

AN INDEX TO
SEWERAGE AND
SEWAGE DISPOSAL.

Cornell University Library

BOUGHT WITH THE INCOME
FROM THE
SAGE ENDOWMENT FUND
THE GIFT OF
Henry W. Sage
1891

A. 44024

6/12/92

Cornell University Library
TD 653.E57

An index to matter pertaining to sewerag



3 1924 004 128 355

engr



Cornell University Library

The original of this book is in
the Cornell University Library.

There are no known copyright restrictions in
the United States on the use of the text.

SEWERAGE AND SEWAGE DISPOSAL

(AN INDEX.)

AN INDEX TO

MATTER PERTAINING TO

SEWERAGE AND
SEWAGE DISPOSAL

IN VOLUMES V—XVII

(December 1881—June 1888)

OF

THE ENGINEERING & BUILDING RECORD

(Prior to 1887, The Sanitary Engineer.)

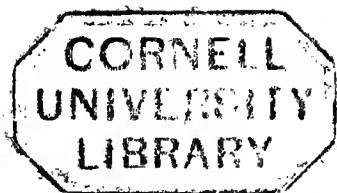
COMPILED BY

Dana C. Barber, C. E.

1889.

THE ENGINEERING & BUILDING RECORD,
NEW YORK.





Entered, according to Act of Congress, in the year 1889,
BY THE ENGINEERING & BUILDING RECORD,
In the Office of the Librarian of Congress, at Washington, D. C.

THE ENGINEERING & BUILDING RECORD PRESS,
NEW YORK.

PREFACE.

FREQUENT references to the back volumes of *The Engineering and Building Record*, in order to answer applications to its editor for information therein contained regarding Sewerage and Sewage Disposal, has not only revealed its great extent and variety but has led to the belief that such a comprehensive record of the actual work of so many able engineers' under so many different conditions, as well as the failures of others less able or less fortunate, would be of very great importance and value to all those who engage in similar work, or desire to learn from the experience of their predecessors both what to do and what to avoid, and to become familiar with the best practice of the day.

To make this record readily available to all who may desire to consult it, is the purpose of this Index, which has been compiled with much labor and discriminating care.

AN INDEX
TO MATTER PERTAINING TO
SEWERAGE AND SEWAGE DISPOSAL,
CONTAINED IN
The Engineering and Building Record,
VOLS. V—XVII.

“A B C” process of sewage purification: See under *Precipitation* under *Purification of Sewage*.

ACIDS: effect of, on materials used in sewer construction:

Cincinnati: on limestone and poor brick; (reference only), Vol. VII., 203.

Glasgow: “pot ale,” Vol. VII., 148.

Kämmerer, Dr., experiments by, Vol. VI., 399.

ACTON, Eng.: purification works, description of: precipitation by magnetic ferrous carbon and compound sewage salts; filtration of effluent through granulated magnetic spongy carbon and sand; claims of superiority over lime process; sludge pressed and ground up for manure, Vol. XVI., 438.

ADAMS, Col. Julius W., C. E.:

Combined system, preference for; (notice of paper in N. J. State Board of Health Report), Vol. VII., 561.

New York City: invited to make examination, with Rudolph Hering, of entire sewerage system, Vol. XVI., 270.

AERATION OF SEWAGE : See under *Purification of Sewage*.

AGITATORS, (in precipitation works) : See under *Precipitation* under *Purification of Sewage*.

AGRICULTURE : See under *Utilization of Sewage*.

ALLEN, Charles, C. E. : paper by, before Am. Soc. C. E., discussing Frederic P. Stearns' paper on disposal of sewage in Massachusetts : history of English methods of purification ; observations at Pullman, Vol. XVI., 180. Plan for purification of sewage of Worcester, Vol. XV., 551 ; Vol. XVI., 121.

ALLEYS : location of sewers in : See *Back Streets*.

ALUMINA, (for precipitating sewage sludge) : See under *Precipitation* under *Purification of Sewage*.

AMSTERDAM (Holland) : Liernur system, extent of ; works for utilization to be constructed, Vol. X., 411.

AMSTERDAM, N. Y. : Need of sewerage system, Vol. XI., 543. Notice of public meeting to agitate the question, Vol. XIII., 87.

ANALYSES OF SEWAGE : See *Sewage* ; see also *Streams*, under *Purification of Sewage*.

ANCIENT SEWERAGE :

Bunzlau, (in Silesia), Germany : systematic sewerage and irrigation works in middle of sixteenth century ; brief description ; *two illustrations (maps)*, Vol. VIII., 416.

Roman sewers, Vol. XV., 179, 462.

“ ‘ANN ELIZA’ AND THE CESSPOOLS ” : (humorous description and mock defense), Vol. V., 320.

ANSONIA, Conn. : plans by F. N. Owen under consideration : résumé, Vol. X., 250.

ARCHIMEDEAN EXTRACTORS : See under *Ventilation of Sewers*.

ASBURY PARK, N. J. :

Cesspools abandoned : kitchen slops removed immediately in water-tight receptacles, Vol. VII., 194 ; Vol. VIII., 157.

Sewerage works : brief description : separate system ; intermittent discharge into sea, Vol. VI., 103, 393. Defects admitted by the founder, Vol. VI., 390. Present satisfactory condition ; former nuisance from leaks in original wooden reservoir ; length of sewers and grade ; editorial comment on latter, Vol. VII., 371.

ASSESSMENTS, sewer :

Connecticut cities and towns, practice in, Vol. XIV., 105.

Hamilton, Ont. : system recommended by the city engineer, Vol. VIII., 255.

Keene, N. H. : proposed, Vol. VII., 103.

New London, Conn., plan employed at, Vol. XVI., 490 ; litigation resulting from objection to : extracts from decision of the arbitrators, Vol. XVII., 264.

Ohio, proposed law in, providing for construction of trunk sewers in cities of first class, by special tax ; comment ; (note), Vol. VII., 155.

Pawtucket, R. I., practice in, Vol. XV., 578.

Philadelphia property owners contest payment of, on ground of improper construction ; reason for bad work on Philadelphia sewers ; (editorial), Vol. VI., 262.

Utica, N. Y. : special case decided invalid by the court because of deviation in construction from ordinance authorizing contract, Vol. XV., 681.

Washington (D. C.) : proposed plan, Vol. IX., 191.

Whitlock, F. H., on : extracts from paper before Conn. Soc. C. E. and Surveyors ; practice in Connecticut cities and towns, Vol. XIV., 105.

ATLANTA, Ga. : systematic system of sewerage called for by Board of Health, Vol. XII., 375 ; employment of E. W. Bowditch to prepare plans recommended, Vol. XVI., 493.

ATLANTIC CITY (N. J.) : Report by E. W. Bowditch to National Board of Health, on sewage and sewage disposal at ; (abstract), Vol. VII., 267. Brief description of sewer construction ; pipe joints under water, Vol. XI., 504.

ATLANTIC COAST RESORTS : See under *Resorts*.

AUGSBURG, Bavaria: Pail system : utilization by evaporation after treatment with sulphuric acid ; profits, Vol. VII., 394.

AUGUSTA, Ga. : Sewerage system : Large expenditure contemplated, Vol. VI., 111. Need of improvement ; foul condition of ; results of inspection, Vol. VIII., 230. Condition and progress of construction during 1886, Vol. XVI., 520.

AUSTIN, Tex. : need of sewerage : extract from Mayor's message, Vol. XII., 545.

AYLESBURY, Eng. : Farm and garden produce grown by the use of guano manufactured from the town sewage : second annual show ; exhibit of fish swimming in the effluent water ; (note), Vol. VI., 492. Claims of the Native Guano Co. concerning their work at, Vol. X., 576.

BACK STREETS, sewers in ; advocated in editorial on "Cities of the Future," Vol. VIII., 440.

BAKER, Prof. Ira O. : paper on strength of cement mortar ; compressive tests, at Watertown Arsenal, of concrete blocks and brick piers ; German experiments on crushing strength of brick and brick work, Vol. XVII., 323 ; errors in above, Vol. XVII., 366.

BALL, Phineas, C. E. : disposal plans for Brockton, Mass. ; irrigation, Vol. XV., 376.

BALTIMORE :

Existing system of drainage, unsatisfactory condition of, Vol. V., 521; Vol. XV., 634.

Latrobe, C. H., sewerage plans of, recommended for adoption by Committee of Councils; editorial comment, Vol. V., 451; review of report making above recommendation, Vol. VI., 127.

Liernur system advocated for, by Dr. C. W. Chancellor; editorial criticism of his paper, Vol. VIII., 614; explanation of above editorial: not written by Colonel Waring as assumed by Dr. Chancellor, Vol. IX., 135.

Privy pit system : hundreds in the cellars of houses; (reference only), Vol. XIII., 471.

Sewerage system recommended by the Mayor : quotation from annual message, Vol. IX., 291.

BANGOR, Eng. : projected sewerage scheme : intermittent discharge into sea by penstock at outlet of sewer ; flushing gate in manhole, Vol. V., 519.

BAR HARBOR, Me. : Report by E. W. Bowditch to National Board of Health on sewerage of ; *two illustrations*, Vol. VII., 292. Abstract of report by Stevenson Towle and William E. Worthen on plans for sewerage prepared by E. W. Bowditch ; *one illustration*, Vol. XV., 261.

BARNES, Dr. Henry J. : review of paper by, on "Sewage Systems and the Epuration of Sewage by Irrigation and Agriculture," with discussion on the same, Vol. X., 267.

BASSETT, C. P., C. E. : Plainfield, N. J., brief abstract of plans for, with estimates, Vol. XV., 635.

BASSETT & NUTE : plans by, for Orange, N. J.; brief description, Vol. XIII., 8.

BATEMAN, James, on sewage irrigation for small towns; abstract of paper before Association of Sanitary Inspectors; Vol. XV., 342.

BATH, N. Y. : State Board of Health urges the adoption of the Memphis system ; editorial criticism, Vol. IX., 611.

BAUMEISTER, Prof. R. : Paper on separate system of sewerage, Vol. VII., 506.

BAYHEAD, N. J., LAND CO. : Introduction of pail system by ; quotation of card of "Sanitary Precautions" for patrons to "read and tack up near the closets," Vol. VI., 323.

BAZALGETTE, Sir Joseph :

Brighton sewerage, on, Vol. VI., 166.

Concrete block sewers constructed by ; description ; *two illustrations*, Vol. VI., 305.

Lea River, towns on, sewage disposal of : plan for joint intercepting sewer, XIV., 563.

London disposal: suggestion to carry to German Ocean, Vol. VIII., 63.

Thames Valley, Lower : scheme for drainage of, Vol. XI., 149.

Ventilation of sewers, on, Vol. VI., 166.

BEACHES : disposal of sewage at : See under *Disposal of Sewage*.

BEDDINGTON, Eng. : sewage farm, some statistics of, Vol. XIV., 199.

BELFAST, Ireland : Efforts to obtain power to raise loan for improving drainage system ; improper location of present outfalls, Vol. XIV., 104. Works for sewerage of the Ballynafeigh and Ravenhill districts put in hand ; sewage to be discharged into river Logan, Vol. XVI., 38.

BELGIAN CITIES : irrigation proposed for, Vol. IX., 264.

BERLIER PNEUMATIC SYSTEM as proposed for Paris : condensed description of plan ; editorial criticism, *one illustration*, Vol. VI., 376. Trial of ; district drained ; M. Durand-Claye on advantages of, over Liernur system, Vol. X., 411.

BERLIN : new sewerage and disposal works, report on, by M. A. Durand-Claye ; *five illustrations besides one full page of details*, Vol. VI., 444. Editorial criticism of some details of construction, Vol. VI., 565. Letter from Rudolph Hering on the above work, Vol. VI., 514. Notice of report on the same by James Hobrecht, Vol. XI., 214. Abstract of official report on the results, particularly of the irrigation experiment, Vol. IX., 547. Criticisms and suggestions by M. Knauff ; (review of pamphlet), Vol. VII., 130.

BEVERLY, Mass. : wooden box sewer ; comment ; (note), Vol. VIII., 328.

BILLINGS, Dr. J. S., U. S. A. : sewerage, on : quotations from article in "Harpers' Magazine," Vol. XII., 248.

BINGHAMTON, N. Y. : Sewerage: Criticism by Colonel George E. Waring, Jr., of plans by Rudolph Hering, Vol. VII., 460, 509 ; Mr. Hering's reply, Vol. VII., 483, 535. Unsuccessful effort of property owner to secure injunction against sewer construction ; (editorial), Vol. XIV., 271.

BIRMINGHAM (Eng.) :

Irrigation fields and intercepting sewers, extension of ; (note), Vol. V., 124.

Purification works, brief description of, by the Royal Commission (on London disposal) ; cost and annual expenditure, Vol. XI., 433.

Tub system : manufacture of poudrette : description of works and process, Vol. X., 193 ; extension of works ; brief account of method of utilization, Vol. X., 504.

BIRMINGHAM, TAME AND REA DISTRICT DRAINAGE WORKS : Account of the formation and work of the Board ; paper by W. S. Till, Engineer to the Board, before British Association for Advancement of Science : combination of Birmingham with surrounding towns and districts for disposal; intercepting sewers; acquisition of land ; character of surface and subsoil ; conduits and carriers ; underdrainage, Vol. XIV., 444 ; treatment : precipitation by lime, followed by irrigation ; sludge trenched in after drying in beds ; agriculture and stock raising ; financial exhibit, Vol. XIV., 500.

BLACKBURN, Eng.: Pail system : Abstract of report by borough engineer ; extension not recommended, Vol. VII., 225.

BLACKSTONE RIVER, Mass., pollution of : See *Worcester, Mass.*

BLACKSTONE VALLEY, Mass. : See *Massachusetts Drainage Commission.*

BOMBAY : pumping works and extension of sewerage system ; (note), Vol. XII., 74.

BOSTON, Mass. :

Disposal : Irrigation proposed by "American Architect;" editorial comment; reasons why separate system and irrigation are not applicable, Vol. VIII., 511. Commission of 1875 on; summary of report, Vol. XV., 345.

Main drainage works :

Carson's trench machine as used on Causeway Street ; *three illustrations*, Vol. XV., 290.

Cost of whole work, Vol. IX., 148.

Description of :

Clarke, Eliot C., First Assistant Engineer, by :
Brief account of previous sewerage and origin of present scheme ; general plan ; main and intercepting sewers ; automatic regulation of storm

BOSTON—(*Continued.*)

water ; filth hoist ; pumping station ; *seven illustrations* (including map) ; Vol. IX., 306. Outlet portion ; tank sewers ; tunnel ; outfall sewer ; reservoir ; discharge sewers ; *three illustrations* ; Vol. IX. 353. Pumping machinery ; high-duty engines ; *two full-page illustrations* ; Vol. IX., 402. Pumping machinery continued ; storm-service pumping engines ; boilers ; *three illustrations* ; Vol. IX., 424. Notice of Mr. Clarke's official report, Vol. XII., 349.

Philbrick, Edward S., by : History of previous sewerage ; *map* and *one illustration* ; Vol. XV., 234. Summary of report of Commission of 1875, Vol. XV., 345. Float experiments to determine best place of discharge ; route of main sewer ; cost per foot ; *one illustration* ; Vol. XV., 516. Junctions of branches with main ; flushing gates ; automatic storm-water regulator ; tide-water gates ; size and cost of various sections ; *fifteen illustrations* ; Vol. XVI., 67. Capacity ; storm water ; experiment to determine effect of sewer construction on height of ground water ; Vol. XVI., 264.

Dorchester Bay, temporary discharge into, proposed during completion of tunnel, but prevented by Legislative act ; Vol. VI., 209.

Operation described by Edward S. Philbrick, with opinion as to success of the method of disposal, Vol. X., 385.

Pumpage in 1885, 1886 and 1887 ; cost, duty ; Vol. XVII., 338.

Pumping begun ; (note), Vol. IX., 124.

Sewage : Composition of : table of analyses, Vol. XII., 274.

BOSTON—(*Continued.*)

Sewer construction : Amount of, in 1882 ; total length of sewers ; (note), Vol. VII., 202.

BOULOGNE : Construction of system of sewers ; disposal : sewage carried out to sea ; cost ; (note), Vol. VI., 399.

BOURNEMOUTH, Eng. : Flushing and ventilation of sewers : Field's flush-tanks ; high ventilators carried up trees and houses, Vol. VIII., 256. Field's flush-tanks of earthenware ; method of filling ; effect of flushing, Vol. IX., 42. Proposed use of sea-water for flushing, Vol. XV., 314.

BOWDITCH, E. W., C. E. : Atlantic coast resorts, drainage of : report to National Board of Health ; (abstracts) ; *two illustrations*, Vol. VII., 267, 292.

BOX SEWERS: Cicero, Ill. : 19,600 feet long, Vol. XV., 551.

BOX SEWERS, STONE : See *Stone sewers*.

BOX SEWERS, WOODEN : See *Wooden sewers* under *Sewer Construction*.

BREAKS IN SEWERS :

London : Flooding District Railway, Vol. XII., 88 ; Vol. XVI., 403.

Newark, N. J. : Cabman's horses drop in, Vol. X., 168.

BRENTFORD, Eng. : Purification works ; precipitation by lime and sulphate of alumina ; sludge dried by flues under the tanks, Vol. IX., 197.

BRESLAU, Ger. : Purification of the sewage of : Flowing in the Oder, by : investigations by Dr. Franz Hulwa : analyses, comments ; (review), Vol. XII., 193. Irrigation, by : investigations by Dr. Klopsch to determine extent, Vol. XI., 412.

BRICK : See under *Sewer Construction*.

BRIGHTON, Eng. : Sewerage :

Bazalgette, Sir Joseph, report by, Vol. VI., 166.

Denton, J. Bailey, main points of report by, Vol. VI., 244.

Editorial comments in the matter, Vol. VI., 161.

Foul condition of the sewers : Note, Vol. V., 85. The "Lancet" on, Vol. V., 522.

Richardson, Dr. B. W., extracts from report by, with editorial comments, Vol. VII., 3.

BROCKTON, Mass. : Sewerage and sewage disposal :
Site selected for disposal disapproved by State Board of Health ; probable abandonment of plan, Vol. XII., 275.
Plans by Samuel M. Gray, Col. George E. Waring, Jr., Rudolph Hering and Phineas Ball ; Mr. Ball's plan adopted, Vol. XV., 376.

BROOKLINE, Mass. : Supreme Court holds the town liable for causing a well to "dry up" in consequence of sewer construction, Vol. XVI., 242.

BROOKLYN, N. Y. :

Flushing Avenue sewer, flooding of : decision of Court of Appeals in suit against the city to recover damages for injuries by, Vol. XIII., 256 ; editorial comments on the same, Vol. XIII., 271.

Inspectors, sewer: Civil Service examination for, to be held ; (note), Vol. IX, 594.

Newtown Creek, pollution of, by Brooklyn sewage ; proposed new sewer to remedy ; (reference only), Vol. XIII., 447.

BROOKS AS SEWERS :

Evils of using :

Delaware, O. : proposed arching of small stream at ; editorial comment, Vol. XIV., 490.

Editorials, general, Vol. VIII., 559 ; Vol. XIV., 489 ; Vol. XVII., 342.

Rawlinson, Sir Robert, on : Vol. X., 483.

BROOKS AS SEWERS—(*Continued.*)

Schenectady, N. Y.: extracts from report of Secretary of State Board of Health, Vol. X., 124.

Trenton, N. J.: Court decision in American House case (hotel claiming right to discharge sewage into open water-course), Vol. XI., 515.

BRYN MAWR, Pa.: Plan of sub-surface irrigation pipes for disposal of sewage from hotel at, (illustrating article by E. S. Philbrick), Vol. VII., 555.

BUENOS AYRES: company constructing and to operate sewerage works; (note), Vol. IX., 545.

BUFFALO, N. Y.: Trunk sewer: Board of Sewer Commissioners; (note), Vol. VI., 67. Examination of possible routes by the Commissioners in connection with Colonel George E. Waring, Jr.; (note), Vol. VI., 206. Colonel Waring's plans submitted to Council; size and estimated cost, Vol. VI., 373. Colonel Waring to prepare specifications, Vol. VI., 398; engaged as consulting engineer during construction, Vol. VII., 183. Fears of pollution of the water-supply by leakage from: opinion of William S. Smith; controversy between Sewer Commissioners and Water Commissioners; editorial comment, Vol. XI., 213. Completion of; size, thickness of walls, velocity, etc.; (note), Vol. XII., 544; length, cost, etc. (note), Vol. XIII., 87.

BUNZLAU, (in Silesia), Germany: Ancient sewerage: description of works (including irrigation) constructed in the sixteenth century; *two illustrations* (maps), Vol. VIII., 416. Typhoid fever, effect of sewerage on mortality from, Vol. XIV., 587.

BURLINGTON, Vt.: Sewerage by open ditches; (reference only), Vol. XIII., 471.

BUXTON, Eng.: Sewerage works, new: cost; precipitation by iron water from a disused colliery and lime; (note), Vol. XI., 476; composition of the iron water; chemical results of treatment, Vol. XI., 497.

CALCULATIONS, Sewer :

Flynn's hydraulic tables, reviews of, Vol. VIII, 326 ;
Vol. XIII., 543

Gerhardt's diagram, review of, Vol. V., 219 : price and
where obtained, Vol. V., 263.

McMath, Robert E., abstract of paper by, before Am.
Soc. C. E., Vol. XV., Supplement to No. 3.

Moore and Baier's paper on Rutter's [Kutter's ?] for-
mula, brief notice of, Vol. XIV., 468.

Separate system, for: maximum flow to be provided for ;
(answer to correspondent), Vol. VII., 366.

CALCUTTA: Sir Robert Rawlinson on the sewerage
of, Vol. VII., 586. Extension of sewerage system and number
of houses connected in 1882-3, Vol. XII., 74.

CALIFORNIA—Stockton Insane Asylum. See *Stockton*.

CAMBRIDGE, ENG.—Disposal: delay in adopting plans,
Vol. X., 408, 528; Vol. XI., 308. Note on scheme of Mr.
Hawksley, Vol. XI., 348.

CANAL, open, conveyance of sewage in: nuisance from,
at Newark, N. J.: opinion of A. Fteley on ; (note), Vol. X.,
129. Description of the same, Vol. XV., 600.

CANNES : Sir Robert Rawlinson on sewerage of; evils
of cesspools, Vol. V., 542.

CANTON (China): Rain-water sewers ; cleansing ;
(note), Vol. X., 168.

CARBONIC ACID GAS in sewer air, per cent. of, Vol.
VII., 265.

CARPENTER, Dr. Alfred:

Earth-closets *versus* water carriage in large cities: crit-
icism of paper by Dr. Thomas Hawksley, Vol. XI.,
496.

Sewage utilization, on: Notice of address before Asso-
ciation of Sanitary Inspectors, Vol. XIV., 56. Ab-
stract of address before Croydon Farmers' Club;
editorial comments, Vol. XIV., 199.

CARPENTER, Dr. Alfred—(*Continued.*)

Ventilation of sewers, remarks on, before the Sanitary Institute, Vol. V., 302.

CARSON'S Trench Machine : See under *Sewer Construction*.

CATCH BASINS : See under *Sewer Construction*.

CAVING IN OF SEWERS : See *Breaks*.

CEDAR RAPIDS, Iowa : Need of sewerage ; unsuccessful attempts to secure, Vol. XIV., 345.

CEMENT : See under *Sewer Construction*.

CESSPOOL GASES : Question as to the inflammability of: case in Providence, R. I., cited by Dr. Charles V. Chapin, Vol. XIII., 445 ; editorial comment on the same, with reprints of editorial (Vol. VII., 265) on explosion in cellar of Cincinnati house ; composition of sewer gas, Vol. XIII., 515.

CESSPOOLS : See under *Disposal of Sewage*.

CHADWICK, Edwin, C. B. : On the Chief Sanitary Principles for Town Drainage ; advocacy of separate system, Vol. XII., 312. On sewage disposal and reduction of death-rate of great cities, Vol. XIII., 247. On the tub system, Vol. VI., 267 ; Vol. XII., 312.

CHANCELLOR, DR. C. W., (Secretary State Board of Health of Maryland) : Editorial notice and criticism of paper by, on the Liernur system, advocating it for Baltimore, Vol. VIII., 614. Explanation of above editorial: not written by Col. Waring, as assumed by Dr. Chancellor, Vol. IX., 135.

CHANUTE, OCTAVE, C. E. : On the separate system, with special reference to Kansas City, Vol. X., 263.

CHARLES RIVER VALLEY (Mass.) : See *Massachusetts Drainage Commission*.

CHARLESTON (S. C.) : Plans of Col. George E. Waring, Jr., for sewerage of: résumé of scheme and estimates, Vol. IX., 387.

CHELSEA, Eng.: Experiments on ventilating sewers by wind cowls, Vol. XIV., 250. Health of sewer laborers at, Vol. XIV., 464.

CHELSEA, Mass.: Breaking into pipe sewers for house-connections not allowed; automatic flush-tanks give trouble, and operation by hand adopted; manhole ventilation satisfactory; trouble with catch-basins by freezing; cost of catch-basins and manholes, Vol. XV., 545. Flushing of pipe sewers: experiments to determine effect of, on house-drain traps, Vol. XVII., 167. Cost of pipe sewers, and assessments on same, Vol. XVII., 278.

