mortar and concrete. Diagrammatic data of a few strength and sea-water tests.
- SONNTAG, C. H. *Is Portland Cement Durable*. Rock Products, v. 7, No. 11 (1908), p. 26.
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- . *Use of Concrete in Sea-Water Structures*. Int. Eng. Cong. Trans., v. 5 (1915), p. 338-363.
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Describes use on Boise, Idaho, project with suggestions.