CHEMICAL WORKS, analysis of waste water from: Glasgow, Vol. XII., 148.

CHESBROUGH, E. S., C. E.: Obituary notices of: Vol. XIV., 295, 302.

CHICAGO:

Death rate, reduction of, by sewer construction, Vol. XII., 248; Vol. XIV., 399.

Deep drainage, with outlet through tunnel to Desplaines river; purification by precipitation and "agitators:" plan of Gordon Nott; editorial comments on the scheme, and on the effusions of cranks in general, Vol. XVI., 317. Reference to letter from Mr. Nott; editorial endorsement of plan recommended by the Commission, Vol. XVI., 430.

Disposal:

Agitation of the question; (special correspondence), Vol. VIII., 520.

Illinois and Michigan canal: centrifugal pumps for discharging contaminated river water into, Vol. VIII., 159. Nuisance caused by sewage in, Vol. XIII., 87.

Illinois river, by: St. Louis fears pollution of her water supply from; (note), Vol. VI., 399.

CHICAGO —(*Continued.*)

- Lake, discharge into, likely to be continued ; editorial comment, Vol. XVI., 205.
- Nuisance caused by present method : description by Dr. R. J. Curtiss, Vol. XIII., 87.
- Drainage and Water Supply Commission : Formation of, favorably reported, Vol. XII., 424. Veto of ordinance providing for appointment of, Vol. XIII., 65. Councils authorize mayor to appoint three experts, Vol. XIII., 233. Resolutions of City Council under which appointed ; Rudolph Hering appointed Chief Engineer ; editorial comment, Vol. XIII., 392. Benetzette Williams appointed Consulting Engineer, Vol. XIV., 424. Additional funds called for ; editorial urging the needed appropriations, Vol. XV., 35. Scope of the investigation : extracts from Chief Engineer's report of progress, Vol. XV., 40. Additional appropriation granted, Vol. XV., 70. Abstract of preliminary report, Vol. XV., 261. Denial of report that Chief Engineer Hering had been relieved, Vol. XVI., 46. Special report on "Diversion of the Flood-Waters of the Desplaines," etc. : (abstracts), Vol. XVI., 242. End of the investigation : letter from the Commission to the Mayor protesting against his order to discontinue the work, Vol. XVI., 715 ; editorial comments, Vol. XVI., 707.
- Flushing of sewers : description of method employed through manholes from traveling tank, Vol. VII., 198.
- Main drainage : editorial notice of, and comments on report by Committee of Citizens' Association, Vol. XII., 328.
- Nott, Gordon, sewerage plan of, Vol. XVI., 317 ; editorial notice of letter from, Vol. XVI., 430.
- Privies on sewered streets ; (reference only, to great number), Vol. X., 169.

CHICAGO—(*Continued.*)

Prize offered for best practical essay on the main drainage, sewerage and water supply of the city and vicinity, Vol. X., 465 ; editorial comment, Vol. X., 504.

CHIMNEYS FOR SEWER VENTILATION : See under *Ventilation of Sewers.*

CHINGFORD, Eng.: Proposed drainage works ; (note), Vol. XIII., 176.

CHISWICK, Eng.: Purification works : (precipitation) : Description of apparatus and operation, by Joseph Hetherington, Resident Engineer : History of the works ; Baldwin Latham's patent revolving screen ; *three illustrations*, Vol. XVI., 320. Engines and pumps ; mixers and agitators ; *three illustrations*, Vol. XVI., 377. Mixers and agitators (continued) ; precipitation tanks, with floating arms ; history of sludge difficulty ; filter-presses, with lime mixer ; importance of competent supervision of machinery during manufacture and erection ; daily record of sewage flow ; relation of rainfall to flow ; leakage of tide water ; lime and alumina for precipitation ; proportion of sludge ; cost of operation ; effect of works on death-rate ; *thirteen illustrations*, Vol. XVI., 404. Nuisance caused by deposit of sludge on the ground ; court requires the Local Board to abstain, Vol. X., 288.

CHLORIDE OF LIME : See under *Deodorizing Sewage* under *London.*

CINCINNATI :

Catch-basins used in ; *two illustrations* ; comments on, Vol. VI., 325. Cost of cleaning, Vol. VII., 247. Condition of sewerage ; frequent reconstruction of small sewers necessitated by effect of acids on limestone and poor bricks ; total length of sewers ; number of connections ; method of ventilation, Vol. VII., 203.

CINCINNATI—(*Continued*)

Explosion in cellar at time of flood (February, 1883, attributed to sewer gas; editorial on probable cause, Vol. VII., 265. Statements concerning, by A. E. Tripp, Assistant City Engineer, Vol. VII., 318.

Extension of sewerage system :

Need of : statement of correspondent, Vol. VII., 203.

Need of completed system emphasized by recent flood, Vol. VII., 303. Objection of taxpayers, Vol. VII., 100; editorial comment, Vol. VII., 97.

Proposed : editorial comment on suggestion to extend water distribution in advance of sewers, Vol. VI., 519.

Improvement of sewerage : Expenditure of \$1,000,000 authorized, Vol. VIII., 231. Progress; expenditure of \$3,000,000 authorized, Vol. VIII., 618. Progress of construction during 1886, Vol. XVI., 493.

McLean Avenue sewer : account of construction ; *one illustration*, Vol. VI., 352.

Walnut Hills : need of sewers ; (note), Vol. V., 124 ; efforts to secure ; (note), Vol. VI., 132. Plan for utilizing power of sewage fall for running machinery for purification ; (note), Vol. VII., 539. Foul condition of gullies from insufficient appropriation for sewers, Vol. IX., 384.

CLARIFICATION (of sewage) : See under *Purification of Sewage*.

CLARKE, ELIOT C., C. E.:

Boston Main Drainage Works, description of, Vol. IX., 306, 353, 402, 424 ; notice of official report on the same, Vol. XII., 349.

Injured by explosion in manholes, Vol. IX., 594, 617.

Medfield, Mass., brief description of sewerage irrigation at ; remarks on sewage purification ; (discussion by Am. Soc. C. E.), Vol. XVI., 181.

CLARKE, ELIOT C., C. E.—(*Continued.*)

Superintendent of Boston sewers, elected, Vol. IX., 268.

CLAY SOIL (in irrigation): See under *Irrigation* under *Purification of Sewage.*

CLEANING SEWERS:

Ball or "pill," by: brief description of, as used at Schenectady, N. Y., Vol. XV., 630.

Dougine's system: brief and claim of patent; *one illustration.* Vol. IX., 290.

Jets of water from perforated pipe running through the sewer, by: "a crank's plan": letter from Salt Lake City, Vol. V., 219.

Pringle's apparatus: endless chain, through manholes, by steam power; abstract of patent claim, Vol. XIV., 280.

Rods of wood, jointed; used at Denver, Vol. XIV., 203.

Scrapers, wooden, with rubber flanges: used at Waterbury, Conn., Vol. XVI., 151.

CLEVELAND (Ohio):

Cayahoga river, plans for preventing the pollution of: Intercepting sewer along the river; recommendation of Common Council Committee; (note), Vol. V., 124. Intercepting sewers in tunnel to receiving wells, with pumpage into lake: plan of J. H. Sergeant, Vol. X., 369. Similar plan by City Engineer Vol. XI., 248.

Hering, Rudolph, sewerage plans by; (note), Vol. VI., 107; résumé of same, Vol. VI., 190; general plan approved by city councils, Vol. VI., 150.

CLOUD-BURSTS: See *Rainfalls, excessive.*

COAST RESORTS: See under *Resorts.*

COLCHESTER, Eng.: Brief description of disposal works: irrigation after sedimentation, Vol. X., 408.

COLLINGWOOD, F., C. E.: On cements: American *vs.* Portland; table of compressive tests, Vol. XII., 468; abstract of paper before Am. Soc. C. E., Vol. XII., 497,

COLLINGWOOD, F., C. E.—(*Continued.*)

Description of improved sewerage system of Newark, N. J., Vol. XV., 600, 628.

COLUMBUS, OHIO.: Need of sewers; great number of cess-pools, Vol. X., 197. Proposed intercepting sewer in canal feeder; (note), Vol. XVII., 247.

COMBINED SYSTEM OF SEWERAGE: See *Separate vs. Combined System.*

COMPANIES, sewerage works constructed and operated by: Buenos Ayres; (note), Vol. IX., 545. Danzig: irrigation; terms, Vol. X., 12.

CONCORD, MASS.: report by Edward S. Philbrick on sewerage of, Vol. V., 388, 407.

CONEY ISLAND: (See also Manhattan Beach): Plan for sewerage of, proposed by Andrew Clerk; Ward's flexible pipe joints on outlet into sea; editorial comments, Vol. VI., 467.

CONNECTICUT CITIES AND TOWNS, practice of sewer assessments in, Vol. XIV., 105.

CONNECTIONS, HOUSE, WITH SEWER: See *House Connections.*

CONTINENTAL TOWNS: notice of paper by J. Gordon, on the drainage of, Vol. XV., 463 (1st col.).

CONTRACTOR'S EXTRA CLAIM for rock excavation in sewer trench where profile showed gravel, allowed by court in Philadelphia; editorial comment, Vol. VII., 107.

COPENHAGEN, SEWERAGE OF: amount of rainfall admitted; size of pipe sewers; exclusion of excreta, Vol. X, 555.

CORNING, N. Y.: Separate system: size and length of sewers; ventilating manholes; Van Vranken flush tanks, Vol. XVII, 365.

COTTAGES, SUMMER: See *Summer Cottages.*

COVENTRY (Eng.): Purification works: precipitation by sulphate of alumina and proto-sulphate of iron and lime; sludge compressed; testimony of J. C. Melliss, engineer of

COVENTRY (Eng.)—(*Continued.*)

the works, as to inoffensiveness of the process, Vol. XIV., 394 (1st col.). Failure of company hitherto treating the sewage; anticipated yearly loss under management of the corporation; proposed conveyance of the sewage to Avon valley, Vol. XI., 328. Proposed enlargement of works; (note), Vol. XI., 438.

CREMATION: See under *Disposal of Sewage.*

CROES, J. J. R., C. E.:

Disposal without discharge into streams: (paper before N. J. Sanitary Association; abstract), Vol. IX, 92.

East Orange, N. J.: Résumé of plans for sewerage and disposal, Vol. VIII, 445; estimated cost of conveying sewage to Newark bay, as compared with local treatment, Vol. XI., 313.

Geneva, N. Y.: Plan of disposal for, Vol. IX., 329.

Lawrenceville, N. J., School: Description of sewerage and disposal works after plans: by sub-surface irrigation; *four illustrations*, Vol. XV., 12.

Mt. Vernon, N. Y.: Criticism of Stevenson Towle's plans for sewerage of, Vol. XII., 252.

Separate system, on: (part of discussion by Am. Pub. Health Assoc.), Vol. VI., 490.

CROPS FOR SEWAGE FARMS: See *Produce* under *Agriculture* under *Utilization of Sewage.*

CROYDON (Eng.): Norwood farm; proposed extension; objection thereto by neighboring inhabitants on ground of nuisance; brief description of process of purification; irrigation, Vol. XIV., 80.

CULVERTS, OLD RAIN-WATER: Evil effects of using, to remove sewage (C. H. Roney), Vol. VII., 231.

DALLAS, Tex.: Separate system: inverted syphon; cheap flush tanks; *two illustrations*, Vol. IX., 332.

DAMS ON STREAMS RECEIVING SEWAGE: near London, Ont.: removal ordered by Board of Health, Vol. XII., 446.

DANZIG (Ger.) : Irrigation works operated by private company ; terms, Vol X., 12.

DAYTON, Ohio : Absence of sewers ; disposal in vaults and cess-pools ; editorial comments, Vol. VI., 511.

DEATH-RATE, RELATION OF, TO SEWERAGE :

Chadwick, Edwin, C. B., quotation from, with editorial comment, Vol. XIII., 247.

Chicago, Vol. XII , 248 ; Vol. XIV., 399.

Chiswick, Eng., Vol XVI., 407.

Havre, Vol. V., 401.

Memphis, Vol. VII., 241, 538 ; Vol. VIII., 159.

Munich, Vol. XII., 153.

New Haven, Conn., Vol. XIV., 278.

Several cities : (collated by Health Officer of Toronto), Vol. XII., 234.

Smith, Erwin F., conclusions of, from data collected by him, Vol. XIII., 463.

DECAUVILLE SYSTEM OF MOVING MATERIAL :

See under *Sewer Construction*.

DEDHAM, Mass. : proposed disposal scheme in conjunction with Hyde Park : connection with Boston, Vol. XIII., 185.

DE MEIJER, DR. VAN OVERBEEK : Advocacy of the Liernur system : Abstract of remarks before International Sanitary Congress at Geneva, Vol. VI., 559. Editorial criticism of his "Les systemes d'evacuation des eaux et immondices d'une ville," Vol. VIII., 590. Letter to Col. Waring, Vol. IX., 236 ; editorial comment on the same, Vol. IX., 231.

DENTON, J. BAILEY, C. E. :

Brighton : main points of report on sewerage of, for the "Lancet," Vol. VI., 244.

Intermittent Downward Filtration works, after plans by : notes of three instances : Dewsbury, Watford and Withington, Vol. XIII., 63.

DENTON, J. BAILEY, C. E.—(*Continued.*)

Lea river, towns on: scheme for drainage of, Vol. XIV., 563.

London, disposal of sewage of: scheme for conveyance to Canvey Island, Vol. XIII., 63; criticism of action of the Board of Works, Vol. XV., 570.

Oxford: Letter stating that the credit for selection of site and general scheme of works at, belongs to him, Vol. VIII., 496.

DENVER, Col.: Separate system: brief description, Vol. VIII., 566; size, grade, velocity, cost, flushing, cleaning, stoppages, etc., Vol. XIV., 203. How the sewerage system was obtained: humorous letter, Vol. VII., 323.

DEODORIZING SEWAGE: See under *London*.

DEPTFORD, Eng.: Large storm-water overflow sewer: description, Vol. X., 28; shorter description, with *one illustration*, Vol. X., 171.

DETROIT, Mich.: Brief description of sewers, with methods employed in disinfecting, Vol. XIII., 86. Condition of the sewerage: abstracts of discussion by the Academy of Medicine, with editorial comments, Vol. XVI., 234.

DEWSBURY, Eng.: Filtration and surface irrigation; cost of preparation per acre, etc.; (note), Vol. XIII., 63.

DIAGRAM OF SEWER CALCULATIONS:

Gerhardt's, review of, Vol. V., 219; price and where obtained, Vol. V., 263.

Hering's, reference to, Vol. VIII., 326.

DIBDIN, W. J.: abstract of paper on sewage sludge and its disposal, Vol. XV., 514; criticism of the same by the "Builder," Vol. XVI., 289.

DISCHARGE THROUGH SEWERS, calculations of: See *Calculations*.

DISINFECTING TANK, Powers' Patent: brief and claim; *one illustration*, Vol. IX., 505.

DISINFECTION OF CESS-POOLS: Pittsburg: proposed ordinance requiring; editorial criticism, Vol. VI., 368.

DISINFECTION OF SEWAGE : (See also *Deodorizing*, under *London*) : By copperas : notice of patented method of W. Conder, Vol. XIII., 152.

DISINFECTION OF SEWERS :

Brooklyn : recommended by Health Commissioner ; editorial comment, Vol. XIII., 127.

Collings and Pike's apparatus : claim of patent ; *one illustration*, Vol. X., 249.

Detroit : by copperas and brimstone ; note, Vol. XII., 90 ; description of methods employed, Vol. XIII., 86.

Gas-works, washings from, recommended by the "Water-Gas Journal ;" editorial criticism, Vol. VII., 416.

Rosenfield's portable apparatus ; brief description, with *one illustration*, Vol. XIII., 85.

Rowan's apparatus for ventilating and purifying ; claim of patent ; *one illustration*, Vol. IX., 74.

Stratford's ditto : patent claim ; *one illustration*, Vol. V., 333

"DISINFECTION VS. SEWERAGE : " Editorial comments on proposed ordinance in Pittsburg requiring disinfection of all vaults and drains, Vol. VI., 368.

DISPOSAL OF EXCRETA : (See also *Dry Removal* under *Disposal of Sewage*; also *Excreta* under *Utilization of Sewage*) : Historical notes on, in Paris, Vol. VIII., 31 ; Prof. Rudolph Virchow on, Vol. VIII., 33.

DISPOSAL OF SEWAGE : (See also *Purification of Sewage*) :

Beaches, at :

Asbury Park, (N. J.), Vol. VI., 103, 393 ; Vol. VII., 371.

Atlantic City, (N. J.), Vol. VII., 267.

Long Branch, (N. J.), Vol. VII., 267 ; Vol. IX., 594.

Ward's flexible joints for cast-iron pipe for discharge sewers at, Vol. VI., 467.

Burial : See under *Dry Removal* under *Disposal of Sewage*.

DISPOSAL OF SEWAGE—(*Continued.*)

Cess-pools :

Asbury Park, (N. J.), at : abandoned and filled with clean earth ; kitchen slops removed immediately in water-tight receptacles, Vol. VII., 194 ; Vol. VIII., 157.

Disinfection of : Pittsburg : proposed ordinance requiring ; editorial comments, Vol. VI., 368.

Disposal of contents : Utilization by farmers ; Florence, (Italy), Vol. X., 243.

English house drainage, old-time, in ; *three illustrations*, Vol. VIII., 272.

Evils of :

“ Ann Eliza ” in defense (?) of, Vol. V., 320.

Durand-Claye, M. A., on, Vol. VIII., 55.

Editorial :

Cincinnati, with special reference to, Vol. VII., 97.

Colorado Springs : for proposed hotel at ; (answer to correspondent), Vol. V., 426.

General explanation of the, Vol. VIII., 302.

Isolated houses distant from sewer ; proper method of disposal ; (answer to correspondent), Vol. XVI., 325.

Kitchen sewage, Vol. VI., 3 ; Vol. X., 71.

Montgomery, Ala. : Vol. VI., 22.

Newark, N. J. : with special reference to, Vol. XII., 228 ; tight, with overflows, Vol. XVI., 155.

Overflowing to sewers, Vol. X., 71 ; Vol. XVI., 155.

Towns, thickly settled : danger of storing contents, mixed with house manure, under barn ; (answer to correspondent), Vol. V., 101.

Galton, Capt., on, Vol. IX., 142.

Hunt, Dr. Ezra M., on, Vol. VI., 324 ; Vol. VII., 561

DISPOSAL OF SEWAGE—(*Continued.*)

- Paris, description of picture exhibited by the city of, at Geneva Sanitary Congress, Vol. VI., 379.
- Philbrick, Edward S., on, Vol. V., 388; Vol. XI., 269.
- Rawlinson, Sir Robert, on ; nuisance and danger to health from emptying, Vol. V., 542.
- Snow, Dr. E. M., Supt. of Health, of Providence, R. I., on, (in first annual report, 1857), Vol. VIII., 151.
- Trenton "State Gazette" on, Vol. VII., 220.
- Typhoid fever, cause of, (Dr. Ezra M. Hunt), Vol. VII., 561. Means of propagating ; (editorial), Vol. IX., 192.
- Florence, Italy : construction ; method of emptying ; storage tanks ; utilization by farmers, Vol. X , 243.
- Newark N. J. : number in, Vol. VII., 369. Danger, of, pollution of wells by, Vol. XII., 228. Evils of tight, with overflows to sewers, Vol. XVI., 155.
- New Haven (Conn.) : Extent of ; (editorial on condition of sewerage), Vol. VIII., 415. War on, by the local papers, Vol. VIII., 566. Prevalence of, a serious cause of apprehension in regard to typhoid, Vol. IX., 192. Decrease of death rate due to abolition of, Vol. XIV., 278. Effect of, on infantile diarrhœa, Vol. XIV., 423.
- Norwich, N. Y. : Insanitary condition of town by reason of, Vol. XII., 12.
- Overflowing to sewers, Vol. VIII, 272 ; Vol. X., 71 ; Vol. XVI., 155.
- Paterson, N. J. : efforts at, to abolish ; (note), Vol. XI., 546.
- Philadelphia : For school-houses ; (editorial note), Vol. VI., 281. Connected with public sewers ; a cause of nuisance ; (note), Vol. VIII., 272.

DISPOSAL OF SEWAGE—(*Continued.*)

- Pittsburg, Pa. : Great number of ; proposed ordinance requiring disinfection ; editorial comments, Vol. VI., 368.
- Choice of proper method, considerations affecting ; (editorial) : misleading statements regarding profit from utilization ; reason of alleged success at Pullman, Vol. XIV., 55.
- Conflict of opinion among English sanitarians, chemists and engineers, as illustrated by Dr. Tidy's paper before Society of Arts ; editorial abstract of this paper and discussion thereon, with comments, Vol. XIV., 223.
- "Continent," editor of the, on, Vol. VII., 305.
- Cremation :
- Excreta : Ross' furnace for privies : claim of patent ; *one illustration*, Vol. VII., 86.
 - Night-soil and house refuse : advocated by engineers of English towns, Vol. XI., 248.
 - Sewage : advocated by J. M. Keating of Memphis ; abstract of paper before American Public Health Association, Vol. X., 532.
 - Sewer gas : brief and claim of A. S. Glover's patent ; *one illustration*, Vol. VI., 253.
- Croes, J. J. R., on, without discharge into streams, Vol. IX., 92.
- Docks, accumulation of sewage sludge in : city of Portland, Me., indicted for allowing, Vol. VII., 184.
- Dry removal :
- Burial near surface of ground : argument against admixture of water with dead organic matter, by Dr. G. V. Poore : editorial abstract and criticism, Vol. XVI., 345.
- Earth-closets :
- Barrels as receptacles ; form proposed by Dr. A.

DISPOSAL OF SEWAGE—(*Continued.*)

- Clifford Mercer, Health Officer of Syracuse, N. Y.; *one illustration*, Vol. XI., 481.
- Carpenter, Dr. Alfred, on, *versus* water carriage for large cities, Vol. XI., 496.
- Hamilton, Ont.: protest by citizens against continuance of, as a public system, Vol. XII., 268.
- Hawksley, Dr. Thomas, on substitution of, for water carriage in large cities; editorial criticism; *one illustration*, Vol. XI., 496; reply to above criticism, Vol. XII., 70.
- Management of: Dr. A. R. Chalmers on the, Vol. XII., 73.
- Military posts, recommended for; (answer to correspondent), Vol. XIII., 325.
- Schools, for public: form recommended for those without adequate water supply and sewers; (answer to correspondent), Vol. VI., 64.
- Versus* water carriage for large cities: notice of paper by Dr. Thomas Hawksley, entitled, "Proposal for the abolition of water carriage in the removal of effete organic matter from towns;" quotation from discussion by Dr. Alfred Carpenter; editorial criticism; *one illustration*, Vol. XI., 496. Dr. Hawksley's reply to above criticism; Vol. XII., 70.
- Workshops, for large: description; method of construction and operation; (answer to correspondent); *one illustration*, Vol. XII., 230.
- Pail system:
- Augsburg, Bavaria: utilization, with profit, Vol. VII., 394.
- Bayhead, N. J. Land Co., introduced by, Vol. VI., 323.
- Birmingham (Eng.): manufacture of poudrette: description of works and process, Vol. X, 193.

DISPOSAL OF SEWAGE—(Continued.)

- Blackburn, Eng.: abstract of report by borough engineer; extension of system not recommended, Vol. VII., 225.
- Hull, Eng.: no longer satisfactory, Vol. V., 367.
- New York State Board of Health, recommended by, for villages without water supply, Vol. 240.
- Rochdale, Eng.: new process of utilization, (manufacture of manure) to be tried; old method a nuisance and expensive; (note), Vol., VI., 373.
- Water carriage *versus*: Editorials, Vol. VI., 22; Vol. XI., 496. Dr. Alfred Carpenter on, Vol. XI., 496.
- Durand-Claye, M. A., on, with special reference to Paris, Vol. XIII., 375.
- English methods, history of: abstract of paper by Charles Allen, Vol. XVI., 180.
- Estuaries and land-locked bays and harbors: Movement of sewage in, by the tide: observations at Southampton, (Eng.), Vol. VI., 413. Discharge of sewage into, condemned; editorials, Vol. IX., 280; Vol. X., 503.
- Excreta: See *Disposal of Excreta*; also *Dry Removal* above, and *Tub System* below.
- Hospitals, from: danger from deposit on land; (answer to correspondent), Vol. XV., 520.
- Isolated houses, proper method for; (answer to correspondents), Vol. VIII., 302; Vol. XVI., 325. (See also Sub-Surface Irrigation under *Purification of Sewage*).
- Massachusetts, in: Proposed law requiring purification before discharge into streams, Vol. VIII., 87. Discussion by Am. Soc. C. E. of paper on, by F. P. Stearns: paper by Charles Allen; remarks by E. C. Clarke, Emil Kuichling *et al.*, Vol. XVI., 180.

DISPOSAL OF SEWAGE—(*Continued.*)

Massachusetts Drainage Commission, extracts from report of : History of experiments and investigations, Vol. XIII., 251. English law on pollution of streams and its effect ; sedimentation and coarse filtration, Vol. XIII., 273. Clarification by precipitants ; irrigation ; *one illustration*, Vol. XIII., 297. Separation from rainfall ; considerations affecting choice of methods in Massachusetts ; conclusions, Vol. XIII., 345.

Night-soil : (See also under *Utilization of Sewage*):

Cremation : advocated by engineers of English towns, Vol. XI., 248 ; proposed for St. Paul, Minn., Vol. XVI., 267.

English cities and towns, principal : methods employed in : abstract of report by Mr. Macbrair, City Engineer of Lincoln (Eng.), Vol. XI., 248.

St. Paul, Minn.: nuisance from dumping, on flats near the city ; proposal to change dumping place to point ten miles distant, or cremate, Vol. XVI., 267.

Pollution of streams :

Common Law, the, on : editorial, Vol. VIII., 175.

English law concerning, and its effect on sewage disposal ; (extract from report of Massachusetts Drainage Commission), Vol. XIII., 273. Extract from proposed new law, Vol. XII., 212.

Hering, Rudolph : notes on the, Vol. XVII., 228.

Editorial notice of the same, with general comments on the subject, Vol. XVII., 225.

Massachusetts : proposed law against, Vol. VIII., 87.

New Jersey, editorial with special reference to, Vol. X., 503.

Robinson, Prof. Henry, on : Abstract of paper on the Rivers Pollution Act of Great Britain ; cause

DISPOSAL OF SEWAGE—(*Continued.*)

of failure to produce anticipated results ; a serious defect ; suggested change, Vol. IX., 429. Editorial notice of two papers by, Vol. XI., 451.

Rochester, N. Y.: Suits against for causing, Vol. VIII., 183 ; Vol. XVI., 37.

Privies :

Raymond, Dr. J. H., extracts from paper by, before American Public Health Association, Vol. X., 50.

School : proper construction of, and disposal of contents ; earth-closets ; (answer to correspondent), Vol. VI., 64.

Sewered streets, on : great number in Chicago, Vol. X., 169.

Water closet system compared with ; (in editorial on sewerage of Montgomery, Ala.), Vol. VI., 22.

Rawlinson, Sir Robert, on : abstract of president's address before Sanitary Institute, Vol. X., 483.

Richardson, Dr. B. W., on : Favors disposal on land in all cases—transporting in tanks by rail or canal when necessary, Vol. IX., 567.

Rivers, discharge into : See *Estuaries* and *Pollution of Streams* above ; also *Streams* under *Purification of Sewage*.

Robinson, Prof. Henry, on : Extracts from paper by, before Sanitary Institute, Vol. X., 603. Editorial notice of two papers by, Vol. XI., 451.

Sea, intermittent discharge into :

Asbury Park, N. J., Vol. VI., 393.

Bangor, Eng., Vol. V., 519.

Boston (Mass.), Vol. IX., 353 ; Vol. X., 385 ; Vol. XV., 516.

Portsmouth, Eng., Vol. IX., 185.

Ward's flexible pipe joints proposed for outlet sewers on beaches ; editorial comment, Vol. VI., 467.

DISPOSAL OF SEWAGE—(Continued.)

- Small cities : Advice to a correspondent ; employment of expert engineer recommended, Vol. XVII., 186.
- Stevenson, Dr. Thomas, on ; extracts from paper before London Medical Officers of Health ; method of the future, Vol. XII., 28.
- Streams, discharge into : See *Estuaries* and *Pollution of Streams* above ; also *Streams* under *Purification of Sewage*.
- Suburban towns and those nearly adjacent to each other : advantage and importance of joint action and works ; editorial emphasis of Sir Joseph Bazalgette's advice (regarding towns on the river Lea), Vol. XIV., 563.
- Tidy, Dr. C. Meymott, on : Brief abstract of paper before Society of Arts, Vol. XIII., 560 ; editorial résumé of the same and discussion thereon, with comments on the conflict of interests of those affected by the question (of disposal), Vol. XIV., 223.
- Transportation in tanks, by rail or canal, to barren sea-coasts, proposed by Dr. B. W. Richardson, Vol. IX., 567.
- Tub system :
- Birmingham (Eng.) : Extension of works for utilization ; poudrette manufacture ; brief description, Vol. X., 504 ; more complete description, Vol. X., 193.
 - Chadwick, Edwin, on, Vol. VI., 267 ; Vol. XII., 312.
- Vawser, Robert, on : Evil of attempts to find a profit in utilization ; ensilage and silos (in connection with irrigation), Vol. XII., 211.
- Villages: James Bateman on irrigation for, Vol. XV., 342.
- Virchow, Prof. Rudolph, on, Vol. VIII., 33.
- Wells, deep : " forcing it into the earth one thousand feet down ; " proposition in a Rochester paper ; comment, Vol. XIV., 349.

DISTILLERIES, ANALYSES OF WASTE-WATER FROM, Vol. XII., 148.

DISTRICT OF COLUMBIA: See *Washington*.

DOCKS, ACCUMULATION OF SEWAGE SLUDGE IN: See under *Disposal of Sewage*.

DRY REMOVAL: See under *Disposal of Sewage*.

DUBLIN: Defective condition of sewerage; foul state of the Liffy, Vol. X., 504, 533.

DURAND-CLAYE, M. ALFRED:

Berlin, report on new sewerage system of; *five illustrations beside one full page of details*, Vol. VI., 444.

Geneva, International Sanitary Congress at: speeches at, in defense of sewers and irrigation, Vol. VI., 559.

Obituary notice of, Vol. XVII., 346.

Paris:

Disposal: objection to cess-pools and privies: to conveyance to the sea, and to chemical and mechanical treatment; advocacy of irrigation and crop raising, Vol. VIII., 55.

Irrigation works, description of, Vol. XIII., 375.

Sewerage: opposition to the Liernur and advocacy of the English system, Vol. X., 411.

DYE WORKS, ANALYSES OF WASTE WATER FROM, Vol. XII., 148.

EARTH-CLOSETS: See under *Dry Removal* under *Disposal of Sewage*.

EASTBOURNE, Eng.: Shone system at: description of works, Vol. V., 474.

EAST ORANGE, N. J. (See also *Orange, N. J.*): Résumé of plan for sewerage and disposal by J. J. R. Croes; discussion by "Town Improvement Society," Vol. VIII., 445. Estimated cost of conveying the sewage to Newark bay as compared with local treatment plan; public meeting favors immediate construction of sewers, Vol. XI., 313.

EDINBURGH : Proposal to carry sewage of southern district directly to the sea by covered culvert, approved ; (note), Vol. IX., 473.

ELBERFIELD, (Ger.) : Abstract of report by William H. Lindley on best means of sewerage : separate system for upper town and combined for lower, Vol. VIII., 79.

ENGINEERS :

Duty of, to urge the adoption of some method of purification when called on to devise sewerage plans ; (editorial), Vol. X., 455.

Examination of, in England ; examination papers used in October, 1887, on sewer construction and sewage disposal, Vol. XVII., 211.

Importance of procuring the services of competent, in designing or constructing works ; (editorial).

General, Vol. VI., 201 ; Vol. VIII., 200 (1st col.) ;

Vol. XVI., 270 ; Vol. XVII., 186.

Grand Rapids, Mich., Vol. XII., 367.

Milwaukee, Vol. XVI., 346.

Montgomery, Ala., Vol. IX., 23

Montreal : ventilation of sewers, Vol. XVII., 129.

Oakland, Cal., Vol. XVII., 358.

Orange, N. J., Vol. XI., 437.

Red Bank, N. J., Vol. IX., 239.

San Francisco, Vol. XII., 367.

Mechanical, recommended by the Trenton (N. J.)

"Gazette" for devising a sewerage system for that city ; editorial comment, Vol. VI., 414.

"Prophets away from Home," as ; editorial comments on the calling of non-resident experts by Philadelphia and Newport (R. I.), Vol. VI., 414.

ENGLISH LAW concerning pollution of streams and its effect on sewage disposal ; (extract from report by Massachusetts Drainage Commission), Vol. XIII., 273.

ENGLISH METHODS of sewage disposal, history of : abstract of paper by Charles Allen, Vol. XVI., 180.

ENSILAGE : See *Silos* under *Agriculture* under *Utilization of Sewage*.

ERIE CANAL, efforts to prevent discharge of sewage into : (note), Vol. XII., 34.

ESTUARIES : See under *Disposal of Sewage*.

EUROPEAN SEWERAGE Systems, report on, by Rudolph Hering ; Résumé and Conclusions with reference to Philadelphia : review of, Vol. V., 246. Letter from the author, correcting "some misapprehensions" in above review, Vol. V., 282. Notice of reprint of report to National Board of Health, Vol. XI., 398.

EXAMINATION : of Engineers, see under *Engineers*; of Sewer Inspectors, see *Inspectors*.

EXCAVATING APPARATUS : See under *Sewer Construction*.

EXCRETA : See under *Utilization of Sewage*; also *Disposal of Excreta*; also *Dry Removal* under *Disposal of Sewage*.

EXPLOSIONS :

Sewer gas, attributed to : Cincinnati, in cellar, at time of flood (Feb. 1883): editorial on probable cause; amount of marsh gas in sewer air, Vol. VII., 265; statements concerning this case, by A. E. Tripp, Ass't. City Engineer, Vol. VII., 318.

Sewers, in : cause of ; (answer to correspondent), Vol.

V., 323; explanation of the majority, Vol. IX., 608.

FACTORY WASTES : See under *Purification of Sewage*.

FARMS : See *Agriculture* under *Utilization of Sewage*.

FIELD'S FLUSH-TANK : See *Tanks* under *Flushing of Sewers*; also *Flush-tanks* under *Sub-Surface Irrigation* under *Purification of Sewage*.

FILTER-PRESSES : See under *Sludge* under *Precipitation* under *Purification of Sewage*.

FILTRATION : See under *Purification of Sewage*.

FIRE, disposal of sewage by : See *Cremation* under *Disposal of Sewage*.

FLAD, HENRY, C. E.: on sewerage and sewage disposal; abstract of President's address before Am. Soc. C. E., Vol. XIV., 155.

FLAT DISTRICTS, SEWERAGE OF: Sir Robert Rawlinson on, with special reference to Calcutta, Vol. VII., 586.

FLORENCE (Italy): Cess-pools : construction ; method of emptying ; storage tanks ; utilization by farmers ; comments. Vol. X., 243.

FLUCTUATIONS IN FLOW OF SEWAGE: German and American experiments ; (editorial), Vol. XIV., 489. Observations at Chiswick (Eng.); weekly and yearly diagrams; *two illustrations*, Vol. XVI., 406.

FLUME (or outlet sewer of wood): See under *Sewer Construction*.

FLUSHING OF SEWERS :

Air currents caused by, in small pipe sewers, and their effect on house drain-traps : experiments by W. E. McClintock at Chelsea, Mass., Vol. XVII., 167.

Automatic method gives trouble at Chelsea, Mass., and is abandoned, Vol. XV., 545.

Direct from street mains : suggestion by correspondent ; comment, Vol. XI., 40.

Gates, by :

Boston Main Drainage Works ; *two illustrations*, Vol. IX., 306 ; Vol. XVI., 68.

Iron valve with sliding stem, invented by Arthur Staple ; *one illustration*, Vol. X., 76.

Johnson's wing-gate ; brief and claim of patent ; *two illustrations*, Vol. VII., 516.

Walthamstow, Eng., recommended for, Vol. VI., 325.

Gate valve, attachment to, by : ("novelty") ; *one illustration*, Vol. XII., 471.

FLUSHING OF SEWERS—(*Continued.*)

Paris, proposed plan for: flush-tanks; number, capacity and distance apart; interval between flushes; cost, Vol. VIII., 254.

Philbrick, Edward S., on: (in report on Sewerage of Concord, Mass.), Vol. V., 407.

Rawlinson, Sir Robert, on: In letter on Sewerage of Calcutta, Vol. VII., 586. Necessity of automatic tanks, Vol. X., 483.

Sea water, by:

Bournemouth, Eng., proposed for: (note), Vol. XV., 314.

San Francisco, proposed for: to be pumped by wind-mills to resevoirs on the hills; (note), Vol. VII., 35.

Tanks (see also *Gates* above):

Barrels used as: Dallas, Tex.; cost; *one illustration*, Vol. IX., 332.

Bartholomew's: *one illustration*; (under English Patents), Vol. X., 588.

Cuntz': *one illustration*; Vol. XII., 448.

Elevated: filled from well by hot-air engine; cost, Vol. VIII., 159

Field's: Description, Vol. VII., 531; of earthenware: in use at Bournemouth, Eng., Vol. IX., 42.

Royalty on, Vol. VI., 367. Trouble with, at Memphis: obstruction of small syphon, Vol. V., 43.

Trouble with, at Pawtucket, R. I., Vol. XV., 578.

Fruhling's self-acting apparatus: utilization of sewage for flushing: brief description of, as used at Konigsberg, Vol. XVI., 321.

Healy's: *one illustration*, Vol. XII., 75.

Hill's brief description; *one illustration*, Vol. X., 339.

Lowrie's, description of; *three illustrations*, Vol. XI., 270; improvement in; *one illustration*, Vol. XIV., 203.

FLUSHING OF SEWERS :

Tanks—(*Continued.*)

McKee's: brief description ; *one illust'n*, Vol. X., 316.

Portable, by :

Chicago: detailed description of operation, Vol. VII., 198.

Denver, Vol. VIII., 566.

Stratford-on-Avon, Vol. XIII., 180.

Rosewater's, as used at Omaha ; *one illustration*, Vol.

XIV., 203. Patent ; *two illustrations*, Vol. XII., 235 ; description, Vol. XIV., 159.

Scott's apparatus: combination of balanced pans ; abstract of patent claim, Vol. XIV., 256 ; detailed description ; *two illustrations*, Vol. 14, 398.

Van Vranken's: description of, as used at Schenectady, N. Y. ; *one illustration*, Vol. XIII., 490.

Vibbard's: brief and claim of patent : *one illustration*, Vol. VIII., 184.

Vibbard & Chandler's: brief and claim of patent : *one illustration*, Vol. VI., No. 26, page v. of supplement.

Waring's syphon and weir chamber (patent): brief description, Vol. XIII., 304.

Waterbury, Conn. (?), kind used at : outlet valve counterweighted by self-filling bucket emptied by small syphon ; *one illustration*, Vol. XVI., 151.

—————'s : (Inventor not known), Vol. XI., 311.

FLUSHING *V.S.* VENTILATION : Reply to a correspondent who thinks that the use of the one precludes the need of the other, Vol. V., 98.

FLUSH-TANKS : See *Tanks* under *Flushing of Sewers* ; also *Flush Tanks* under *Sub-Surface Irrigation* under *Purification of Sewage*.

FLYNN, P. J., C. E.: Hydraulic tables for the calculation of discharge through sewers, etc.: reviews of, Vol. VIII., 326 ; Vol. XIII., 543.

FOLKARD, CHARLES WATSON : Analysis of Potable Water, with special reference to previous sewage contamination : review of paper on, with abstract of discussion, Vol. VI., 230.

FORT WAYNE, Ind.: Two instances of grossly defective sewer construction, cited by correspondent, Vol. VIII., 373.

FRAMINGHAM, Mass.: See *South Framingham*.

FRANKFORT-ON-THE-MAIN :

Cleanliness and efficiency of sewers ; decrease of typhoid fever since construction, Vol. VI., 559.

Disposal works : precipitation by sulphate of alumina ; brief description, Vol. XI., 438.

FRANKLAND, PROF.: Brief description of scheme for disposal submitted to Hendon by, in conjunction with Dr. Thomas Stevenson, Vol. XIII., 445.

FTELEY, ALPHONSE, C. E.: Sewerage of Newark N. J.: Opinion on means of abating open canal nuisance, Vol. X., 129. Report on adaptation of street grading to improved sewerage system : extract, with editorial comment, Vol. XVI., 37. Appointed, with W. H. Worthen, to report on completed works, Vol. XVI., 214 ; notice of their report, Vol. XVI., 265.

FUMIGATION : See *Disinfection*.

GALTON, DOUGLAS, C. B.: On disposal of sewage : Notes on results of utilization at Doncaster, Bedford and Reading, and experience of Col. Jones of Wrexham, Vol. VI., 561. On the evils of cess-pools, Vol. IX., 142.

GALVESTON (Tex.): Disposal question : City Engineer's unfavorable opinion of sewerage experts ; editorial comment, Vol. X., 483.

GARDINER, PROF. JAMES T.: Report to New York State Board of Health on Sewerage (from study of European methods): editorial notice and criticism, Vol. V., 337.

GAS, SEWER : See *Sewer Gas*.

GASES, CESS-POOL: See *Cess-pool Gases*.

GAS-WORKS, washings from, as a disinfectant for sewers: advocated by "Water-Gas Journal"; editorial criticism, Vol. VII., 416.

GATES (See also under *Sewer Construction* and under *Flushing of Sewers*): Sewer: Patents of Samuel Johnson: briefs and claims; *two illustrations*, Vol. IX., 362.

GENEVA, N. Y.: Tax payers urged by a citizen to employ a competent sanitary engineer to devise plan of sewage disposal, to avoid pollution of lake; comments, Vol. VIII., 63. J. J. R. Croes engaged to prepare plans, Vol. VIII., 87; Mr. Croes' plan of disposal, Vol. IX., 329.

GENEVA, Switzerland: Debate on Sewerage at International Sanitary Congress at, Vol. VI., 559. (For detailed index, see *International Sanitary Congress* under *Sewerage*).

GEORGETOWN, D. C.: See *Washington*.

GERHARDT, WM. PAUL: Diagram of Sewer Calculations: review of, Vol. V., 219; price and where obtained, Vol. V., 263.

GERMS IN SEWAGE, number of, Vol. VIII., 33; Vol. XII., 308.

GERMS, disease; destruction or removal of, from sewage: See under *Purification of Sewage*.

GLASGOW: Analyses of refuse water from chemical works and other factories at, Vol. XII., 148.

GRADING, STREET: adaptation of, to sewerage requirements: Newark, N. J.: Extracts from report of A. Fteley, with editorial comments, Vol. XVI., 37.

GRAND RAPIDS, Mich.: Citizen's Committee seeking advice on sewerage by circular letters to engineers: copy of same and a reply, with editorial comment, Vol. XII., 367.

GRASS: See under *Produce* under *Agriculture* under *Utilization of Sewage*.

GRAY, SAMUEL M., C. E.:

Providence: To be sent to Europe by the City to examine sewage utilization and disposal works, Vol. IX., 316, 340. Review of his report, Vol. XI., 8. Abstracts of plans for disposal, Vol. X., 586; Vol. XIV., 393.

Rhode Island State Farm: Purification works after plans by: irrigation; detailed description; *seven illustrations*, Vol. XIII., 322.

GREEN BAY, Wis.: Square stone sewer: editorial comment on "municipal ignorance," Vol. XIV., 463.

GROUND WATER: (See also *Sub-soil Drainage* under *Separate System*; also *Underdrainage* under *Irrigation* under *Purification of Sewage*, and *Soil Drainage* under *Sewer Construction*.)

Admission of, to sewers: at top, by open joints: advocated by Charles Slagg: editorial criticism, Vol. IX., 121.

Lowering of, by sewer construction:

Boston: experiment to determine extent of, by low-level intercepting sewer, Vol. XVI., 264.

Brookline, Mass.: Supreme Court holds the town liable for causing well to "dry up," Vol. XVI., 242.

London: general effect, Vol. X., 50.

North Lansing, Mich.: making wells dry, Vol. VII., 107.

GUANO, manufacture of, from sewage: See *Native Guano Co.* under *Utilization of Sewage*.

GULLIES: See *Catch-Basins* under *Sewer Construction*.

GUTTER DRAINAGE: New Orleans: Report of Committee on Flushing, Vol. VII., 273. Description of works and operation; *three illustrations*, Vol. IX., 329. Improper construction of gutters, Vol. XII., 47; Vol. XIV., 350.

HAMILTON, Ont.: Cost of sewers, Vol. IX., 190. Protest by citizens against continuance of earth-closets as a public system, Vol. XII., 268. System of sewer assessments recommended by City Engineer, Vol. VIII., 255.

HANSON'S PROCESS OF PURIFICATION: See under *Purification of Sewage*.

HARTFORD, Conn.: Defective sewerage; letter from correspondent, with editorial comment, Vol. XII., 230.

HAVRE (France): Defective condition of sewers a cause of high mortality; investigation to be made, Vol. V., 401. Combined system recommended by M. Edouard Widner, Vol. VII., 129.

HAWKSLEY, DR. THOMAS, on the substitution of earth-closets for water carriage in large cities; editorial criticism; *one illustration*, Vol. XI., 496. Reply to above criticism, Vol. XII., 70.

HEALTH OF SEWER LABORERS: See *Laborers, sewer*.

HEALTH RESORTS: See *Resorts*.

HENDON, Eng.: Disposal: Advice to the Local Board by Mr. Melliss, Vol. VII., 510. Offer of the Native Guano Co., Vol. X., 576; offer accepted, Vol. XI., 83. Scheme submitted by Prof. Frankland and Dr. Thomas Stevenson: brief description, Vol. XIII., 445. Controversy on the subject: letter from Sir Robert Rawlinson advising the Board to retain the treatment in their own hands, Vol. XIV., 516.

HENLEY-ON-THAMES: Shone system at: description; *two illustrations*, Vol. XVII., 181.

HERING, RUDOLPH, C. E.:

Berlin: Letter on the sewerage works of, Vol. VI., 514.

Binghamton, N. Y.: Replies to Col. Waring's criticisms on his plans for the sewerage of, Vol. VII., 483, 535.

Brockton, Mass.: Brief description of disposal plans for, (irrigation), Vol. XV., 376.

HERING, RUDOLPH, C. E.—(*Continued.*)

- Chicago Drainage and Water Supply Commission, appointment as Chief Engineer of ; editorial comment, Vol. XIII., 392. Denial of report of removal from above position, Vol. XVI., 46.
- Cleveland (Ohio) : Abstract of plans for sewerage of, Vol. VI., 190.
- Diagrams for calculating dimensions and discharge of sewers ; reference in review of Flynn's tables, Vol. VIII., 326.
- European Sewerage Systems, report on : Review of *Résumé* and conclusions with reference to Philadelphia, Vol. V., 246. Letter correcting "some misapprehensions" in above review, Vol. V., 282. Notice of reprint of report on same subject to National Board of Health, Vol. XI., 398.
- Flush-tanks : Field's annular syphon : adjusting to discharge different amounts ; *two illustrations*, Vol. XI., 459.
- Memphis : Letter on results of six years' experience with sewers of : review of the essential and novel features, Vol. XVI., 739.
- Montgomery, Ala. : Abstract of report on sewerage of, Vol. XVII., 142.
- New London, Conn. : Intercepting sewers designed by : description ; *nine illustrations*, Vol. XV., 401.
- New York City : Invited to examine the sewerage system with Col. Julius W. Adams, Vol. XVI., 270.
- Philadelphia : Letter stating the "cause of the deplorable condition" of the sewerage works ; new law regulating size of sewers, Vol. VI., 89. Report on European sewerage systems with special reference to the needs of : final conclusions : Review of, Vol. V., 246 ; letter in reply to and explanation of above, Vol. V., 282.

HERING, RUDOLPH, C. E.—(*Continued.*)

Pollution of Streams: notes on the, Vol. XVII, 228.

Racine, Wis.: Brief abstract of plans for sewerage of, Vol. VI., 150.

Separate system: Letter in commendation of Benetzette Williams' paper (Vol. XI., 413), with some criticisms, Vol. XI., 416; second letter, in reply to Mr. Williams, Vol. XI, 499.

Waterbury, Conn.: Brief abstract of plans for sewerage of, Vol. VI., 423. Description of works constructed after above plans; *eight illustrations*, Vol. X., 51.

Wilmington, Del.: employed by, "to examine into the feasibility of establishing a sewerage system," Vol. VII., 202; objection to said employment by citizen, on ground of Mr. Hering's non-residency and non-approval of leaching cess-pools, Vol. VII., 370.

HERTFORD, Eng.: Effluent from purification works (precipitation), pollutes river Lea; legal action; decision of Court, Vol. X., 312.

HESTON AND ISLEWORTH DISTRICT (Eng.): Adoption of Shone system; cost, Vol. XIII., 537.

HOLABIRD, GEN. S. B., U. S. A.: Ventilation of sewers: "Some points from practical experience in San Francisco" on small pipe sewers, Vol. IX., 44.

HOSPITAL SEWAGE: Risk of disposing on land; (answer to correspondent), Vol. XV., 520.

HOUSE CONNECTIONS WITH SEWER:

Breaking into pipe sewers for, not allowed at Chelsea, Mass., Vol. XV., 545.

Paris: All houses obliged to deliver rain-water and household waste into sewers, Vol. X., 272.

Proper point of entrance: Opinion of "Journeyman Plumber," X., 434.

HULL (Eng.): Pail system of dry removal no longer satisfactory, V., 367.

HUNT, DR. EZRA M.: On cess-pools, Vol. VI., 324 ; Vol. VII., 561.

HYDE PARK, Ill.: Brief abstract of report on proposed sewerage works by John A. Cole and Benetzte Williams : double system ; pumpage ; irrigation, Vol. X., 413. Abstract of paper on same by Mr. Williams before Western Society of Engineers, Vol. XI., 413.

HYDRAULIC POWER OF SEWAGE: See *Power, hydraulic.*

HYDRAULIC TABLES, for the calculation of Discharge through sewers, pipes and conduits, by P. J. Flynn : reviews of, Vol. VIII., 326 ; Vol. XIII., 543. (See also *Calculations, sewer.*)

INSPECTORS OF SEWERS : Brooklyn : Civil service examination for, to be held, Vol. IX., 594.

INTERMITTENT DOWNWARD FILTRATION : See under *Filtration*, under *Purification of Sewage.*

IRON, CAST : See *Cast Iron* under *Sewer Construction.*

IRRIGATION : See under *Purification of Sewage.*

ISLEWORTH : See under *Heston and Isleworth.*

ISOLATED HOUSES, PROPER METHOD OF DISPOSAL FOR : (answer to correspondent), Vol. XVI., 325. (See also *Sub-Surface Irrigation* under *Purification of Sewage.*)

ITALIAN CITIES : bad condition of sewerage, as affecting English and American visitors ; (reference only), Vol. V., 161. (See also *Florence, Naples and Venice.*)

ITALIAN RYE-GRASS : See under *Grass* under *Produce* under *Agriculture* under *Utilization of Sewage.*

JACKSONVILLE, FLA., Sewerage Map of ; (reference to, in *Plumbing Regulations*), Vol. VI., 29.

JERSEY CITY (N. J.): Defective condition of sewerage ; (reference only), Vol. VI., 111.

KALAMAZOO, MICH.: Length and cost of pipe sewers, Vol. IX., 190.

KANSAS CITY (Mo.): Abstract of discussion between Octave Chanute and Robert Moore, on separate *vs.* combined system, with special reference to that city; editorial comment, Vol. X., 263.

KEENE, N. H.: Brief description of plans for Waring system, under construction, Vol. VI., 322; doubt about its completion, Vol. VII., 346; completion of: brief description of works, Vol. VIII., 208; amount of pipe of each size, and cost of construction, Vol. IX., 124. Sewer ordinances proposed by Edward P. Adams, Vol. VII., 103.

KENSINGTON, Eng: Purification works: delay in construction; failure of irrigation schemes; chemical filtration being considered; (note), Vol. VII., 250.

KEW: See *Richmond*.

KIDDERMINSTER (Eng.): Defective condition of sewers; extent of the Midden system, Vol. XII., 128.

KINGSTON, JAMAICA: Notice of report on sewerage of, by Col. George E. Waring, Jr., Vol. XVI., 296; abstract of plan recommended, Vol., XVI., 327.

KITCHEN SLOPS, DISPOSAL OF: Asbury Park, N. J.: immediate removal in water-tight receptacles; cess-pools abandoned, Vol. VII., 194. Editorials on the evil of discharging into cess-pools, Vol. VI., 3; Vol. X., 71.

KNAUFF, M.: Review of pamphlet by, on storm-water removal in towns, with special reference to Berlin, Vol. VII., 130.

KUICHLING, EMIL, C. E.:

Cement mortars: for use in public works; abstract of report on, Vol., XVII., 252, 265, 288, 300; influence of the fineness of sand upon: abstract of paper before Am. Soc. C. E., Vol. XVI., 583.

Purification of sewage: quantity of sewage per acre in irrigation; odors of European sewage farms; (discussion by Am. Soc. C. E.), Vol. XVI., 181.

KUICHLING, EMIL, C. E.—(*Continued.*)

Specifications for vitrified stoneware pipe sewers, Vol. XII., 168.

LABORERS, SEWER, HEALTH OF : Chelsea, Eng., Vol. XIV., 464 ; Maidstone, Eng., Vol. XII., 168.

LAKWOOD, N. J. : Separate system ; description of works, Vol. XV., 183.

"LANCET," THE LONDON : Sewers and sewerage, on ; editorial criticism of, Vol. VI., 61. Brighton, on the sewerage of, Vol. V., 522.

LARGEST SEWER : Deptford, Eng. : Said to be the largest in the world after the *cloaca maxima* ; description, Vol. X., 28 ; shorter description, with *one illustration*, Vol. X., 171.

LATHAM, BALDWIN, C. E. : Revolving screen invented by : description of, as used at Chiswick ; *one illustration*, Vol. XVI., 320.

LATROBE, C. H., C. E. : Plans by, for sewerage of Baltimore, recommended by Committee of Councils ; editorial comment, Vol. V., 451 ; review of report making above recommendation, Vol. VI., 127.

LAW OF LAND DRAINAGE AND SEWERS, THE : a treatise by S. S. Kennedy and J. S. Sandars : review of, Vol. XI., 483.

LAWRENCEVILLE, N. J., School : Description of sewerage and sewage disposal works after plans by J. J. R. Croes ; *four illustrations*, Vol. XV., 12.

LAWS : (See also *Ordinances.*)

New Jersey : " Act to provide for drainage and sewerage in densely populated townships in which there is a public water supply," Vol. X., 13 ; editorial comment on, Vol. X., 7.

Ohio : providing for construction of trunk sewers by special tax ; (note), Vol. VII., 155.

LAWS—(*Continued.*)

Pennsylvania: Proposed, (asked for by Pittsburg) providing for payment of cost of main sewers out of general taxation; editorial comment, Vol. X., 432.

LAWS, W. GEO., editorial notice of paper by, on sewer ventilation, Vol. VI., 514.

LEA RIVER (Eng.): Disposal of sewage from towns upon: unsatisfactory condition of purification works; plan of Sir Joseph Bazalgette: conjoint intercepting sewer to Barking, with precipitation works; Bailey Denton's scheme: cheaper intercepting sewer, partly in open ditch; (editorial), Vol. XIV., 563. Foul condition of; (notes), Vol. XII., 249, 269. Pollution of, by effluent from Ware Sewage farm at Hoddesdon; report of action therefor; decision of the Court, Vol. XIII., 416. Pollution by effluent from Hertford purification works; brief report of action therefor, Vol. X., 312.

LEICESTER (Eng.): Unsatisfactory condition of sewerage and disposal; expected profit from sale of manure not realized; main sewers too small, Vol. XV., 462 (3rd col.)

LEMON, JAMES, C. E.: Separate system, on: paper before Congress of the Sanitary Institute, Vol. VI., 415.

LEYTON, Eng.: Purification works; brief description: precipitation by alumina, iron and lime; value of sludge after pressing, Vol. IX., 89. Another description: use of vertical wheel strainer to remove solids, Vol. X., 458. More complete description by W. Dawson, Surveyor of the Local Board: precipitation by lime and black ash; detailed account of the operation of Johnson's filter presses; cost of cloths; cost of works, Vol. XI., 289. Testimony to inoffensiveness of the works, Vol. XIV., 394 (1st col.)

LIERNUR SYSTEM:

Amsterdam (Holland), at: extent of, Vol. X., 411.

Chancellor, Dr. C. W. (Secretary State Board of Health

LIERNUR SYSTEM :

Chancellor, Dr. C. W.—(*Continued.*)

of Maryland), advocated by, for Baltimore : editorial criticism of his paper, Vol. VIII., 614. Explanation of above criticism : not written by Col. Waring, as assumed by Dr. Chancellor, Vol. IX., 135.

de Meijer, Dr. van Overbeek, advocated by : Abstract of arguments before International Sanitary Congress at Geneva, Vol. VI., 559. Editorial criticism of his "Les systemes d'evacuation des eaux et immondices d'une ville," Vol. VIII., 590. Letter to Col. Waring, Vol. IX., 236 ; editorial comment on the same, Vol. IX., 231.

Durand-Claye, M. A., on, as compared with the Berlier system, Vol. X., 411.

LIFTING SEWAGE : Methods employed for slight lifts : paddle wheel suggested ; (answer to correspondent), Vol. XVII., 171.

LIME, AS A PRECIPITANT : See under *Precipitation* under *Purification of Sewage*.

LIME, CHLORIDE OF : See under *Deodorizing Sewage* under *London*.

LINDLEY, WM. H., C. E. : Abstract of report by, on best means of sewerage Elberfeld, Germany, Vol. VIII., 79.

LONDON :

Deodorizing Sewage :

Chloride of lime ; amount used ; cost, Vol. X., 217.

Manganate of soda and sulphuric acid, (applied in the sewers to prevent nuisances from ventilators), Vol. XIII., 561.

Permanganate of soda and sulphuric acid ; amount and cost ; Vol. XII., 249. Effect of : Opinion of the Board of Works, Vol. XII., 273. Opinion of an Italian correspondent on the value of, Vol. XII., 368. To be continued, Vol. XIII., 128.

LONDON :

Deodorizing Sewage :

Permanganate of Soda—(*Continued.*)

Inefficiency of, in summer of 1886, Vol. XV., 626.

Disposal of Sewage : (See also *Purification of Sewage* under *London* ; also *Thames, pollution of the.*)

Bazalgette, Sir Joseph : Suggestion of, to carry to German ocean, Vol. VIII., 63.

Denton, Bailey : Scheme projected by (in conjunction with Colonel Jones) : Conveyance to Canvey Island, Vol. XIII., 63. Deprecates action of Board of Works in disregarding utilization, constructing underground tanks at Barking and resorting to homœopathic doses of lime, Vol. XV., 570.

Innes, Rose (Mr.) : Suggestion to carry to barren wastes on Kent and Essex coasts, Vol. VIII., 63.

Local Government Board : Discharge of crude sewage at Barking condemned by engineer of, Vol. X., 337.

Metropolitan Sewage Discharge Commission : Preliminary report : conclusions on present methods and effect on river, Vol. IX., 453.

Rawlinson, Sir Robert, on, Vol. X., 483.

Utilization : Argument for, by a London weekly, Vol. XIV., 56. Favored by Bailey Denton, Vol. XV., 570. Metropolitan Sewage Discharge Commission on, Vol. XI., 350.

Ground water : Lowered 30 feet since installation of the Metropolitan drainage, Vol. X., 50.

Mud, liquid, sweeping of, into sewers from streets, decided by the Court to be illegal, Vol. IX., 400.

Parliament, Houses of : Drainage and Ventilation : Preliminary report of Committee of Ventilation : Air

LONDON :

Parliament, Houses of—(*Continued.*)

of the palace contaminated by gas from low-level sewer, owing to absence of proper ventilation of the latter ; reconstruction of the palace drainage system recommended, Vol. X., 264 ; Vol. XIV., 32. Final report : description of existing system ; Shone's hydro-pneumatic system recommended, Vol. XIV., 177 ; above recommendation adopted, Vol. XIV., 320. Description of former drainage and the new Shone works : abstract of Mr. Shone's report ; *twelve illustrations*, Vol. XV., 456.

Purification of Sewage :

Metropolitan Sewage Discharge Commission (or Royal Commission of 1882), on : Abstract of final report, Vol. XI., 104. Extracts from same : on profits from utilization, Vol. XI., 350 ; on purification by application to land, Vol. XI., 373, 433 ; conclusions, Vol. XI., 476.

Precipitation :

Barking, description of proposed tanks at, with method of operation, Vol. XV., 545.

Dibdin, W. J. (chemist of Metropolitan Board of Works) : Abstract of paper by : effect of various chemicals ; iron sulphate better than alumina ; comparative cost ; methods of disposal of sludge, Vol. XV., 514. Criticism of above paper by the "Builder" : purification of the Thames not to be materially improved by the present scheme of the Board ; editorial comment, Vol. XVI., 289.

Experiments on, to comply with requirements of the Royal Commission, Vol. XI., 373 ; Vol. XII., 8, 288.

LONDON :

Purification of Sewage :

Precipitation—(*Continued.*)

Metropolitan Board of Works : abstract of report by, on precipitation and disposal of sludge, Vol. XIII., 560. Precipitation favored by, but opposed by the Royal Commission, (note, in British Correspondence), Vol. XIV., 200 ; letter from John Johnson & Co., correcting the above by stating that the Commission reported favorably on precipitation, Vol. XIV., 348 ; letter in reply from the British correspondent, Vol. XIV., 499.

Sludge. disposal of : consideration of methods, Vol. XIII., 56. Carriage by ship to sea, Vol. XII., 293 ; Vol. XIV., 272 ; Vol. XVII., 156.

Reservoir for accumulating sewage and precipitating sludge : Area and capacity, Vol. IX., 213 (1st col.). Cost of proposed enlargement, Vol. V., 107, 147. Description of proposed new, at Barking, Vol. XV., 545.

Sewers :

Construction : Examples of circular and egg-shaped ; brief description ; *two illustrations*, Vol. V., 107 ; correction of errors in above description, Vol. V., 159.

Gullies, method of trapping ; *four illustrations*, Vol. X., 362.

Largest (storm-water overflow-sewer) : brief description, Vol. X., 28 ; another description, with *one illustration*, Vol. X., 171.

Main : length and cost, Vol. IX., 305 (top of 1st col.).

Northern high level intercepting : weir and side entrance to storm-water overflow ; *full-page illustration*, Vol. VI., 150.

LONDON :

Sewers :

Northern high level intercepting—(*Continued.*)

Progress of construction during 1884, Vol. XI., 540.

Total length, Vol. IX., 213 (1st col).

Ventilation :

Methods employed : description, with comments by a "Journeyman Plumber," Vol. X, 362.

Metropolitan Board of Works : Editorial notice of report of Committee of, Vol. XIII., 487.

Shafts in chimney breasts and walls of houses, Vol. X., 240 ; Vol. XI., 479, 540.

Surface gratings : complaints of nuisance from ; typhoid fever and throat troubles attributed to gas from, by Dr. Sedgewick Saunders ; closure suggested, Vol. V., 522 ; closure of some effected, Vol. XI., 540.

Westminster : See *Parliament Houses*, above.

LONDON, Ont. : Sewage in river pools causes nuisance ; removal of dams ordered by Court, Vol. XII., 446. Intercepting sewer and purification by precipitation recommended by committee of Provincial Board of Health, Vol. XIV., 399.

LONG BRANCH (N. J.) : Hotels, disposal of sewage of : report by E. W. Bowditch to National Board of Health, Vol. VII., 267 ; report of N. J. State Board of Health, Vol. IX., 594.

LOS ANGELES (Cal.) : Sewage farm proposed ; sewer in tunnel ; (note), Vol. XV., 490 ; editorial notice of same, Vol. XVI., 641. Sewage utilized on farms for fourteen years ; (note), Vol. XV., 522.

LOUISVILLE (Ky.) AND PORTLAND CANAL : right of the city to drain into, denied by the Federal Government ; intercepting sewer recommended, Vol. XVI., 149 ; Vol. XVII., 358.

LOWRIE'S FLUSHING APPARATUS: See under *Tanks* under *Flushing of Sewers*.

LOWRIE, Mr.: plans made by, on separate system, for Denver, four years before details adopted at Memphis were patented, (Rosewater), Vol. XV., 687 (3d col.).

MACON, Ga.: Sewerage system, proper, construction of, urged by chairman of Board of Health, Vol. XI., 546.

MAIDSTONE, Eng.: Purification by precipitation; sludge pressed by "pumping engine of special design," Vol. XV., 454.

MANCHESTER (Eng.): Purification works: praise of, by French Engineers, Vol. XI., 348; proposed extension, Vol. XVII., 311.

MANGANATE OF SODA, for deodorizing sewage: See under *Deodorizing Sewage* under *London*.

MANGEL-WURZEL: See under *Produce* under *Agriculture* under *Utilization of Sewage*.

MANHATTAN BEACH, disposal at: Precipitation, Vol. VI., 310; condition of works in May, 1884, Vol. X., 12.

MANHOLES: See under *Sewer Construction*.

MANUFACTORIES, Sewage from: See *Factory Wastes* under *Purification of Sewage*.

MARLBORO, Mass.: Report on sewerage and sewage disposal by Edward S. Philbrick, Vol. XI., 269. Editorial consideration of disposal in reference to pollution of Boston water-supply, Vol. X., 259. Anticipated pollution of water supply of Taunton by proposed discharge into Nemasket River; legal means of preventing; deficient powers of State Board of Health in the matter, Vol. XII., 488.

MARSH GAS in Sewer Air, per cent. of, Vol. VII., 265.

MASSACHUSETTS:

Disposal of sewage in:

Am. Soc. C. E., discussion by, of paper by Frederick

MASSACHUSETTS :

Disposal of sewage in ;

Am. Soc. C. E., discussion by—(*Continued.*)

P. Stearns : Paper by Charles Allen : history of English methods of purification ; observations at Pullman ; Remarks by E. C. Clarke : account of irrigation at Medfield, Mass. ; observations at Pullman ; Remarks by Emil Kuichling : quantity of sewage per acre ; odors of sewage farms ; Remarks by Seth Green, Robert McMath, *et al.*, Vol. XVI., 180.

Proposed law requiring purification before discharge into the streams, Vol. VIII., 87.

Drainage Commission (for Valleys of Mystic, Blackstone and Charles Rivers): Establishment of, recommended by State Board of Health : brief abstracts of arguments on, Vol. IX., 432. Appointment of : composition ; duties ; editorial comments, Vol. X., 194. First session : names of members ; sewage disposal of Worcester, (notes), Vol. X., 432, 487. Surveys in progress, Vol. XII., 295. General report : Abstract, Vol. XIII., 251. Extract from the report : Methods of sewage disposal, Vol. XIII., 251 ; English law concerning pollution of streams and its effect ; sedimentation and coarse filtration, Vol. XIII., 273 ; Clarification by precipitants ; purification by land ; *one illustration*, Vol. XIII., 297 ; Separation of sewage from rain-fall ; considerations affecting choice of methods in Massachusetts ; conclusions, Vol. XIII., 345. Considerations by Legislative Committee, of the report and of the bill proposed : unfavorable expressions ; (brief abstract), Vol. XIII., 376. Favorable report on the plan submitted for the Charles River valley, Vol. XIII., 424. Recommendations as to disposal of sewage of Natick,

MASSACHUSETTS :

Drainage Commission—(*Continued.*)

South Framingham, and the Women's Prison ; (note), Vol. XIII., 17.

Pollution of Streams, in : Proposed law to prevent, Vol. VIII., 87.

Reformatory, (formerly State Prison): Disposal: history and description of new works : sedimentation ; composting and utilization of sludge in agriculture ; distribution through wooden troughs on movable trestles ; (abstract of report by the engineer, Wm. Wheeler) ; *two illustrations*, Vol. XV., 63.

State Board of Health :

Law giving the Board general oversight of all inland waters, Vol. XV., 141. Editorial comment ; engineers appointed ; first towns to submit plans and questions, Vol. XV., 131. Editorial review of first report, Vol. XVI., 289.

Mystic River investigation : names of committee appointed, Vol. XVI., 653.

Purification of sewage, experiments on ; filtration through various soils : editorial reference, with comment, Vol. XVII., 261.

Worcester : plan for purification recommended by commission appointed by the Board, Vol. V., 498.

MEDFIELD, Mass. : Brief description of irrigation works, Vol. XVI., 181.

MEDWAY RIVER, Eng., purification of sewage discharging into ; (note), Vol. X., 559.

MELLISS, ——— C. E. : Advice to the Local Board of Hendon (Eng.) on disposal, Vol. VII., 510.

MEMPHIS, (Tenn.) :

Death rate : No increase that can be charged to the

MEMPHIS :

Death rate—(*Continued.*)

sewerage, Vol. VII., 241, 538. Reduction of, due to sewerage, Vol. VII., 611 ; Vol. VIII., 159, Vol. XV., 606.

Expenses of maintaining the sewerage system in 1882 and 1883 ; tables, Vol. IX., 380.

Flush-tanks (Field's) : Obstruction of the small syphons ; letter of explanation from J. H. Humphreys, Vol. V., 43.

House-connections, number and cost of, Vol. XII., 313.

Intercepting sewer to the Mississippi ; construction of, begun, Vol. XII, 313 ; completion of, Vol. XV., 606.

Manholes. (See also *obstructions*) :

Number put in by the city after construction, Vol. XVI., 737.

Opinion on omission of :

Hering, Rudolph, Vol. XVI., 739.

Philbrick, Edward S., Vol. XVI., 737.

Rawlinson, Sir Robert, Vol. XVI., 737.

Waring, Col. George E., Jr., Vol. XIV., 472 (1st col.).

Obstructions in sewers : All in 6-inch pipe, Vol. XVI., 739. Number and cost of removal during first two years, Vol. VII., 611 ; in 1882 and 1883, (by months), Vol. IX., 380 ; in 1883, Vol. XVI., 737. Number per week in autumn of 1887, Vol. XVI., 739.

Outlet of sewers : Improperly located, polluting the bayou ; (references only), Vol. V., 2, 401. Proposed change from Wolf River to the Mississippi opposed by President Hadden ; comment, Vol. IX., 530 ; change urged by President of Board of Health, Vol. XII., 415.

MEMPHIS—(*Continued.*)

Patents on details of Colonel Waring's work at : Note, Vol. V., 522 ; editorial answer to question by Rudolph Hering, Vol. IX., 546 ; letter from Colonel Waring in reference to same, Vol. IX., 572.

Progress of construction in 1882 and 1883, Vol. IX., 380 ; in 1886, Vol. XV., 606.

Results of six years' experience with the sewers of : Letter from Rudolph Hering reviewing the essential features of the system, Vol. XVI, 739 ; editorial reference to above, with summary of early criticism on omission of manholes, Vol. XVI., 737.

Sub-soil drainage, omission of ; (references only), Vol. V., 2 ; Vol. V. 401.

Working of the sewerage system : answer by the City Engineer to questions by the State Engineer of California, Vol. IX., 380.

MEMPHIS SEWERAGE SYSTEM : See *Waring Sewerage System*.

MEXICO, CITY OF : proposed drainage : Notes, Vol. XI., 420 ; Vol. XIV., 448, 548, and supplement to No. 21. Editorial notice of, Vol. XVI., 609.

MILITARY POSTS, Sewage Disposal at : Earth-closets ; irrigation ; (answer to correspondent), Vol. XIII., 325.

MILWAUKEE (Wis.): Disposal : Nuisance from discharge of crude sewage into river ; flushing tunnel proposed, Vol. XIV., 280. Nuisance to be considered by grand jury ; depth of sludge in river, Vol. XIV., 297. Action to be taken under State law to secure relief ; editorial comment, Vol. XVI., 346 ; résumé of plan, Vol. XVI., 439, 621 ; work stopped, Vol. XVI., 717. Chester B. Davis and Col. H. Flad appointed Consulting Engineers, Vol. XVII., 61.

MINNEAPOLIS (Minn.): Proposed ordinance taking the control of sewer construction from the City Engineer ; editorial comment, Vol. XVII., 113.

MODERN SEWER CONSTRUCTION AND SEWAGE DISPOSAL, by Edward S. Philbrick : (For detailed index, see under *Philbrick*): Vol. XV., 11, 111, 234, 345, 516 ; Vol. XVI., 67, 264.

MONTGOMERY, Ala. : Sewerage system : need of better : extract from address by Mayor Gaston, with editorial comments, Vol. VI., 22. Another quotation from Mayor Gaston ; complaint by Health Officer Means : advocates stopping the vents ; editorial comment, Vol. VIII., 38. Construction about to be begun ; editorial comment, advising employment of experts, Vol. IX., 23. Abstract of report by Rudolph Hering, Vol. XVII., 142.

MONTREAL :

Cost of sewer construction and repairs in 1885 ; (note), Vol. XIV., 63.

Drainage scheme recommended by the City Surveyor : brief resumé, Vol. XIII., 400.

Ventilation of Sewers : Letter from Secretary of Board of Health asking what would be the best method for that city, Vol. XVII., 138 ; editorial reply, advising employment of competent engineers, Vol. XVII, 129.

MOORE, ROBERT, C. E. : On the separate system, in reply to Octave Chanute, Vol. X., 263.

MORRISTOWN, N. J.: Insane Asylum : Purification of sewage by irrigation after sedimentation ; distribution through raised wooden gutters, Vol. XII., 173.

MORTALITY-RATES : See *Death-rates*.

MORTLAKE, Eng. : See *Richmond* ; also *Thames Valley, Lower*.

MOUNT VERNON, N. Y.: Plan for sewerage by Stevenson Towle ; (brief description), Vol. V., page 519 ; discussion of same by the Mt. Vernon "Chronicle," Vol. VI.,

MOUNT VERNON, N. Y.—(*Continued.*)

305. Opposition by village of East Chester to plan of discharge into Hutchinson River, Vol. VII., 87. New Legislative act asked for, Vol. IX., 286. Attorney-General makes application to Supreme Court to compel County Supervisors to remedy the sewage nuisance, Vol. XIII., 233. History of the sewerage movement; abstract of plans by Stevenson Towle: approved by Col. Julius W. Adams and criticised by J. J. R. Croes, Vol. XII., 252. Plans approved; (note), Vol. XVII., 78.

MUD, liquid, sweeping of, into sewers: decided illegal in London by a law court, Vol. IX., 400.

MUNICH: death-rate of, in relation to its sewers; review of paper by Dr. S. Soyka, Vol. XII., 153.

MYSTIC, Blackstone and Charles River Valleys Drainage Commission: see *Drainage Commission* under *Massachusetts*.

MYSTIC RIVER (Mass.): Committee appointed by State Board of Health to investigate pollution of, and means of protection; (note), Vol. XVI., 653.

NAHANT, Mass.: Pipe sewers advised and constructed; (reference only), Vol. VI., 229. Cost of system, Vol. VI., 206.

NANTUCKET, Mass.: Need of sewers, Vol. V., 144. Plans of E. W. Bowditch, Vol. IX., 316. Sanitary condition defended by Dr. Harold Williams; criticism of State Board of Health; reply by Dr. Abbott, Secretary of the Board; editorial comments, Vol. XI., 451.

NAPLES (Italy): Sewerage system of the lower city to be remodeled; (reference only), Vol. XIII., 585.

NAPOLEON, Ohio: Description of defective sewers, Vol. XVII., 306.

NATICK, Mass.: See under *Drainage Commission* under *Massachusetts*.

NATIVE GUANO CO.: See under *Utilization of Sewage*; see also *A. B. C. Process* under *Precipitation* under *Purification of Sewage*.

NAUGATUCK VALLEY, Conn. : Proposed intercepting sewer from Winsted to the Sound ; (note), Vol. XVI., 299.

NEWARK, N. J. :

Cess-pools and privies : Number of, Vol. VII., 369.

Editorial comment on a citizen's view of the danger of pollution of wells by cess-pools, Vol. XII., 228.

Evils of tight vaults with overflows to sewer, Vol. XVI., 155.

Sewerage : Conveyance of sewage in open canal causes nuisance : opinion of Alphonse Fteley on means of abating the evil, Vol. X., 129. Plan for same proposed by James F. Bless ; Col. Julius W. Adams and Rudolph Hering endorse Mr. Fteley's plan, which is accepted, Vol. X., 408 ; but not signed by the Mayor in consequence of citizen's protest ; opposition of Mr. Bless ; meeting of the protestants ; endorsements of engineers' plan ; editorial comments, Vol. X., 431. Brief description of plans adopted, Vol. X., 562. Total length of brick and pipe sewers ; plan of intercepting sewers, Vol. XIV., 254. Detailed description of improved sewerage system ; *ten illustrations*, Vol. XV., 600, 628. Extract of report of A. Fteley on adaptation of street grading to the improved system ; editorial comment, Vol. XVI., 37. Appointment of A. Fteley and W. H. Worthen to examine and report upon the completed work, Vol. XVI., 24 ; notice of their report, Vol. XVI., 265.

NEWBURYPORT, Mass. : Need of sewers ; Memphis system recommended by the Board of Health, Vol. IX., 72.

NEW HAVEN, Conn. : Progress and condition of sewerage ; retention of cess-pools and privy-vaults ; (editorial), Vol. VIII., 415. War on cess-pools by the local papers, Vol. VIII., 566. Prevalence of cess-pools a serious cause of apprehension in regard to typhoid, Vol. IX., 192.

NEW JERSEY : Sewerage :

Act to provide for, in densely populated townships having a public water supply, Vol. X., 13 ; editorial comment on above, Vol. X., 7.

Coast resorts : review of State Board of Health report on : (notice of Ocean Beach and Long Branch), Vol. IX., 594.

General agitation of the question throughout the State ; towns having works in progress or under consideration, Vol. XII., 315.

NEW LONDON, Conn.:

Assessments, sewer : plan employed, Vol. XVI., 490 ; litigation resulting from objection to ; extracts from decision of the arbitrators, Vol. XVII., 264.

Intercepting sewers designed by Rudolph Hering : description ; *nine illustrations*, Vol. XV., 401.

Proposed sewerage : urged by Health Committee, Vol. IX., 25 ; preliminary examination, Vol. X, 432.

NEW ORLEANS (La.) :

Canals, drainage : improvement of, by planking the bottoms and adding a pump ; (note), Vol. V., 227. Insufficient flushing ; (editorial), Vol. XVI., 177.

Gutter drainage : Report of Committee on Flushing, Vol. VII., 273. Description of flushing plant and its operation ; *three illustrations*, Vol. XI., 329. Improper construction causes defective drainage, Vol. XII., 47 ; Vol. XIV., 350.

Sewerage problem : Auxiliary Sanitary Association on the, Vol. V., 519 ; the "Picayune" on the, Vol. XII., 519. Proposed offering of prize for best drainage system, Vol. XIII., 65 ; Vol. XVI., 439.

Topographical survey, proposed, Vol. V., 519 ; Vol. XIII., 65.

NEWPORT, R. I.:

Main sewer, doubts as to level of ; examination to be made ; (notes), Vol. XVI., 617, 621 ; result of examination ; (note), Vol. XVI., 653.

Sewerage plans proposed by E. S. Chesbrough and Capt. Cotton, adoption of ; comment on the omission of their plan for disposal, Vol. VI., 342.

Sewerage system, need of : Brief reference in editorial on "Sanitary matters in Newport," Vol. VI., 341. Letter from a summer resident, Vol. VI., 342. City Council urged by Citizen's Municipal Reform Association to adopt a, Vol. VIII., 304.

NEWTON, Mass.: Memphis system and irrigation recommended by Committee of Aldermen ; (note), Vol. IX, 99. Sewerage scheme as provided for the Charles River valley system, satisfactory to legislative Committee on Drainage, Vol. XIII., 424.

NEWTOWN CREEK : See under *Brooklyn*.

NEW YORK CITY :

Northern portion of, (above Harlem River): disposal in, becoming a serious question ; (editorial), Vol. VI., 321.

Sewerage system : improvement and enlargement of : Examination of entire system to be made by Rudolph Hering and Col. Julius W. Adams, Vol. XVI., 270.

Sewer construction : methods of determining amount of rock excavation by borings ; "unbalanced bids," Vol. IX., 143. Notice of Engineer Towle's report for 1885 ; description of change made in circular brick sewers to reduce width of dry weather stream : lining of concrete and earthenware ; *two illustrations*, Vol. XIII., 491. (Patent on above : claim ; *one illustration*, Vol. XII., 15). Total length of sewers in 1886, Vol. XV., 209.

NEW YORK CITY—(*Continued*).

Waring, Col. George E., Jr.'s plan for the drainage of : his reply to editorial criticisms on his article in "Scribner's Magazine," May-June, 1881; editorial comment, Vol. V., 10; quotations from the article referred to, asserting the foul condition of existing sewers, Vol. 426.

NEW YORK STATE BOARD OF HEALTH :

Bath (village of) : adoption of Memphis system for, urged by the Board; editorial criticism, Vol. IX., 611.

Peekskill, report on a system of sewerage for : review of; editorial criticism of the Board in the matter, Vol. IX., 543. Letter from "Civil Engineer" approving above criticism, Vol. IX., 592.

Separate system of sewerage recommended by, Vol. V., 240; editorial comment, Vol. V., 337.

Sewage disposal in N. Y. towns : extract from report on, Vol. XIII., 351.

NIGHT-SOIL : See under *Disposal of Sewage* and under *Utilization of Sewage*.

NITRIFICATION : See under *Purification of Sewage*.

NORFOLK, Va.:

Separate system after plans by Col. George E. Waring Jr.: description of by J. H. Humphreys, Vol. VII., 155. Completion of, trial section; controversy about sewer ordinances; copy of proposed; editorial comments, Vol. VII., 439.

Sub-soil water: collection and disposition of, Vol. VII., 247.

Syphon outlet for a low district, designed by Col. George E. Waring, Jr.: description; *three illustrations*, Vol. XV., 486. Letter from William Henry Baldwin on the above, Vol. XV., 521. Letter from W. T. Brooke, City Engineer, on the same, stating

NORFOLK, Va.—(*Continued.*)

height of lift and claiming credit for design, Vol. XV., 604. Letter from W. H. Chapman stating elevations of various parts, Vol. XV., 633. Another letter from Mr. Brooke on the same, Vol. XVI., 555.

West sewerage system: Letter from Col. George E. Waring, Jr., on the demand for damages from the city by company owning patents on pumping and utilization granted to Walter S. West; denial of any ground for claim, Vol. XV., 43. Letter from president of the company in reply to above, Vol. XV., 266.

NORRISTOWN, Pa. Hospital for the Insane: Brief description of large square flush tank used in irrigation works, Vol. XIII., 160.

NORWICH, N. Y.: Need of sewers; insanitary condition from cess-pools and privy vaults, Vol. XII., 12.

NOTT, GORDON; Plan for draining Chicago; deep sewers; tunnels to Desplaines River; purification by precipitation and "agitators:" editorial abstract and comments, Vol. XVI., 317; editorial notice of letter from, Vol. XVI., 430.

NOTTINGHAM (Eng.): Sewage farm; clay-soil lightened with ashes; (note), Vol. XV., 342.

NUISANCE FROM PURIFICATION WORKS: See under *Purification of Sewage.*

OAKLAND, Cal.: Defective and inadequate condition of sewerage system; editorial advice in regard to proper method of obtaining improvement, Vol. XVII., 358.

OHIO: Proposed law providing for the construction of trunk sewers in cities of first grade of first class, by special tax; comment, Vol. VII., 155.

OIL AND TALLOW REFINERIES, analyses of sewage from: Glasgow, Vol. XII., 148.

OMAHA (Neb.): Extract from City Engineer's report for 1883; operation of the Waring system; editorial com-

OMAHA, Neb.—(*Continued.*)
ment, Vol. IX., 547. Notes from report for 1885 : catch-basins ; flush tanks ; *one illustration*, Vol. XIV., 203. Abstract of 1886 report : opinion of the Waring system, Vol. XV., 687.

ORANGE, N. J.: (See also *East Orange.*) :

Sewerage plans by Bassett & Nute ; brief description, Vol. XIII., 8 ; approval by Committee on Sewerage ; co-operation with East Orange, and disposal at tide water suggested ; (note), Vol. XIII., 473 ; more definite report of the same, Vol. XIII., 518. Proposition to discharge into Newark sewers ; editorial comment, Vol. IX., 263 ; permission refused, Vol. XIII., 351.

ORDINANCES, sewer :

Keene, N. H., proposed for, by Edward P. Adams, Vol. VII., 103.

Norfolk, Va., proposed for ; comments, Vol. VII., 440.

OVERFLOW, damages from sewer :

Brooklyn : decision of Court of Appeals in case of Flushing Avenue sewer, Vol. XIII., 256 ; editorial comments, Vol. XIII., 271.

Milwaukee : into cellar through house connection, from omission of back-flow trap : suit decided in favor of city, Vol. XVII., 67.

OVERFLOWS, Stormwater : See *Stormwater Overflows*. under *Sewer Construction*.

OWEN FREDERICK N., C. E.: Plans by, for sewage disposal, for Ansonia, Conn.: brief description, Vol. X., 250.

OXFORD, Eng.: Sewage farm : description of, by W. H. White : chiefly on preparation of the land and methods of distribution ; financial exhibit, Vol. VIII., 232. Letter from Bailey Denton, stating that the credit for selection of site and general scheme of works belongs to him, Vol. VIII., 496.

OXIDATION OF SEWAGE : See *Aération* and *Nitri-
fication* under *Purification of Sewage*.

PAIL SYSTEM of Removing Excreta : See under *Dry
Removal* under *Disposal of Sewage*.

PARIS :

Disposal of excreta : Admission of, to the sewers :
recommended by Commission of Society of Public
Health, Vol. V., 403 ; decision of Committee on
Sanitary Improvement, Vol. VIII., 254. Historical
notes on, Vol. VIII., 31.

Disposal of Sewage :

Durand-Claye, M. A., opinions of : objections to cess-
pools and privies, to conveyance to the sea, and to
chemical and mechanical treatment ; advocacy of
irrigation and crop-raising, Vol. VIII., 55.

Irrigation : Recommended by Commission, Vol. V.,
124 ; by M. A. Durand-Claye, Vol. VIII., 55 ; by
M. Wazon, Vol. X., 294. Delay in carrying out
M. Durand-Claye's schemes, Vol. X., 528. De-
scription of works, by M. A. Durand Claye ; (ab-
stract of report in "Annales des Ponts et Chaus-
sées"), Vol. XIII., 375.

Sewerage :

Berlier's system : Proposed : condensed description ;
comments ; *one illustration*, Vol. VI., 376. Trial
of : district drained ; M. A. Durand-Claye on ad-
vantages of, over Liernur system, Vol. X., 411.

Cess-pools, evils of, shown in picture exhibited at
Geneva Sanitary Congress, Vol. VI., 379.

Durand-Claye, M. A., on : opposition to the Liernur,
and defence of the English system, Vol. X., 411.

Flushing of sewers, resolution regarding, by the
Commission on Sanitary Improvement ; size and
intervals of tanks ; frequency of flushes ; estimated
cost, Vol. VIII., 254.

PARIS :

Sewerage—(*Continued.*)

House connections : all houses required to deliver rain water and household waste into the sewers
Vol. X., 272.

Memphis system to be tried in section of, Vol. VII., 303 ; “note on the conditions under which the Waring system might be partially applied to Paris,” by M. Vauthier, Vol. VIII., 446.

Sewers, report of the Commission of the Society of Public Health in favor of : abstract, Vol. V., 403 ; Reason of the inoffensiveness of the, Vol. VI., 517.

Utilization in agriculture : passage of bill authorizing ; proposition for construction of covered canal to the sea, with reservoirs (*en route*) for benefit of farmers, Vol. XVII., 163.

PASSAIC, N. J.: Disposal : plan to discharge into Passaic River objected to by officials of Jersey City and Newark ; editorial comments, Vol. X., 311. Negotiations for construction of a Waring system ; (note), Vol. X., 513.

PATENTS on Waring Sewerage System : See *Patents* and *Royalty* under *Separate System*.

PATERSON, N. J.:

Cement not conforming to specifications : contractor allowed to use, by Street Committee of Councils ; editorial comment, Vol. IX., 495. City Engineer loses his position on account of ordering contractor to comply with specifications, Vol. X., 8.

Cement sewer pipe, controversy over use of, Vol. VIII., 279, 351, 472.

Cess-pools and privy vaults, efforts to abolish ; (note), Vol. XI., 546.

Sewers built previous to 1873, defects in plan and construction of, Vol. XI., 314.

PAVEMENTS, breaking of, in maintenance of sewers : back streets or alleys advocated for exclusive location of sewers and pipes ; (editorial), Vol. VIII., 440.

PAWTUCKET, R. I. : Statistics of sewers ; trouble with Field's flush-tank ; assessments, Vol. XV., 578.

PEEKSKILL, N. Y. : Report on sewerage system, by State Board of Health, editorial review of : criticism of the Board, Vol. IX., 543 ; letter from "Civil Engineer" approving above criticism, Vol. IX., 592.

PERMANGANATE OF SODA for deodorizing sewage : See under *Deodorizing* under *London*.

PETERSFIELD, ENG. : Separate system : purification by upward filtration through gravel, followed by irrigation ; brief description, Vol. XIV., 296.

PHILADELPHIA :

Census Office report on sewerage and house-drainage, by Col. George E. Waring, Jr.: extracts from, Vol. VI., 24. Letter from Rudolph Hering referring to above : another cause of the bad sewerage ; new law prescribing shape of sewers, Vol. VI., 89.

Cess-pools : For school-houses; (editorial note), Vol. VI. 281. Connected with public sewers, a cause of nuisance, (note), Vol. VIII., 272.

Committee of one hundred, discussion of the sewerage question by ; editorial comment on general condition and needs of the city, as to sewerage, Vol. VII., 322.

Disposal : call on the authorities to study up the question, by the "North American ;" (editorial note), Vol. VI., 485.

Dobson's Run, intercepting sewers for, proposed by Russell Thayer, Superintendent Fairmount Park, Vol. VII.; 107.

PHILADELPHIA—(*Continued.*)

Experts, non-resident : objection by the Philadelphia "Bulletin" to the employment of ; editorial comment, Vol. VI., 162. Editorial on "prophets away from home," relating to same, Vol. VI., 414.

Foul condition of the sewers : Causes : decomposing matter from cess-pools, Vol. VII., 52 ; chief engineer receiving instruction from councilmen, Vol. VI., 89.

Hering, Rudolph : Report on European sewerage systems, with special reference to the needs of that city: final conclusions : Review of, Vol. V., 246 ; letter from, in reply to, and explanation of above, Vol. V., 282. Editorial comment on criticism of above report, by Philadelphia "North American," Vol. V., 197. Letter explaining cause of bad sewerage ; new law prescribing shape of sewers, Vol. VI., 89.

Improvement of the sewerage : proposed appointment of commission of experts ; (note), Vol. XVII., 110.

Sewer assessments : Property owners contest payment on ground of improper execution of work, by contractor ; reason for bad work on Philadelphia sewers ; (editorial), Vol. VI., 262.

Sewer construction : Crossing of underground conduits at street intersections, proposed ordinance regulating ; editorial comments ; argument for subways, Vol. VI., 485.

"Times," the Philadelphia, on the sewerage, Vol. VI., 104.

Waring, Col. George E., Jr., requested to examine and report suggestions for improvement of the sewerage ; (note), Vol. VI., 108.

Water Supply : Health Board apprehend pollution of, from sewer through which water main passes ; editorial comments, Vol. VI., 222.

PHILBRICK, EDWARD S., C. E.:

Boston Main Drainage Works: description of operation of, with opinion as to success of the method of disposal, Vol. X., 385. (See also description of the works, under *Modern Sewer Construction*, below.)

Cess-pools, on the evils of, Vol. V., 388; Vol. XI., 269.

Concord, Mass: Report on the sewerage of, Vol. V., 388, 407.

Irrigation, on: Quotation from article on "House Drainage" in "American Architect," Vol. V., 426. Discussion on paper by Dr. Henry J. Barnes, Vol. X., 267. Report on sewerage and disposal for Marlboro, Mass., Vol. XI., 269.

Marlboro, Mass.: Report on sewerage and disposal of, Vol. XI., 269.

Memphis, on the omission of manholes at, Vol. XVI., 737.

Modern Sewer Construction and Sewage Disposal: General considerations, Vol. XV., 11. Considerations affecting choice of combined or separate system; storm-water overflows, Vol. XV., 111. Boston Main Drainage Works: History of previous sewerage; *map and one illustration*, Vol. XV., 234. Summary of report of Commission of 1875, Vol. XV., 345. Float experiments to determine best place for discharge; route of main sewer; cost per foot; *one illustration*, Vol. XV., 516. Junctions of branches with main; flushing gates; automatic storm-water regulator; tide-water gates; size and cost of various sections; *fifteen illustrations*, Vol. XVI., 67. Capacity of works; storm-water; experiment to determine effect of sewer construction on height of ground water, Vol. XVI., 264.

Separate or combined system, on considerations affecting a choice of, Vol. XV., 111.

PHILBRICK, EDWARD S., C. E.—(*Continued.*)

Sub-surface irrigation: Answer to objections to, Vol. VI., 513. Detailed description of; *four illustrations*, Vol. VII., 530, 554. Proper dimensions of tanks and amount of distributing tile for hospital of 25 beds, Vol. VIII., 444.

PIERSON AND STALEY: See *Staley and Pierson*.

"PILL" FOR CLEANING SEWERS: See *Ball* under *Cleaning Sewers*.

PIPE SEWERS: (See also under *Separate System* and under *Sewer Construction*; also *Sewer Pipe* under *Sewer Construction*).

House-connections with: Chelsea, Mass.: not to be made by breaking into the pipe: insertion of Y-branches required, Vol. XV., 545.

Tree-roots, obstruction by:

Brooklyn, Vol. IX., 592.

Cleveland, Vol. IV., 142.

Specimen of, Vol. VI., 104.

Milwaukee; *one illustration*, Vol. VI., 51; other cases, Vol. XVI., 744; Vol. XVII., 120.

PITTSBURG (Pa.):

Cess-pools, great number of; proposed ordinance requiring disinfection of; editorial comments, Vol. VI., 368.

Sewerage: Discussion of, by Western Pennsylvania Society of Civil Engineers; (note), Vol. VI., 47. Proposed law providing for payment of cost of main sewers out of general taxation; editorial comment, Vol. X., 432.

PLAINFIELD, N. J.: Sewerage plans of C. P. Bassett; (brief abstract), Vol. XV., 635.

PNEUMATIC SYSTEMS: See *Berlier*, *Liernur* and *Shone*.

POLLUTION OF STREAMS AND OF WATER : See under *Disposal of Sewage*.

PORTLAND, Maine : Indicted for allowing sewer deposits to accumulate in a dock ; (note), Vol. VII., 184. Plan for intercepting sewer prepared by the City Engineer adopted in preference to plan by J. Herbert Shedd ; brief description of both plans, Vol. X., 600. Channels through the flats in the bay from the sewer outlets to deep water recommended by the City Engineer ; estimated cost ; (note), Vol. XI., 540.

PORTLAND, Oregon : Condition of sewers, as described by correspondent, Vol. VII., 506.

PORTSMOUTH, Eng. : Disposal into sea from 4,000,000 gallon concrete tank discharging in one hour, Vol. IX., 185. Prizes for disposal scheme, award of, Vol. XII., 28.

PORTSMOUTH, N. H. : Defective condition of sewers ; (reference only), Vol. V., 320.

POTSDAM (Ger.) : Shone system of sewerage proposed for ; brief description of project ; disposal schemes ; irrigation after precipitation, and aëration by cascades ; proposed cost, Vol. XI., 376.

POUDRETTE : See under *Excreta* under *Utilization of Sewage*.

POWER, HYDRAULIC, OF SEWAGE, UTILIZATION OF :

Boston : in excavating ; (temporary), Vol. XII., 148.

Cincinnati : proposed plan, for running purification machinery in sewerage of suburban hills, Vol. VII., 539.

Salford, Eng. : to run mixing and other machinery, in purification works, Vol. X., 220.

PRECIPITATION : See under *Purification of Sewage*.

PRIVIES : See under *Disposal of Sewage*.

PRIZES FOR DRAINAGE PLANS :

Chicago : for best practical essay, Vol. X., 465 ; editorial comment, Vol. X., 504.

New Orleans : Proposed offering of, Vol. XIII., 65 ; Vol. XVI., 439.

Portsmouth, Eng. : For disposal scheme, award of, Vol. XII., 28.

San Francisco : Offered, Vol. XVI., 18.

York, Eng. : Offered, Vol. XIII., 32.

PROVIDENCE (R. I.) : Sewerage and disposal : Review of report on, with study of European works. by Samuel M. Gray, City Engineer, Vol. XI., 8. Objection to Mr. Gray's plan for disposal by Providence "Journal": irrigation preferred to precipitation ; editorial comment, Vol. XII., 8. Complaints of unsatisfactory condition of the sewerage, Vol. XIV., 38. Summary of Mr. Gray's plan for disposal, Vol. X., 586 ; more complete abstract of the same, with special reference to the purification process recommended, Vol. XIV., 393. Commission consisting of Joseph P. Davis, Rudolph Hering and Robert Moore, appointed to report on above plan, Vol. XIV., 599 ; brief abstract of their report, Vol. XIV., 572 ; full abstract, Vol. XV., 134. Mr. Gray's plans adopted by City Councils ; essential features ; (editorial), Vol. XVI., 262. Early report (1857) by Dr. E. M. Snow, on condition of the sewerage : prevalence and evils of cess-pools, privies and faulty sewers : extracts, Vol. VIII., 151.

PULLMAN, (ILL.) : Brief descriptions of sewerage and sewage farm : by Benzette Williams, Vol. VI., 206 ; by Dr. O. C. DeWolf, Vol. IX., 476. Reasons of alleged commercial success of the farm ; (editorial), Vol. X., 360 (1st col.) ; Vol. XIV., 55. Observations on the farm by Charles Allen : sewage not purified when the crops do not need it, or in severely cold weather, Vol. XVI., 121, 181 (1st col.) Description of pumping engines ; *one illustration*, Vol. VII., 35

PUMPELLY, RAPHAEL : on the "filtering capacity of soils," (in paper on "The relation of Soils to Health,") Vol. VIII., 34, 57.

PUMPING STATIONS, (Sewage) :

Boston Main Drainage Works : *one illustration, (full-page plan)*, Vol. IX., 309.

Newark, N. J. : *one illustration, (elevation)*, Vol. XV., 630.

PUMPS AND PUMPING MACHINERY, (Sewage):

Boston Main Drainage Works : Brief description, Vol. IX., 308. Detailed description of Leavitt high duty; *two full page illustrations*, Vol. IX, 402. Storm-service (Worthington); *three illustrations*, Vol. IX., 424.

Chiswick, Eng.: Description ; *two illustrations*, Vol. XVI., 377.

Newark, N. J.: Description, Vol. XV., 630.

Pullman : Description ; *one illustration*, Vol. VII., 35.

Salford, Eng.: Brief description, Vol. X., 220.

Stratford-on-Avon : Description, Vol. XIII., 180.

Twickenham, Eng.: Brief description, Vol. XIII., 153.

Walthamstow, Eng.: For Sludge ; *four illustrations*, Vol. XV., 138.

PURIFICATION OF SEWAGE : (See also *Disposal of Sewage and Utilization of Sewage*):

"A B C" process : See under *Precipitation*, below.

Acton, Eng.: Precipitation, Vol. XVI., 438.

Aëration :

Cascades : Proposed for Potsdam (Ger.); description of method, Vol. XI., 376.

Smith, Dr. R. Angus, experiments by, Vol. VI., 42.

Storer's process : notice of, by Dr. Wallace and Mr. Gale, Vol. VI., 9, 163.

Waring, Col. George E., Jr.: part of his scheme for Worcester, Mass., Vol. V., 498.

PURIFICATION OF SEWAGE :

Aëration—(*Continued.*)

- Weirs, by flowing over : Sheffield : after precipitation by lime, and filtration through coke, Vol. XIV., 105.
- Alumina : See under *Precipitation*, below.
- Beddington, Eng.: Agriculture, Vol. XIV., 199.
- Berlin : Irrigation, with agriculture, Vol. VI., 444; Vol. IX., 547.
- Birmingham and associated towns, (Saltley farm) : Irrigation, with agriculture, after precipitation, Vol. XI., 433; Vol. XIV., 444, 500.
- Brentford, Eng.: Precipitation, Vol. IX., 197.
- Breslau : Irrigation, Vol. XI., 412.
- Bunzlau (in Silesia), Ger.: Irrigation, with agriculture, Vol. VIII., 418, (1st col.).
- Buxton, Eng.: Precipitation, Vol. XI., 476, 497.
- Chiswick, Eng.: Precipitation, Vol. XVI., 320, 377, 404.
- Clarification : (See also *Precipitation* below) : Argument for, by writer in "Journal of Science," on the ground that light is essential to destruction of disease germs ; objection to irrigation ; editorial comment, Vol. XII., 487.
- Clarke, Eliot C., on, Vol. XVI., 181.
- Colchester, Eng.: Irrigation after sedimentation, Vol. X., 408.
- Concord, Mass.: Irrigation (proposed), Vol. V., 407.
- Coventry, Irrigation after precipitation : references only, Vol. XI., 328, 433, 438 ; Vol. XIV., 394 (1st col.).
- Croes, J. J. R., on :
- Irrigation after clarification; (abstract of paper before the N. J. Sanitary Association), Vol. IX., 92.

PURIFICATION OF SEWAGE :

J. J. R. Croes—(*Continued.*)

- Plans by : Lawrenceville, N. J., School, Vol. XV., 12 ; East Orange, N. J., Vol. VIII., 445.
- Croyden, Eng.: Irrigation, Vol. XIV., 80.
- Danzig, Ger.: Irrigation, Vol. X., 12.
- Defosse's system : brief description : filtration through specially prepared turf, spongy iron and limestone, Vol. XVII., 294.
- Degree of : Proposed in England : extract from new "Rivers Purification Bill," Vol. XII., 212. Standard for effluent proposed by Dr. C. Meymott Tidy, Vol. XIV., 223.
- Dewsbury, Eng.: Filtration and surface irrigation, Vol. XIII., 63.
- English law concerning pollution of streams, and its effect on sewage disposal ; number of towns having purification works, Vol. XIII., 273. Proposed degree of purification : text of new "Rivers Purification Bill," Vol. XII., 212.
- English methods, history of, by Charles Allen, Vol. XVI., 180.
- Factory wastes : Chemical composition : Glasgow ; table, Vol. XII., 148. Tweed and Gala Rivers (Scotland), method employed to prevent pollution of : abstract of report by Prof. Crum-Brown, Vol. VI. 325.
- Filter-presses : See *Presses* under *Sludge* under *Precipitation*, below.
- Filters : Farquhar-Oldham (for water or sewage) : brief description ; *one illustration*, Vol. X., 340.
- Filtration :
- Basic slag of the Bessemer process, through : proposed by Neujeuen, of Liege ; (note), Vol. VII., 221.

PURIFICATION OF SEWAGE :

Filtration—(*Continued.*)

- Carbon, (granulated magnetic spongy) and sand, through, after precipitation by magnetic ferrous carbon and compound sewage salts : Acton, Eng., Vol. XVI., 438.
- Carbon, sand and shingle, through ; Richmond, Kew, Barnes and Mortlake, proposed for, after precipitation, Vol. XV., 8.
- Coarse : inefficiency of : Extract from report of Massachusetts Drainage Commission, Vol. XIII., 274.
- Coke, through, after precipitation : Chiswick, Eng., Vol. XVI, 404 ; Sheffield, Vol. XIV., 105.
- Defosse's system : prepared turf, spongy iron and limestone : brief description, Vol. XVII., 294.
- English experiments on artificial ; (in paper by Charles Allen before Am. Soc., C. E.), Vol. XVI., 180.
- Intermittent (through soil) : (See also *Irrigation*, below) :
- Denton, Bailey, on : abuse of the process, Vol. XV., 570.
- Dewsbury, Eng. : acreage ; cost, Vol. XIII., 63.
- Massachusetts State Board of Health, experiments on, Vol. XVII., 261.
- Stratford-on-Avon : Vol. XIII., 180.
- Watford, Eng. : acreage, Vol. XIII., 63.
- Withington, Eng. : acreage ; cost, Vol. XIII., 63.
- Intermittent downward : (See also *Irrigation*, below) : Definition of, as distinguished from broad irrigation, by Charles Allen, Vol. XVI., 181 (1st col.).
- Iron, (spongy), specially prepared turf and limestone : (Defosse's system) : brief description, Vol. XVII., 294.

PURIFICATION OF SEWAGE :

Filtration—(*Continued.*)

- Massachusetts State Board of Health experiments on, through various soils: editorial reference to and comment on, Vol. XVII., 261.
- Peat and gravel, through: followed by precipitation with milk of lime: (Dr. Petri's process): experiment at Berlin: brief account, Vol. VII., 130.
- Pumpelly's experiments on the filtering capacity of soils, Vol. VIII., 34, 57.
- Sawdust, through, after being heated with perchloride of iron—the sawdust to be burned for production of pumping power: proposed by J. J. R. Croes for East Orange, N. J., Vol. VIII., 445.
- Slag, basic, through: formation of company to work Neujeuen's patent, Vol. VII., 221.
- Soils, filtering capacity of: (See *Capacity* under *Irrigation*, below).
- Massachusetts State Board of Health experiments on, Vol. XVII. 261.
- Pumpelly, Raphael, on, in "The Relations of Soils to Health," Vol. VIII., 34, 57.
- Upward: Petersfield, Eng., Vol. XIV., 296.
- Frankfurt: Precipitation, Vol. VI., 559; Vol. XI., 438.
- Germs, disease, in sewage: removal or destruction of: "Filtering capacity of soils," by Raphael Pumpelly, Vol. VIII., 34, 57. Opinions of Folkhard, Latham, Tidy, Thudichum, and others, with editorial comment, Vol. VI., 230. Result at Gennevilliers, Vol. XIII., 375.
- Hanson's system (involving use of black ash waste): not properly carried out at Tong, Eng.: consequent complaint of failure, Vol. VI., 323.
- Henley-on-Thames: Irrigation after sedimentation, Vol. XVII., 181.

PURIFICATION OF SEWAGE—(*Continued.*)

- Hendon, Eng.: "A B C" process, Vol. X., 576; Vol. XI., 83. Precipitation and intermittent filtration through land, (proposed), Vol. XIII., 445.
- Irrigation, (including "Intermittent Downward Filtration"):
- Barnes, Dr. Henry J., paper by, before Suffolk (Mass.) Medical Society, and discussion by E. S. Philbrick, E. C. Clarke, and others, Vol. X., 267.
- Bateman, James, on, for villages, Vol. XV., 342.
- Belgian cities, advantages of, for this method: review of treatise on "Le Sewage: son utilization et son Eparation," by J. Babut de Marès, Vol. XI., 264.
- Berlin: Description of works, by M. A. Durand-Claye, Vol. VI., 446; abstract of official report on pecuniary and sanitary results, Vol. XI., 547.
- Birmingham (and associated districts): after precipitation by lime: Character of land; underdrainage; distribution; financial exhibit, Vol. XIV., 444, 500. Shorter description, Vol. XI., 433.
- Boston: proposed for, by "American Architect"; editorial comments: reason why the separate system and utilization are not applicable, Vol. VIII., 511.
- Breslau: Investigations, by Dr. Klopsch, of chemical results, Vol. XI., 412.
- "Broad," definition of, as distinguished from "Intermittent Downward Filtration," by Charles Allen, Vol. XVI., 181 (1st col.).
- Bunzlau (in Silesia) Ger.: Begun in 1559: brief description, Vol. VIII., 418 (1st col.).
- Capacity of the soil for purification: Experiments (on a small scale) by Dr. Walker and Mr. McKie, of Carlisle, Eng., reported by Prof. Henry Robin-

PURIFICATION OF SEWAGE :

Irrigation—(*Continued.*)

son, with his conclusions, Vol. V., 106. Experiments by Mass. State Board of Health : editorial notice, Vol. XVII., 261. Dr. Klopsch's investigation of results at Breslau irrigation fields, Vol. XI., 412. (See also *Quantity* under *Irrigation*, below).

Carriers :

Brick and earth : Birmingham, Vol. XIV., 445.

Steep slopes, on : Oxford, (Eng.), Vol. VIII., 232.

Wooden gutters : On movable trestles : Massachusetts Reformatory, Vol. XV., 63. V-shaped, on stakes ; holes in bottom : Morristown, N. J., Insane Asylum, Vol. XII., 173.

Clay land : method and cost of preparation : (Prof. Henry Robinson), Vol. X., 603.

Clay soil, stiff, lightened by admixture of ashes : Nottingham (Eng.) ; (note), Vol. XV., 342.

Colchester, Eng. : after sedimentation : brief description, Vol. X., 408.

Concord, Mass. : proposed plans for, by Edward S. Philbrick, Vol. V., 407.

Coventry (Eng.) : After precipitation : Testimony to inoffensiveness of the works, Vol. XIV., 394 (1st col.). Failure of company operating the works, Vol. XI., 328. Number of persons to the acre, Vol. XI., 433. Proposed enlargement of the works, Vol. XI., 438.

Croes, J. J. R., on, Vol. IX., 92.

Croyden, Eng. : Brief description, Vol. XIV., 80.

Danzig, Ger. : Operated by private company ; terms, Vol. X., 12.

Degree of purity of the effluent ; investigations by Dr. Klopsch at Breslau, Vol. XI., 412.

PURIFICATION OF SEWAGE :

Irrigation—(*Continued.*)

Dewsbury, Eng.: Cost of preparing ground ; (note), XIII., 63.

Durand-Claye, M. A., on, Vol. VI., 559, Vol. VIII., 55.
Flush-tanks (for intermittently discharging sewage) ;
(see also under *Sub-surface Irrigation*) : Large square, used by Col. Waring at Norristown Hospital for the Insane : brief description, Vol. XIII., 160.

Frost, effect of : Answer to correspondent, citing successful instances at Dresden and in Massachusetts, Vol. VIII., 157. Observations on, especially at Pullman, in coldest weather, Vol. XIII., 298 ; Vol. XVI., 181 (1st col.).

Hall, William Ham, (State Engineer of California), on preparation of ground and the arrangements for distribution : Case of Stockton Insane Asylum, Vol. IX., 329.

Henley-on-Thames : after sedimentation ; (reference only), Vol. XVII., 181.

Isolated hotel at Colorado Springs, recommended for ; (answer to correspondent), Vol. V., 426.

Los Angeles, Cal. : With agriculture ; (proposed), Vol. XV., 490.

Malvern, Eng. : Low death-rate due largely to successful working of the system, Vol. XIII., 247.

Massachusetts Drainage Commission on ; *one illustration*, Vol. XIII., 297.

Massachusetts Reformatory (formerly State Prison) : Sedimentation and composting of sludge ; distribution through wooden troughs on movable trestles ; *two illustrations*, Vol. XV., 63.

Medfield, Mass. : Brief description, Vol. XVI., 181.

PURIFICATION OF SEWAGE :

Irrigation—(*Continued.*)

- Norristown, N. J., Insane Asylum : Natural precipitation in earth "settling beds," and distribution through V-shaped wooden gutters, Vol. XII., 173.
- Nottingham (Eng.): Clay soil lightened with ashes ; (note), Vol. XV., 342.
- Oxford (Eng.): Preparation of the land, and distribution ; financial exhibit, Vol. VIII., 232.
- Paris : Recommended by Commission for entire sewage, except excreta ; brief outline of plan proposed, Vol. V., 124. Description of the Gennevilliers irrigation fields by M. A. Durand-Claye, Vol. XIII., 375.
- Petersfield, Eng.: After upward filtration through gravel, Vol. XIV., 296.
- Philbrick, Edward S., on : Quotation from article on "House Drainage," in "American Architect," Vol. V., 426. Report on sewage disposal of Concord, Mass., Vol. V., 407 ; of Marlboro, Mass., Vol. XI., 269.
- Potsdam (Ger.) : With aëration by cascades, after precipitation ; (proposed), Vol. XI., 376.
- Providence (R. I.) Commission, report by, with special reference to that city, Vol. XV., 134.
- Pullman (Ill.) : Brief description of works : by Benzette Williams, Vol. VI., 206 ; by Dr. O. C. De Wolf, Vol. IX., 476 ; Purification not always effected ; money making the first object ; (Charles Allen), Vol. XVI., 121, 181 (1st col.).
- Quantity of sewage per acre per day : Statement of Emil Kuichling, Vol. XVI., 181 (2d col.). (See also *Capacity* under *Irrigation*, above.)
- Rawlinson, Sir Robert, on : Cost and actceage required for London, Vol. X., 483.

PURIFICATION OF SEWAGE :

Irrigation—(*Continued.*)

Redditch, Eng.: Colt killed by drinking from effluent of sewage farm : Court holds Local Board responsible, Vol. XII., 368.

R. I. State Institutions : Description of works designed by Samuel M. Gray ; *seven illustrations*, Vol. XIII., 322.

Robinson, Prof. Henry : Conclusions as to capacity of the soil for purification, from experiments of Dr. Walker and Mr. McKie, of Carlisle, Vol. V., 106. Extracts from paper read at Dublin meeting of Sanitary Institute ; silos and ensilage, Vol., X., 603.

Royal Commission of 1882 (or "Metropolitan Sewage Discharge Commission") on, Vol. XI., 373, 433.

Small towns, for : Abstract of paper by James Bate-man before Association of Sanitary Inspectors, Vol. XV., 342.

Southam, Eng.: With agriculture ; brief description, Vol. V., 17.

Stockton, Cal., State Insane Asylum : Present (unsatisfactory) and proposed methods of distribution, Vol. IX., 329.

Stratford-on-Avon : Brief description of works : underdrainage and distribution, Vol. XIII., 180.

Typhoid fever, poison of : value of irrigation in destroying : opinion of Mr. Latham (Baldwin?), citing Croydon in illustration, Vol. VI., 230. Editorial opinion, Vol. XV., 520.

Underdrainage : Descriptions :

Oxford (Eng.), Vol. VIII., 232.

Paris, Vol. XIII., 375.

R. I. State Institutions (near Providence), Vol. XIII., 322.

PURIFICATION OF SEWAGE :

Irrigation :

Underdrainage—(*Continued.*)

Saltley farm, (Birmingham and allied towns), Vol. XIV., 444.

Stratford-on-Avon, Vol. XIII., 180.

Vawser, Robert, on, Vol. XII., 211.

Warrington, R., on : causes of the purifying action of the soil, and the conditions affecting such action, Vol. V., 498, Vol. XI., 105.

Watford, Eng. : Horizontal terraces and osier beds; (note), Vol. XIII., 63.

Withington, Eng. : Cost of preparing ground; (note), Vol. XIII., 63.

Worcester, Mass. Insane Asylum : Fresh sewage distributed over grass close about the building, without slightest offense, Vol. V., 426.

Lawrenceville, N. J., School : Sedimentation and sub-surface irrigation, Vol. XV., 12.

Leicester (Eng.) : Precipitation, Vol. XV., 462, (3d col.).

Leyton, Eng. : Precipitation, Vol. IX., 89; Vol. X., 458; Vol. XI., 289.

Light, influence of : See *Clarification.*

London : Precipitation : Area and capacity of reservoirs, Vol. IX., 213. Experiments, Vol. XI., 373; Vol. XII., 8, 288. Criticism of methods employed, Vol. XV., 570. Proposed schemes : Irrigation, Vol. VIII., 63; precipitation, Vol. XIII., 63; enlargement of reservoirs, Vol. V., 107, 147; Vol. XV., 545; methods of disposal of sludge, Vol. XII., 293; Vol. XIII., 56; Vol. XIV., 272; Vol. XVII., 156.

Los Angeles, Cal. : Irrigation; (proposed), Vol. XV., 490; agriculture, Vol. XV., 522.

Maidstone, Eng. : Precipitation, Vol. XV., 454 (3d col.).

PURIFICATION OF SEWAGE—(*Continued.*)

Manhattan Beach : Precipitation, Vol. VI., 310 ; Vol. X., 12.

Massachusetts :

Drainage Commission, on : Abstract of report, Vol. XIII., 251 ; extracts, Vol. XIII., 251, 273, 297, 345.

Proposed bill requiring, in, Vol. VIII., 87.

Reformatory, (formerly State Prison) : Irrigation, Vol. XV, 63.

State Board of Health, experiments by, on filtration through various soils, Vol. XVII., 261.

Medfield, Mass. : Irrigation, Vol. XVI., 181.

Metropolitan Sewage Discharge Commission : see under *Purification of Sewage* under *London*.

Morristown, N. J., Insane Asylum : Irrigation, Vol. XII., 173.

Nitrification, notes on, by Prof. R. Warrington : advocacy of the ferment theory ; distribution of the nitrifying organism of the soil ; conditions influencing the process ; (abstract of paper before British Medical Association at Montreal), Vol. XI., 105. Extracts from kindred paper by same author (? — "Mr. Robert Warrington"), Vol. V., 498.

Nottingham (Eng.) : Irrigation, Vol. XV., 342.

Nuisances from works for : at Chiswick, Eng., Vol. X., 288 ; Vol. XVI., 404 ; Croydon, Eng., Vol. XIV., 80 ; Hertford, Eng., Vol. X., 312 ; Redditch, Eng., Vol. XII., 368 ; Stockton, Cal., Insane Asylum, Vol. IX., 329 ; Stratford-on-Avon, Vol. XVII., 282 ; Ware, Eng., Vol. XIII., 416

Oxford (Eng.) : Irrigation, Vol. VIII., 232.

Paris : Irrigation with agriculture, Vol. V., 124 ; Vol. XIII., 375.

PURIFICATION OF SEWAGE—(*Continued.*)

Petersfield, Eng.: Irrigation after upward filtration through gravel, Vol. XIV., 296.

Petri's process of filtration and precipitation; brief description, Vol. VII., 130.

Potsdam (Ger.): Irrigation and aëration by cascades after precipitation; (proposed), Vol., XI, 376.

Precipitation :

“A B C” process (employed by the Native Guano Co.): Proposed for Hendon (Eng.): offer of the company; their work at Aylesbury and Leeds, Vol. X., 576. Above offer accepted, Vol. XI., 83. Exhibit of produce from the Aylesbury farm, Vol. VI., 492.

Acton, Eng.: Magnetic ferrous carbon and compound sewage salts; filtration of effluent through granulated magnetic spongy carbon and sand, Vol. XVI., 438.

Agitators: Form described by the “Ironmonger,” for introducing chemicals above the settling tanks; driven by the flowing sewage; *one illustration*, Vol. XI., 59. Description of those used at Chiswick (Eng.); *three illustrations*, Vol. XVI., 378, 404.

Alumina :

Analysis of, and proportion used at Chiswick, Eng., Vol. XVI., 407.

Frankfurt, used at; (reference only), Vol. XI., 438.

Alumina and lime :

Brentford, Eng.: Sludge dried by flues under tanks, Vol. IX., 197.

Chiswick, Eng.: Proportion of sludge; cost of operation; detailed description of works; *nineteen illustrations*, Vol. XVI., 320, 377, 404.

PURIFICATION OF SEWAGE :

Precipitation—(*Continued.*)

Alumina, iron and lime :

Coventry (Eng.) : Number of years in operation ; filter-pressing of sludge ; inoffensiveness of the process, Vol. XIV, 394 (1st col.).

Leyton, Eng. : Sludge filter-pressed and sold for manure ; Vol. IX., 89. Inoffensiveness of the works, Vol. XIV., 394 (1st col.).

Birmingham : See under *Irrigation*.

Black ash and lime : Leyton, Eng. ; Vol. XI., 289.

Brentford, Eng. : Lime and sulphate of alumina ; sludge dried by flues under the tanks, Vol. IX., 197.

Buxton, Eng. : Lime, with iron water from a disused colliery ; chemical results, Vol. XI., 476. 497.

Carbon, magnetic ferrous, with "compound sewage salts" : Acton, Eng. : claim for superiority over lime process, Vol. XVI., 438.

Carbon, mixed with sulphuric acid : Southampton, Eng., Vol. XV., 60 ; Vol. XVII., 315.

Chiswick, Eng. : Lime and alumina : Detailed description : patent screen, engines and pumps, mixers and agitators, filter-presses ; *nineteen illustrations*, Vol. XVI., 320, 377, 404.

Coventry : See under *Irrigation*.

Dibdin, W. J. (Chemist of Metropolitan Board of Works), on : Effect of various chemicals ; iron sulphate better than alumina, Vol. XV., 514. Criticism by the "Builder" on above ; editorial comment, Vol. XVI., 289.

Difficulty with, on account of varying quality and quantity of sewage ; danger of river pollution by the chemicals ; (notice of paper by J. B. Jerram), Vol. XV., 205.

PURIFICATION OF SEWAGE :

Precipitation—(*Continued.*)

Durand-Claye, M. A., opposed to ; (reference only),
Vol. VIII., 55.

English towns, number of, employing, and practice
in, Vol. XIII., 297 ; Vol. XVI., 181.

Frankfurt : Sulphate of alumina ; brief description,
Vol. XI., 438.

Hanson's process at Tong, Eng. ; (note), Vol. VI.,
323.

Injurious effects of chemicals on stream into which
effluent is discharged : secondary action : criticism
of London " Builder " on, in case of Thames ;
editorial comment, Vol. XVI., 289. J. B. Jerram
on the same, Vol. XV., 205.

Iron sulphate in solution : Conder's patent : claims
for, Vol. XIII., 152.

Iron and Lime :

Buxton, Eng., Vol. XI., 476, 497.

Proportion recommended for London sewage by
chemist of Metropolitan Board of Works, Vol.
XIII., 560. Above proportion of lime character-
ized by Bailey Denton as " Homeopathic dose,"
Vol. XV., 570.

Recommended in preference to alumina and
lime by W. J. Dibdin, Chemist of Metropolitan
Board of Works ; comparative cost, Vol. XV.,
514.

Leicester (Eng.) : Unsatisfactory condition ; ex-
pected profit from sale of manure not realized,
Vol. XV., 462 (3d col.).

Leyton, Eng. : Alumina, iron and lime ; sludge
pressed, Vol. IX., 89. Lime and black ash waste
after removal of solids by vertical wheel strainer :
sludge sold for manure ; brief description, Vol.

PURIFICATION OF SEWAGE :

Precipitation :

Leyton, Eng.—(*Continued.*)

X., 458. More extensive description ; working of Johnson's filter presses, Vol. XI., 289. Testimony to inoffensiveness of the works, Vol. XIV., 394 (1st col.).

Lime :

Birmingham, Vol. XI., 433; Vol. XIV., 500.

Maidstone, Eng., Vol. XV., 454.

Methods of using ; proportion required ; cost in England ; probable cost in America, Vol. XIII., 297.

Proper proportion ; danger from excess ; (Dr. Thomas Stevenson), Vol. XII., 28.

Salford, Eng.; machinery for lifting and measuring ; mixing machinery ; Vol. X., 220.

Salisbury, Eng.; brief description ; Johnson's filter-presses, Vol. XII., 274.

Sheffield, Eng.: Preceded by self-subsidence and followed by aëration over weirs ; description, Vol. XIV., 105.

London: Report by Metropolitan Sewage Discharge Commission, Vol. XI., 104, 476. Experiments with lime and proto-sulphate of iron, Vol. XI., 373 ; Vol. XII., 8, 288. Report by Metropolitan Board of Works : Lime and proto-sulphate of iron, Vol. XIII., 560. Description of proposed tanks at Barking, with method of operation, Vol. XV., 545.

Maidstone, Eng.: Lime, Vol. XV., 454.

Manhattan Beach, (Coney Island); Notes, Vol. VI., 310 ; Vol. X., 12.

Massachusetts Drainage Commission on, Vol. XIII., 297.

PURIFICATION OF SEWAGE :

Precipitation—(*Continued.*)

Melliss, Mr. —, on, before Local Board of Hendon, Eng., Vol. VII., 510.

Mixing machines : Chiswick, Eng.: Description, with *four illustrations*, Vol. XVI., 378, 404. Salford, Eng.: With lime hoist run by hydraulic power of effluent, Vol. X., 220.

Potsdam (Ger.): See under *Irrigation*.

Providence Commission, report by, with special reference to that city, Vol. XV., 134.

Rawlinson, Sir Robert, on cost of, for London, Vol. X., 483.

Richmond, Kew, Barnes and Mortlake : Proposed : with filtration of effluent through sand, shingle and carbon, Vol. XV., 8.

Robinson, Prof. Henry, on, Vol. X., 604.

Salford, Eng.: Lime : mixing machinery ; utilization of water power from fall of effluent, Vol. X., 220.

Salisbury, Eng.: Lime : Brief description ; Johnson's filter-presses, Vol. XII., 274.

Sheffield (Eng.): Lime : preceded by sedimentation and followed by filtration and aëration, Vol. XIV., 105.

Sludge :

Amount produced per 1,000 people by lime process, and by alumina or iron with lime : (Prof. Henry Robinson), Vol. X., 604.

Chiswick, Eng.: Account of difficulty in disposing of ; description of lime mixers and sludge presses ; proportion of, to sewage ; cost ; *three illustrations*, Vol. XVI., 404.

Composted : Massachusetts Reformatory, Vol. XV., 63.

PURIFICATION OF SEWAGE :

Precipitation :

Sludge—(*Continued.*)

Dibdin, W. J., abstract of paper by : effect on, of the various chemicals used for precipitation ; methods of disposal, Vol. XV., 514.

Dried by flues under the tanks : Brentford, Eng., Vol. IX., 197.

Dug into land : Birmingham, Vol. X., 604 ; Vol. XI., 433.

Farmers, removed by : Colchester, Eng., Vol. X., 408.

French apparatus for the removal of ; *one illustration*, Vol. XIV., 250.

Plowed in : Walthamstow, Eng., Vol. XV., 138.

Pressed :

Acton, Eng. : afterward ground up for manure, Vol. XVI., 438.

Coventry, Eng. ; Vol. XIV., 394 (1st. col.).

Maidstone, Eng. ; by pumping engine of special design, Vol., XV., 454.

Presses :

Chiswick, Eng. : Description of those used at ; cost of operation ; *three illustrations*, Vol. XVI., 405.

Johnson's : description ; *two illustrations*, Vol. X., 340 ; experience with, at Leyton, Eng. ; importance of keeping out coarse solids ; cost of cloths, Vol. XI., 289.

Proportion of : in American sewage, Vol. XIII., 297 ; at Chiswick, Eng., Vol. XVI., 404.

Proportional weight after pressing : London, Vol. XIII., 561 (1st. col.).

Pumps adapted both to sewage and thick sludge : Walthamstow, Eng. ; *four illustrations*, Vol. XV., 138.

PURIFICATION OF SEWAGE :

Precipitation.

Sludge—(*Continued.*)

- Road sweepings mixed with, for manure ; Southampton, Eng., Vol. XVII., 315.
- Sea, carriage to, by ship ; London, Vol. XII., 293 ; Vol. XIII., 56 ; Vol. XIV., 272 ; XVII., 156.
- Trenched into land : Birmingham : amount of land required per ton, Vol. XIV., 500.
- Value of : Opinion of Engineer Melliss, Vol. VII., 510 ; at Leyton, Vol. IX., 89.
- Weights of, with varying degrees of moisture ; (Prof. Henry Robinson), Vol. X., 604.
- Southampton (Eng.) : Porous Carbon ; Shone injectors ; sludge mixed with road sweepings for manure ; *five illustrations*, Vol. XVII., 315.
- Shorter description, Vol. XV., 60.
- Tanks : Chiswick, Eng. : Description of those used at ; floating arms for drawing off ; *three illustrations*, Vol. XVI., 404. London : proposed for Barking : description, Vol. XV., 545.
- Walthamstow, Eng. : Reference only, in description of pumps, Vol. XV., 138.
- Providence Commission, (Davis, Hering and Moore), on, Vol. XV., 134.
- Pullman (Ills.) : Irrigation with agriculture, Vol. VI., 206 ; Vol. XI., 476 ; Vol. X., 360 (1st col.) ; Vol. XIV., 55 ; Vol. XVI., 121, 181 (1st col.).
- Reading, Eng. : Agriculture, Vol. V., 83.
- Rhode Island State Farm : Irrigation, Vol. XIII., 322.
- Richmond, Kew, Barnes and Mortlake : (Proposed) : Precipitation with filtration of effluent, Vol. XV., 8.
- Robinson, Prof. Henry, on, Vol. V., 106 ; Vol. X., 603.

PURIFICATION OF SEWAGE :

- Royal Commission (of 1882) on London sewage disposal : See *Metropolitan Sewage Discharge Commission* under *Purification of Sewage* under *London*.
- Salford, Eng. : Precipitation, Vol. X., 220.
- Salisbury, Eng. : Precipitation, Vol. XII., 274.
- Saltley Farm : See *Birmingham*.
- Screen, Baldwin Latham's revolving : description of, as used at Chiswick ; *one illustration*, Vol. XVI., 320.
- Sedimentation, (without chemicals) :
- Colchester, Eng. : brief description ; sludge removed by farmers, Vol. X., 408.
- Henley-on-Thames : before irrigation ; solids readily purchased by farmers, Vol. XVII., 181.
- Mass. Drainage Commission, extract from report of, Vol. XIII., 274.
- Mass., Reformatory : composting of sludge and utilization in agriculture, Vol. XV., 63.
- Morristown, N. J., Insane Asylum, Vol. XII., 173.
- Sheffield, Eng. : Precipitation, after sedimentation, Vol. XIV., 105.
- Slater, J. W., on : review of treatise by, Vol. XVII., 202.
- Southam, Eng. : Irrigation with agriculture, Vol. V., 17.
- Southampton, Eng. : Precipitation, Vol. XV., 60, Vol. XVII., 315.
- Stevenson, Dr. Thomas, on : Irrigation after precipitation, the method of the future, Vol. XII., 28.
- Stockton, Cal., Insane Asylum : Irrigation, Vol. IX., 329.
- Stratford-on-Avon : Irrigation and agriculture, XIII., 180.
- Streams, by flowing in :
- Fleck, Dr. H., review of report by, of investigation of polluted streams of Saxony ; analyses of water of Elbe above and below Dresden, Vol. XI., 503.

PURIFICATION OF SEWAGE :

Streams, by flowing in—(*Continued.*)

Hering, Rudolph : Notes on the Pollution of Streams, Vol. XVII., 228.

Hulwa, Dr. Franz, investigations on water of the Oder above and below Breslau ; three tables of analyses : Review, Vol. XII, 193.

McMillan, Prof. (of Princeton), on : Brief abstract of paper before Sanitary Association of N. J., Vol. VII., 52.

Robinson, Prof. Henry, on : Extracts from paper before Sanitary Institute, Vol. X., 604.

Sub-surface Irrigation :

Cold climates, in : "Will it work in Iowa?" (answer to correspondent), Vol. VI., 286. About Boston, Vol. VIII., 157.

Flush-tanks : Field's : description, Vol. VII., 531 ; capable of being adjusted to discharge different amounts : (letter from Rudolph Hering) ; *two illustrations*, Vol. XI., 459 ; modification used by Edward S. Philbrick ; *one illustration*, Vol. VII., 554. Pierson's patent ; *one illustration*, Vol. XII., 115. Arrangement of, with settling basin ; (answer to correspondent) ; *two illustrations*, VI., 50 ; above arrangement not patented, Vol. VI., 367 ; proper dimensions for hospital of 25 beds, Vol. VIII., 444.

Lawrenceville, N. J., School : after plans by J. J. R. Croes : Detailed description, with *four illustrations*, Vol. XV., 12.

Philbrick, Edward S. : Objections to the system answered by, Vol. VI, 513. Detailed description ; *three illustrations* and *full page plan* of distribution pipes at Bryn Mawr Hotel, Vol. VII., 530, 554. Size of tanks and amount of distributing tile for hospital of 25 beds, Vol. VIII., 444.

PURIFICATION OF SEWAGE :

Sub-surface Irrigation—(*Continued.*)

Tilting tanks suggested for use in place of flush tanks, Vol. XII., 72.

Without flush tank : constant discharge ; comment on plan illustrated in T. N. Clark's "Building Superintendence," Vol. X, 295.

Swamp land, wooded : intermittent flow over : part of scheme proposed for Worcester, Mass., by Col. George E. Waring, Jr., Vol. V., 498.

Tidy, Dr. C. Meymott, on, Vol. XIV., 223.

Vawser, Robert, on, Vol. XII., 211.

Virchow, Prof. Rudolph, on Vol. VIII., 33.

Walthamstow, Eng. : Precipitation, Vol. XV., 138.

Warrington, Prof. R. : see *Nitrification* above, (under *Purification of Sewage.*)

Watford, Eng. : Intermittent filtration and osier beds, Vol. XIII., 63.

Withington, Eng. : Intermittent filtration ; osier beds, Vol. XIII., 63.

Worcester, Mass. : Col. Waring's scheme, and plan recommended by State Board of Health, Vol. V., 498.

City Engineer Allen's plan, Vol. XV., 551 ; Vol. XVI., 121. Insane Asylum at : Irrigation, Vol. V., 426.

QUICKSAND, construction of sewers in : See under *Sewer Construction.*

RACINE, Wis. : Separate system proposed by Rudolph Hering : brief abstract of plan, Vol. VI., 150.

RAINFALL, SEWER-FLOW IN RELATION TO : Observations begun in New York, Philadelphia and Washington ; (reference only in report of Am. Soc. C. E. meeting), Vol. XVII., 257. Observations at Chiswick, Eng. : daily record, Vol. XVI., 404.

RAINFALLS, EXCESSIVE : Discussion of paper on, (by Maj. R. T. [L.] Hoxie), by Am. Soc. C. E. ; size of sewers carrying stormwater; provision for cloud-bursts, Vol. XIV., 154 ; correction of error in size of sewer mentioned in above, Vol. XIV., 206 ; formula proposed by S. Whinery, Vol. XIV., 468 ; continuation of above discussion, Vol. XVI., 466, 524. Deductions of Prof. F. E. Nipher, from Dr. Engelmann's observations at St. Louis ; duration of heavy rains, Vol. XI., 154.

RAINWATER, EXCLUSION OF : See *Separate vs. Combined System* ; also *Roof and Yard Water* under *Separate System*.

RAISING SEWAGE : See *Pumps and Pumping Machinery* ; also *Lifting*.

RAWLINSON, SIR ROBERT :

Cannes, sewerage of ; evils of cess-pools, Vol. V., 542.

Cast-iron pipes for sewers ; experience as to durability, Vol. XVII., 90.

Flat districts, sewers in : letter on sewerage of Calcutta, Vol. VII., 586.

Hendon, Eng. : letter to the Local Board of, on the subject of purification works, Vol. XIV., 516.

Ideal drainage system, on the, Vol. XVI., 66.

Minimum size of street sewers and house-drains, Vol. XVII., 90.

Professional labors of, sketch of the, Vol. XVII., 220.

Removal of sewage, time occupied by complete, in some English towns ; (note), Vol. XV., 370.

Separate system, opinion on, Vol. V., 337, 451.

Sewerage, on, Vol. X., 451 ; Vol. X., 483.

Steep gradients, sewers on, Vol. XVII., 90.

Ventilation of sewers : provides funds for compilation of information on, Vol. XVI., 326, 515.

Waring (or Memphis) system, on the novelties of, Vol. X., 451 ; Vol. XVI., 737.

RAYMOND, Dr. J. H.: Extracts from paper by, on Privies, before Am. Pub. Health Assoc., Vol. X., 50.

READING, Eng.: Sewage farm: brief financial report of, Vol. V., 83.

RECEIVING-BASINS: See under *Sewer Construction*.

REDDITCH, Eng.: Colt poisoned by effluent from sewage farm; legal action, Vol. XII., 368.

RESERVOIRS for accumulating sewage to be discharged into the sea or tide-water:

Asbury Park, N. J., Vol. VI., 393.

Boston: Main Drainage Works; *three illustrations*, Vol. IX., 353.

London, Vol. IX., 213 (1st col.).

Portsmouth, Eng., Vol. IX., 185.

RESORTS:

Atlantic Coast; abstract of report to National Board of Health, by E. W. Bowditch, on sanitary condition of; *two illustrations*, Vol. VII., 267, 292.

Health: Danger from defective sewerage of: (editorial) Vol. VI., 81.

New Jersey Coast: Review of report by State Board of Health on sewerage of; (notice of Ocean Beach and Long Branch), Vol. IX., 594.

Riviera Coast, the: Defective condition of sewerage, Vol. VI., 148.

Seaside, sewerage of: Importance of attention to, by Health Boards and residents; discharge of crude sewage into estuaries or along coasts to be prevented; (editorial), Vol. IX., 280.

Summer: Editorial plea for better sewerage at, Vol. XII., 345.

RHODE ISLAND STATE FARM: Purification works: Irrigation: detailed description of underdrainage and carriers; *seven illustrations*, Vol. XIII., 322.

RICHARDSON, DR. B. W.:

Brighton, Eng.: Extracts from report on sewerage of, Vol. VII., 3.

Separate system, on: Brief abstract of paper before the Society of Arts, Vol. IX., 503; abstract from same paper, with editorial criticism, Vol. IX., 567.

Transportation of sewage in closed tanks, by night trains to barren sea-coasts for disposal by irrigation, proposed by, Vol. IX., 567.

RICHFIELD SPRINGS, N. Y.: Separate system, under construction; brief description; (note), Vol. XII., 12.

RICHMOND, Kew, Barnes and Mortlake; proposed drainage scheme for: intercepting sewers; precipitation, with filtration of effluent through sand, shingle and carbon, Vol. XV., 8.

RIVERS, discharge of sewage into: See *Streams* under *Purification of Sewage*, and *Estuaries* under *Disposal of Sewage*; also *Pollution of Streams* under *Disposal of Sewage*.

RIVIERA HEALTH RESORTS: See under *Resorts*.

ROBINSON, Prof. Henry, C. E.:

Disposal of Sewage: Irrigation; precipitation; discharge into river or sea; (extracts from paper before Sanitary Institute), Vol. X., 603. So as to avoid pollution of streams: editorial notice of, and comment on two papers by, Vol. XI., 451.

Irrigation: Report of experiments by Dr. Walker and Mr. McKie on capacity of the soil for purification, with his conclusions therefrom, Vol. V., 106.

Rivers Pollution Act: Abstract of paper on the, Vol. IX., 429.

Sandown, Eng.: Report on sewerage of, showing probable cause of stench from gratings in road, complained of by Mr. John Walter, M. P.; opinion as to power of English Sanitary Authorities to abate such nuisances, Vol. V., 9.

ROCHDALE, Eng.: Pail system at: new process of manufacturing manure to be tried; old process a nuisance and expensive; (note), Vol. VI., 373.

ROCHESTER, N. Y.:

Disposal: Nuisance caused in adjoining town by sewage in open drain; suit by the town against the city for injunction to restrain; granted and sustained by Court of Appeals; editorial comment, Vol. XVI., 37. Another similar suit decided against the city, Vol. VIII., 183. Comments on proposition to dispose of sewage by forcing it into the earth, Vol. XIV., 349.

Sewerage: Length and cost of sewers, Vol. VI., 471.

Defective condition; (note), Vol. X., 556. New outlet sewer through bed of old canal; brief description, Vol. VI., 351. Another proposed; route and length, Vol. VII., 231.

ROCK EXCAVATION FOR SEWERS: See under *Sewer Construction*.

ROMAN SEWERS, Vol. XV., 179, 462.

ROOF WATER: See under *Separate System*.

ROOTS, TREE, obstruction of pipe sewers by: See *Tree Roots* under *Pipe Sewers*.

ROSEWATER, ANDREW, C. E.: On the sewerage of Omaha (Neb.): quotations from and abstracts of annual reports: operation of the Waring system; use of untrapped catch basins; flushing, Vol. IX., 547; Vol. XIV., 203; Vol. XV., 687.

ROSEWATER & CHRISTIE: Sewerage plans for Wichita, Kan.: brief description, Vol. XVII., 302.

ROSEWATER'S FLUSH-TANK: See under *Tanks* under *Flushing of Sewers*.

ROYAL COMMISSION of 1882, on London sewage disposal: See *Metropolitan Sewage Discharge Commission* under *Purification of Sewage* under *London*.

ROYALTY : On separate system, see under *Separate System* ; on Field's flush-tanks, see under *Field's* under *Tanks* under *Flushing of Sewers*.

ROZSAHEGYI, Dr., of Buda-Pesth : experiments by, of movement of air in sewers, Vol. V. 384.

RYE-GRASS : See under *Grass* under *Produce* under *Agriculture* under *Utilization of Sewage*.

SACRAMENTO, Cal. : Citizens' report on the sewerage question ; editorially commended as unusually sensible, Vol. IX., 354. Irrigation recommended by State Engineer, Vol. IX., 316.

ST. LOUIS (Mo.) : Accumulation at outlet of sewer causes overflow through manhole ; (note), Vol. V., 534. Need of additional sewers, Vol. IX., 215. Brief history of sewer construction, with corresponding death-rates : review of Homan's Sanitary Survey, Vol. XIII., 14. Abstract of paper by Robert E. McMath on the future drainage of, Vol. XIII., 376.

ST. PAUL (Minn.) : Sewer construction by day's work ; (note), Vol. VI., 150. Nuisance from dumping of night-soil on flats near the city ; proposition to change dumping place to distant point, or cremate, Vol. XVI., 267.

SALFORD, Eng. : Description of sewerage and purification works ; precipitation by lime ; pumping and mixing machinery, Vol. X., 220.

SALISBURY, Eng. : Brief description of purification works : precipitation ; Johnson's filter presses, Vol. XII, 274.

SALT, use of, in cement : See *Frost* under *Cement* and under *Cement Mortars* under *Sewer Construction*.

SALT LAKE CITY (Utah) : Defective condition of sewerage : humorous article from the "Laramie Boomerang," Vol. VI., 109.

SALTLEY SEWAGE FARM: See *Birmingham, Tame and Rea District Drainage Works*.

SAND: See under *Cement Mortars* under *Sewer Construction*.

SANDOWN, Eng.: Report by Prof. Henry Robinson on sewerage of, showing probable cause of nuisance from sewer ventilators; editorial comment in continuation (from Vol. IV., 555) of reply to question of Mr. John Walter, M. P., Vol. V., 9.

SAN FRANCISCO (Cal.):

Defective condition of sewerage, Vol. XIII., 183; cause of high death-rate, Vol. VI., 41, 347; editorial comments, Vol. XII., 367; sewers "perfectly level", Vol. V., 85; wooden sewers badly decayed, Vol. VI., 499.

Flushing of sewers by sea-water pumped by wind-mills to reservoir on hills, suggested by the "Chronicle"; (note), Vol. VII., 35.

Prizes offered for sewerage plans, Vol. XVI., 18.

SARATOGA SPRINGS (N. Y.): Consideration of plans for disposal; (note), Vol. VI., 232.

SAVANNAH, Ga.: Proposed legislative law providing for construction of sewers, Vol. VI., 541. Editorial comment on Dr. Falligaut's offer to bet \$1,000 that his proposed system will work well, Vol. XVII., 65; correction of error in above, Vol. XVII., 109.

SCHENECTADY, N. Y.: Agitation of sewerage question; (note), Vol. IX., 384. Extracts from report to local Board of Health, by State Board of Health, showing evils resulting from use of natural water courses as sewers, Vol. X., 124. Brief statistics of sewerage system, Vol. XIII., 87. Description of new separate system, with some details of construction, including Van Vranken's flush-tank; *one illustration*, Vol. XIII., 490. Progress of construction and experience with new system in 1886; description of "pill" used in cleaning, Vol. XV., 630.

SCREEN, BALDWIN LATHAM'S REVOLVING :
See under *Purification of Sewage*.

SEA, DISCHARGE OF SEWAGE INTO : See under
Disposal of Sewage.

SEASIDE RESORTS, SEWERAGE OF : See *Resorts*.

SEDIMENTATION : See under *Purification of Sewage*.

SEPARATE SYSTEM : (See also *Separate vs. Combined System* ; also *Waring Sewage System* ; also *Separation*).

Asbury Park, N. J. : Description, Vol. VI., 103, 393.

Baltimore : Recommended by C. H. Latrobe, Vol. V.,
451 ; Vol. VI., 127.

Cleveland, O. : Résumé of plan by Rudolph Hering,
Vol. VI., 190.

Dallas, Tex. : Description ; cheap flush tanks ; *two illustrations*, Vol. IX., 332.

Denver, Col. : Plan for, made by Mr. Lowrie, "on this
system, four years before the details at Memphis were
patented," (Rosewater), Vol. XV., 687 (3d col.). De-
scriptions of works, Vol. VIII., 566 ; Vol. XIV., 203.

First engineer to advocate, Vol. XII., 192.

Kalamazoo, Mich. : Length and cost of pipe sewers,
Vol. IX., 190.

Keene, N. H. : Brief descriptions of works, Vol. VI.,
322 ; Vol. VIII., 208 ; Vol. IX., 124.

Lakewood, N. J. : Description, Vol. XV., 183.

Large cities, as applied to : Discussion by Octave
Chanute and Robert Moore, with special reference to
Kansas City ; editorial résumé of, and comment on,
Vol. X., 263.

Lemon, James, on : Paper before congress of the Sani-
tary Institute, Vol. VI., 415.

Memphis (Tenn.) : See *Memphis*, above.

New York State Board of Health, recommended by,
for general use, Vol. V., 240 ; editorial comments,
Vol. V., 337.

SEPARATE SYSTEM—(*Continued.*)

Norfolk, Va. : after plans by Col. George E. Waring, Jr. : description by J. H. Humphreys, Vol. VII., 155.

Patent on : (See also *Royalty*, below) : Brief answer to correspondent, Vol. V., 522.

Pipe Sewers : (See also under *Sewer Construction*) : Minimum limit in size (for streets) : Opinion of Rudolph Hering, (in letter on results of experience with the sewers of Memphis), Vol. XVI., 739 ; Opinion of Sir Robert Rawlinson, Vol. XVII, 90.

Pullman, (Ills.) : Brief description of works : abstract of paper by Benezette Williams, Vol. VI., 206 ; more complete description, by Dr. O. C. De Wolf, Vol. IX., 476.

Racine, Wis. : Proposed : brief abstract of plan by Rudolph Hering, Vol. VI., 150.

Rawlinson, Sir Robert, on : Vol. V., 337, 451 ; (for tropical climates), Vol. VII., 586 ; (on novelties of the Waring system), Vol. V., 451, Vol. XVI., 737.

Richfield Springs, (N. Y.) : Brief description, Vol. XII., 12.

Roof and yard water, propriety of admitting to the house drainage system :

Association of Municipal and Sanitary Engineers and Surveyors, discussion by, Vol. VIII., 252.

Hering, Rudolph, on, Vol. VII., 483, 535 ; Vol. XVI., 739.

Lemon, James, on, Vol. VI., 415.

Rawlinson, Sir Robert, on, Vol. V., 337, 451.

Waring, Col. George E., on, Vol. VII., 460.

Royalty on, claims for : Letter from Rudolph Hering, inquiring as to legal claims concerned in the use of the separate system in this country ; editorial reply : quotation of "brief" and "claim" of patent issued

SEPARATE SYSTEM :

Royalty on : claims for—(*Continued.*)

to George E. Waring, Jr. ; detailed consideration of claim covering use of automatic flush-tank at head of lateral sewers, Vol. IX., 546. Letter from Col. Waring in reference to above, Vol. IX., 572.

Sacramento, Cal., recommended for, with irrigation, Vol. IX., 354.

Schenectady, N. Y. : Description of works, Vol. XIII., 490.

Size of sewers in : Means of calculating ; (answer to correspondent), Vol. VII., 366. Minimum size to be used : opinion of Rudolph Hering, Vol. XVI., 739 ; of Sir Robert Rawlinson, Vol. XVII., 90.

Sub-soil drainage, as a part of the system : Omission of, at Memphis ; (references), Vol. V., 2. 401. Effect of, on death-rate ; amount of sub-soil water admitted into sewers of eight English towns ; (in paper by James Lemon), Vol. VI., 415. Method at Norfolk, Va., (Waring system), Vol. VII., 247.

Theory and construction of the : Review of treatise on, by Cady Staley and George S. Pierson, Vol. XIV., 524.

Walthamstow, Eng. : a failure at, Vol. VIII., 252.

SEPARATE VS. COMBINED SYSTEM :

Am. Pub. Health Assoc., discussion by, of paper by Dr. J. W. Compton on "Combined Sewers dangerous to Public Health," Vol. VI., 490.

Assoc. of Municipal and San. Engineers and Surgeons, résumé of discussion by, Vol. VIII., 252.

Baumeister, Prof. R., paper by, Vol. VII., 506.

Boston : reason why the separate system is not applicable to, Vol. VIII., 511.

Chadwick, Edwin, on, Vol. XII, 312.

SEPARATE VS. COMBINED SYSTEM—(Continued.)

Chanute, Octave, abstract of discussion between, and Robert Moore, with special reference to Kansas City, Vol. X, 263.

Comparative cost of, in several American cities, Vol. XI., 413; estimated, for Kansas City, Vol. X, 263.

Hering, Rudolph, on, Vol. XI., 416, 499.

Kansas City, Mo.: Abstract from discussion between Octave Chanute and Robert Moore, with special reference to, Vol. X., 263.

Massachusetts Drainage Commission on, Vol. XIII., 345.

Moore, Robert, on, with special reference to Kansas City, Vol. X., 263.

Philbrick, Edward S., on, Vol. XV., 111.

Richardson, Dr. B. W., on: Brief abstract of paper before Society of Arts, Vol. IX., 503; full extract from same, with editorial criticism, Vol. IX., 567.

Rosewater, Andrew, on, Vol. XV., 687.

Waring, Col. George E., jr., on: Criticism of paper by Prof. R. Baumeister, Vol. VII., 583.

Williams, Benezette, on, Vol. XI., 413, 460.

SEPARATION OF SEWAGE AND RAINWATER IN TOWN WASTES: "Unfortunate in having been developed into a system, and as such treated in a commercial rather than engineering spirit;" (editorial), Vol. VI., 301.

SETTLING BASINS IN SUB-SURFACE IRRIGATION SYSTEM: See under *Sub-Surface Irrigation* under *Purification of Sewage*.

SEWAGE, ANALYSES OF: Boston, Vol. XII., 274; Glasgow, Vol. XII., 148.

SEWERAGE:

"An admirable report on, by a citizens' committee;" (Sacramento, Cal.), IX., 354.

Ancient: See *Ancient Sewerage*.

SEWERAGE—(*Continued.*)

Billings, Dr. J. S., U. S. A., on : Quotations from article in "Harper's Magazine," XII., 248.

International Sanitary Congress at Geneva: Abstract of debate on, as follows : Brouardel, Dr. P. : argument against sewers. De Meijer, Dr. Overbeek : criticism on Paris sewers ; praise of separate system ; argument in favor of Liernur system. Durand-Claye, M. A. : defense of sewers and irrigation. Duverdy, M. : sewage farms near Berlin overcharged with sewage ; great area required for irrigation, the objection to it. Teissier, Dr. J. : reasons for and against sewers in the matter of specific germs. Trélet, M. Emile : in favor of sewers ; mortality from typhoid lower in houses connected with sewers than in those with cess-pools. Varrantrapp, Dr. G. : cleanliness of Frankfurt sewers ; result of efficient sewerage on death-rate, especially typhoid fever, Vol. VI., 559.

"Lancet," the London, on ; editorial criticism, Vol. VI., 61.

Rawlinson, Sir Robert, on, Vol. V., 451 ; Vol. X., 483. Small towns, in : Editorial on absence of sewers in many towns having water supply, and generally improper design and faulty construction where found, Vol. VIII., 199 ; comment on above by "American Architect," Vol. VIII., 295. *Versus* cess-pools : general explanation of the evils of the latter, Vol. VIII., 302.

"Theoretical, Practical and Political :'" Editorial on the cardinal principles of, Vol. V., 258.

SEWERAGE SYSTEMS, patented :

Comstock & Jefferson's : brief and claim of patent ; *one illustration*, Vol. VI., 424.

Waring's : See *Waring Sewerage System*.

SEWER CONSTRUCTION :

Ancient : Bunzlau (in Silesia), Ger., in 16th century, Vol. VIII., 416. Rome, Vol. XV., 179, 462.

Atlantic City (N. J.) : Brief description ; pipe joints under water, Vol. XI., 404.

Berlin : Description by M. A. Durand-Claye ; *five illustrations, besides one full page of details*, Vol. VI., 444 ; editorial criticism on some details in above, Vol. VI., 565.

Boston : Main Drainage Works :

Clarke, Eliot C., (First Ass't Engr.), description by, of : Main and intercepting sewers ; automatic storm water regulators ; filth hoist ; pumping station ; *seven illustrations* (including map), Vol. IX., 306. Outlet portion ; tank sewers ; tunnel ; outfall sewer ; reservoir ; discharge sewers ; *three illustrations*, Vol. IX., 253.

Philbrick, Edward S., description by, of : Junctions of branches with main ; flushing gates ; automatic storm-water regulator ; tide-water gates ; size and cost of various sections ; *fifteen illustrations*, Vol. XVI., 67. Experiment to determine effect of sewer construction on height of ground water, Vol. XVI., 264.

Brick : Crushing strength of, and brick work : report, by Prof. Ira O. Baker, of Watertown Arsenal and German tests, Vol. XVII., 323 ; errors in above, Vol. XVII., 366. What constitutes a good, for sewers ; (answer to correspondent), Vol. XIII., 542.

Buffalo, (N. Y.) : Trunk sewer : Size, thickness of walls, etc. ; (note), VII., 544 ; length, cost etc., Vol. XIII., 87.

Carson's Trench Machine : Description ; account of use on Boston intercepting sewers ; *four illustrations*, Vol. XV., 290.

SEWER CONSTRUCTION—(*Continued.*)

Cast iron pipe for sewers : Experience of Sir Robert Rawlinson, as to durability, XVII., 90.

Lead joints in, not affected by galvanic action : testimony of W. Bryan, Vol. VII., 391.

Catch-basins :

Advisability of, question as to the : conditions determining ; (answer to correspondent citing cost of cleaning, in Cincinnati), Vol. XII., 247.

Chelsea, Mass. : Cost, with iron hoods and pipe drains ; trouble from freezing, Vol. XV., 545.

Cincinnati, form used in ; *two illustrations*, Vol. VI., 325.

Trapping, method of, in London ; *four illustrations*, Vol. X., 362.

Trapping and general construction ; (answer to correspondent), Vol. VII., 199.

Traps, without : Omaha, Vol. XIV., 203 ; Vol. XV., 687.

Waterbury, Conn., description of pattern used at, in connection with receiving basins ; *three illustrations*, Vol. XIV., 151.

Cement : (See also *Cements, Mortars and Concretes*, below).

Best for brick sewers ; (answer to correspondent), Vol. XIII., 542.

Collingwood, F., on : Table of compressive tests ; American *vs.* Portland, Vol. XII., 468. Abstract of paper before Am. Soc. C. E., Vol. XII., 497.

Compressive strength :

Am. Soc. C. E., on, Vol. XVI., 157.

Cluss, Adolph, on, Vol. XVII., 305.

Collingwood, F., on, Vol. XII., 468, 497.

Duty on, proposed abolition of : editorial on, Vol. XVII., 239.

SEWER CONSTRUCTION :

Cement—(*Continued.*)

Frost, effect of, resisted by addition of salt, Vol. XV., supplement to No. 1 ; Vol. XVI., 716 ; Vol. XVII., 60.

Hardening of, French experiments on the, Vol. X., 555.

Industry, statement of the, Vol. XVII., 243.

Paterson, N. J.: Inferior quality, not conforming to specifications, used by contractor by permission of Street Committee of Councils ; editorial comments, Vol. IX., 495.

Portland :

Bernays, ———, on : Notes from paper on concrete, before Inst. C. E., Vol. V., 18.

Grant, John, on : Notes from paper before Inst. C. E., Vol. V., 18.

Magnesia in : Cause of expansion, Vol. XVII., 227. Letter from Howard Fleming : Importance of analysis ; simple test for slag cement, Vol. XVII., 257.

Price of, increase in, Vol. XVII., 61:

“Purging,” for removal of uncombined lime : Methods employed by George F. Deacon, on the Vyrnwy dam, Vol. XVII., 263.

Sea-water, action of, on : Experience on Aberdeen Harbor Works, Vol. XVI., 351 ; on Boulogne and Calais Harbor Works, Vol. XVI., 152.

Versus American for pipe joints : “American Architect,” quotation from, with editorial, Vol. XIII., 325. Phinney, H. W. B., letter from, taking exception to above ; in favor of Portland ; editorial reply, Vol. XIII., 397.

Slag, blast furnace, from : abstract of paper by J. E. Stead, with description of Ransome’s process by R. J. Friswell, Vol. XVI., 678.

SEWER CONSTRUCTION :

Cement—(*Continued.*)

Sugar, influence of, upon : Extract from article in the "Engineer" by A. N. Barnes, Vol. XV., 458. Experiments by Harry De B. Parsons : abstract of paper before Am. Soc. M. E., Vol. XVII., 60.

Tests :

Boulogne and Calais Harbor Works, for : Portland only ; chemical test ; sea-water used in mixing ; manner of preparation ; immersion in sea-water ; also testing of cement mortar ; by F. Guillian, Vol. XVI., 152.

Long dates, at : by Reginald Empson Middleton, Vol. XVI., 123.

Noyes, E. B. : abstract of paper before Am. Soc. C. E., Vol. XVI., 584.

Testing machines :

Bailey, W. H. & Co., three patterns made by : brief description ; *three illustrations*, Vol. VIII., 423 ; Vol. XII., 418.

Bailey's briquette mould ; *one illustration*, Vol. XII., 418.

De Michele's : brief description ; *one illustration*, Vol. XI., 545.

International Health Exhibition, one shown at : brief description ; *one illustration*, Vol. X., 316.

Inventions Exhibition, four shown at : exhibited by Henry Faija, Patrick Adie and W. H. Bailey (two) : brief descriptions ; *five illustrations*, Vol. XII., 418.

Poughkeepsie bridge, one used at : designed by J. F. O'Rourke ; *one illustration*, Vol. XVII., 117.

Testing needle : description, Vol. XVI., 294.

Cement mortars :

Adhesive strength : table of, Vol. XVII., 252 ; experiments on, Vol. XVII., 265.

SEWER CONSTRUCTION :

Cement mortars—(*Continued.*)

Brick sewers, how best made for ; (answer to correspondent), Vol. XIII., 542.

Frost, effects of : résumé by Emil Kuichling, Vol. XVII., 289, 300.

Public work, for use in : abstract of report by Emil Kuichling : General considerations ; tests ; tables of adhesive and shearing strength, Vol. XVII., 252. Adhesion : various experiments, Vol. XVII., 265. Sand : proportion, quality and effect ; effect of frost continued ; report of tests for Rochester at Cornell University, Vol. XVII., 300.

Sand : influence of the fineness of, Vol. XVI., 583 ; proportion, quality and general effect of, XVII., 288.

Strength of : Baker, Prof. Ira O., on : compressive tests at Watertown Arsenal on concrete blocks and brick piers ; German experiments on crushing strength of brick-work, Vol. XVII., 323 ; errors in above, Vol. XVII., 366.

Cement sewer pipe : See *Sewer-pipe, cement*, below, (under *Sewer Construction*).

Cements, mortars and concretes : investigation of characteristics of, by committee of Am. Soc. C. E. : questions to which answers are sought, with suggestions as to manner of tests and observations, Vol. XIII., 207, 256.

Cincinnati : Catch-basins used in ; comment ; *two illustrations*, Vol. VI., 325. McLean Ave. sewer, account of construction of ; *one illustration*, Vol. VI., 352.

Circular brick sewers adapted to smaller flow by lining invert with concrete and earthenware, as applied to old sewers in New York City ; *two illustrations*, Vol.

SEWER CONSTRUCTION :

Circular brick sewers—(*Continued.*)

XIII., 491. Patent on above : claim ; *one illustration*, Vol. XII., 15.

Concrete blocks :

Sewers built of : description of two constructed by Sir Joseph Bazalgette ; *two illustrations*, Vol. VI., 305.

Tests of compressive strength, Vol. XVII., 323.

Concrete under water : method of laying employed by M. Houde, Vol. XVI., 466.

Crossing of underground conduits at street intersections : proposed law to regulate, in Philadelphia ; editorial comments ; argument for sub-ways, Vol. VI., 485.

Decauville system of moving material : description, with *three illustrations*, Vol. XVI., 123.

Denver, (Col.) : size, grade, velocity, flushing, cleaning, stoppages, cost, etc., Vol. XIV., 203.

Excavating and moving material : cost of, in Paris, Vol. X., 272.

Excavating apparatus :

Carson's trench machine : description : account of use on Boston intercepting sewers ; *four illustrations*, Vol. XV., 290.

"Decauville," the, as used on Tancarville canal and sewer (at Havre) ; *three illustrations*, Vol. XVI., 123.

Flume, (rectangular outlet sewer of wood) : Newark, N. J. : detailed description ; *one illustration*, Vol. XV., 628. 629.

Gates :

Flushing : Boston Main Drainage Works ; *two illustrations*, Vol. IX., 306 ; Vol. XVI., 67.

Tide-water : Boston Main Drainage Works ; *two illustrations*, Vol. IX., 306 ; Vol. XVI., 67.

SEWER CONSTRUCTION—(*Continued.*)

Gullies : See *Catch-Basins*.

Inlet, Collins' patent disinfecting : brief and claim, Vol. VIII., 284.

Invert blocks :

Hollow, advantages of, and objections to : letter from R. H. Thorpe, (of London), with editorial comment ; *five illustrations*, showing English and American patterns, Vol. V., 68.

Rader's : brief and claim of patent ; *two illustrations*, Vol. V., 369.

Junctions of branches with main sewer : Boston Main Drainage Works ; *one illustration*, Vol. XVI., 67. Newark, N. J., Improved Sewerage System, Vol. XV., 629, 630.

Level pipe sewer at Streatham, Eng. : description, with *one illustration*, Vol. VI., 106.

Location in back streets or alleys : editorial argument for passages behind and parallel to main streets, in which to place all pipes, to avoid disturbing pavement of main streets, Vol. VIII., 440.

London practice, briefly described by R. H. Thorpe ; *two illustrations*, Vol. V., 107 ; correction of errors in above, Vol. V., 159. Largest storm-water overflow sewer : description, Vol. X., 28 ; another description, with *one illustration*, Vol. X., 171.

Manhole covers :

Banner, E. G., design of ; *one illustration*, Vol. IX., 263.

Brady's patent : *one illustration*, Vol. X., 588.

Manholes :

Cost of : Chelsea, Mass., Vol. XV., 545.

Omission of, especially on small pipe sewers :

Hering, Rudolph, on, Vol. XVI., 739.

Philbrick, Edward S., on, Vol. XVI., 737.

SEWER CONSTRUCTION :

Manholes—(*Continued.*)

Rawlinson, Sir Robert, on Vol. XVI., 737.

Waring, Col. George E., Jr., on, XIV., 472 (1st. col.) ; Vol. XVI., 737.

Modern : series of articles by Edward S. Philbrick, Vol. XV., II, III, 234, 345, 516 ; Vol. XVI., 67, 264. (For detailed index, see under *Philbrick.*)

Newark, N. J. : Description (by F. Collingwood) of Improved Sewerage System : Details of construction in wet ground : sheeting planks driven by aid of water jet ; timber and plank foundation ; trench draining ; *four illustrations* and *map*, Vol. XV., 600. Masonry in quicksand ; deposit sewers ; filth hoists ; pump-wells ; discharge-well ; flume ; pumps ; junction of branch with main ; *five illustrations*, Vol. XV., 628.

New London, Conn. : Description of intercepting sewers designed by Rudolph Hering ; *nine illustrations*, Vol. XV., 40.

New York City : Method of determining amount of rock excavation by borings ; "unbalanced bids", Vol. IX., 143. Change in cross-section of circular brick sewers to reduce width of dry weather stream : lining of concrete and earthenware ; *two illustrations*, Vol. XIII., 491 ; patent on above method ; claim ; *one illustration*, Vol. XII., 15.

Norfolk, Va. : Difficulties in laying pipe below ground water level, Vol. VII., 155. Syphon outlet for low district, designed by Col. Waring ; *three illustrations*, Vol. XV., 486.

Pipe sewers : (See also under *Separate System* ; also *Sewer-pipe* under *Sewer Construction*).

Alignment : apparatus used at Denver "for keeping the line of small pipes while laying them," Vol.

SEWER CONSTRUCTION :

Pipe Sewers :

Alignment—(*Continued.*)

XIV., 203. Method employed at Lakewood, N. J., Vol. XV., 183.

Joints under water : Method of making, at Atlantic City, Vol. XI., 504. Stanford joint as used at Norfolk, Vol. VII., 156 (1st col.).

Level : description of one at Streatham, Eng.; *one illustration*, Vol. VI., 106.

Specifications for Rochester, N. Y., by E. Kuichling; editorial comments, Vol. XII., 168. Letter from Blackmer & Post, expressing favorable opinion of above, and calling for general standard from city engineers of U. S., Vol. XII., 272.

Quicksand, construction in : Pipe sewers at Norfolk, Vol. VII., 156 (1st col.). Intercepting sewers at Newark, N. J., Vol. XV., 602.

Receiving basins : Waterbury, Conn., description of pattern used at ; *three illustrations*, Vol. XVI., 151.

Rock excavation, methods of determining amount of, beforehand ; inefficiency of borings as used in New York ; "unbalanced bids," Vol. IX., 143.

Sewer-pipe, cement :

Disadvantages of ; (answer to correspondent), Vol. XVII., 121.

Machine for construction of continuous, in the trench: description, with *two illustrations*, Vol. VII., 226.

Manufacture, improved method of : rapid hardening, (note), Vol. VI., 325.

Value of, compared with stoneware or earthenware pipe : Paterson, N. J.: Mayor refuses to sign contract for ; editorial comments, quoting Eliot C. Clarke and Col. Julius W. Adams, Vol. VIII., 279 ; testimony of Paterson City Engineer in favor of,

SEWER CONSTRUCTION :

Sewer Pipe, cement :

Value of—(*Continued.*)

Vol. VIII., 351, 472 ; letter from "Civil Engineer" concerning use of, at Norwich, Conn.; comments, Vol. VIII., 397.

Sewer pipe machine: Burdick and Davis' patent; claim ; *one illustration*, Vol. IX., 554.

Sewer pipe machinery: manufacturers of ; (answer to correspondent), Vol. XVII., 26.

Soil drainage by sewers and their construction: General effect at London, Vol. X., 50. Experiment at Boston to determine extent of, Vol. XVI., 264. Removing water from wells: at North Lansing, Mich., causes "much dissatisfaction." Vol. VII., 107 ; town of Brookline, Mass., held liable for, Vol. XVI., 242.

Storm-water overflows :

Boston Main Drainage Works: automatic regulating apparatus ; *two illustrations*, Vol. IX., 308 ; Vol. XVI., 68.

London, on northern high level intercepting sewer: description, with *full page illustration*, Vol. VI., 150.

Waterbury, Conn.: *one illustration*, Vol. X., 51.

Syphon, inverted: under stream: Dallas, Tex.: description ; *one illustration*, Vol. IX., 332.

Syphon outlet for low district at Norfolk, Va., designed by Col. George E. Waring, Jr.: description ; with *three illustrations*, Vol. XV., 486.

Tide-gates: Boston Main Drainage Works ; *one illustration*, Vol. IX., 306 ; Vol. XVI., 67. Tibbal's patent back-water gate: brief and claim ; *one illustration*, Vol. IX., 50.

Trench machines: See *Carson's*, above.

Tunneling, advisability of, for small brick sewer (of specified size): answer to correspondent, Vol. XI., 272.

SEWER CONSTRUCTION :

Tunnels :

Bar Harbor, (proposed); *one illustration*, Vol. XV., 261.

Boston : Main Drainage Works ; *one illustration*, Vol. IX., 355.

Cincinnati : McLean ave. : description ; *one illustration*, Vol. VI., 352.

Ward's flexible pipe joints for outlet sewers into sea at beaches : proposed by Andrew Clerk for Coney Island ; editorial comment, Vol. VI., 467.

Waterbury, Conn. : Description of system designed by Rudolph Hering ; *eight illustrations*, Vol. X., 51.
Description of receiving and catch-basins, Vol. XVI., 151.

Water main passing through sewer (at right angles) : case at Philadelphia evokes protest from the Health Board ; editorial comment on the question of supposed danger of contamination, Vol. VI., 222.

Wooden Sewers : (See also *Flume*):

Beverly, Mass. : Box sewer built without engineering advice ; comment, Vol. VIII., 328.

Boston : Main Drainage Works : wooden shell, lined with concrete ; *two illustrations*, Vol. IX., 306.

Cicero, Ills. : Proposed : pine plank for several miles ; opposition ; injunction obtained against construction ; Vol. IX., 240.

New London, Conn. : outfall sewer : brief description ; *one illustration*, Vol. XV., 402.

San Francisco : Badly decayed ; (reference only), Vol. VI., 499.

SEWER GAS :

Apparatus for consuming, Ogilvie & Bennem's ; patent claim ; *one illustration*, Vol. VI., 333.

Burning : case at Chicago ; editorial comment ; explanation of explosions, Vol. IX., 608.

SEWER GAS—(*Continued.*)

Composition of, Vol. VII., 265 ; investigations of Prof.

Carnely and Mr. Haldane of Dundee, Vol. XVI., 487.

Destructors : editorial on the numerous plans proposed for ventilating sewers and disinfecting sewer gases by fire, Vol. XVII., 237.

Electrolysis of : humorous editorial on schemes of crank inventors for destruction or utilizing by electricity, Vol. XIV., 415.

Liverpool (Eng.) : death of a youth from inhaling sewer air ; (note), Vol. XV., 164.

Manchester (Eng.) : Six laborers overcome in sewer ; (note), Vol. X., 193.

SEWER-PIPE : See under *Sewer Construction.*

SHEFFIELD, (Eng.) : Complete scheme of sewerage recommended : purification by "filtration beds" ; estimated cost, Vol. VII., 514. Description of purification works ; precipitation by lime, followed by aëration over weirs, Vol. XIV., 105.

SHIPS FOR CARRYING SEWAGE SLUDGE TO SEA : London ; Vol. XII., 293 ; Vol. XIV., 272 ; Vol. XVII., 156.

SHONE, ISAAC, C. E. : on ventilation of sewers : letter suggested by Mr. John Walter's queries, Vol. V., 103.

SHONE PNEUMATIC SYSTEM :

Beaumaris, Wales, about to adopt ; (note), Vol. XIII., 200.

Concord, Mass., proposed for, by Edward S. Philbrick, Vol. V., 407.

Eastbourne, Eng., at : description of works, Vol. V., 474.

Henley-on-Thames, at : description of works ; *two illustrations*, Vol. XVII., 181.

Heston and Isleworth District (Eng.), adopted by ; cost, Vol. XIII., 537.

SHONE PNEUMATIC SYSTEM—(*Continued.*)

Lake, Ills., adopted at; lift, etc.; (note), Vol. XVII., 173.

Parliament, Houses of : recommended for, Vol. XIV., 177 ; recommendation adopted, Vol. XIV., 320 ; description of the work ; *twelve illustrations*, Vol. XV., 456.

Potsdam (Ger.), proposed for : description of project, Vol. XI., 376.

Reliability of pneumatic action in : answer to correspondent, Vol. VII., 175.

SILOS : See under *Agriculture* under *Utilization of Sewage*.

SIZE OF SEWERS :

Means of determining : Reviews of : Flynn's tables, Vol. VIII., 326 ; Vol. XIII., 543 ; Gerhardt's diagram, Vol. V., 219 ; McMath's paper, Vol. XV., supplement to No. 3 ; Moore and Baier's paper, Vol. XV., 468 ; in separate system, Vol. VII., 366.

Minimum : Opinion of Sir Robert Rawlinson, Vol. XVII., 90 ; of Rudolph Hering, XVI., 739.

SLAGG, CHARLES : "Sanitary work in the smaller towns and villages," by ; brief review, Vol. IX., 121.

SLATER, J. W. : review of book by, on Sewage Treatment, Purification and Utilization, Vol. XVII., 202.

SLAUGHTER HOUSES, analyses of sewage from : Glasgow, Vol. XIII., 148.

SLUDGE, SEWAGE : See under *Precipitation* under *Purification of Sewage*.

SMALL STREAMS : Use of, as open sewers, see *Brooks*.

SMALL TOWNS :

Irrigation for : abstract of paper by James Bateman before Association of Sanitary Inspectors, Vol. XV., 342.

SMALL TOWNS—(*Continued.*)

Sewerage of : absence of sewers, and defective condition ; (editorial), Vol. VIII., 199 ; comments on above, by "American Architect," Vol. VIII., 296. Sewers *vs.* cess-pools ; general explanation of evils of the latter ; (answer to correspondent), Vol. VIII., 302. Brief review of Slagg's "Sanitary work in Smaller Towns and Villages, Vol. XI., 121.

SMITH, Dr. R. ANGUS, on sewage purification, especially by aëration, Vol. VI., 42.

SNOW, Dr. E. M., Supt. of Health, Providence, R. I. : Remarks by, on cess-pools and sewerage, in first annual report, (1857), Vol. VIII., 151.

SODA, permanganate of, for deodorizing sewage : See under *Deodorizing* under *London*.

SOIL DRAINAGE by sewer construction : See under *Sewer Construction*.

SOUTHAM, Eng. : Brief description of disposal works : irrigation with agriculture, Vol. V., 17.

SOUTHAMPTON (Eng.) : Purification works : precipitation by porous carbon ; sludge mixed with road sweepings and sold to farmers, Vol. XV., 60. More complete description : working expenses ; *five illustrations*, Vol. XVII., 315.

SOUTH FRAMINGHAM, Mass. : Sewage disposal : Recommendation of State Drainage Commission ; (note), Vol. XIII., 17. Proposition to build open drain to Sudbury River, opposed by towns below ; (note), Vol. XIII., 425. Report on sewerage and disposal by S. C. Heald : pipe sewers and irrigation ; estimate, Vol. XVI., 299.

SOYKA, Dr. J. : Experiments by, on movement of air in sewers : full abstract of report on, Vol. VII., 76. Death-rates in Munich in relation to its sewers : review, Vol. XII., 153.

SPECIFICATIONS for vitrified stone-ware pipe sewers, by E. Kuichling for Rochester, N. Y. ; editorial comments, Vol. XII., 168.

SQUARE STONE SEWER : See *Stone Sewer*.

STALEY AND PIERSON'S treatise on the theory and construction of the separate system : review of, Vol. XVI., 524.

STAMFORD, Conn. : Agitation of the sewerage question ; formation of a Sanitary Association, Vol. VI., 186. Foul sanitary condition of the town ; blind ditch used as a sewer, Vol. XII., 440. Plans of Col. George E. Waring, Jr., adopted by borough meeting ; (note), Vol. XIII., 40.

STANFORD JOINT (for pipe sewers below ground water level) : as used at Norfolk, Va., Vol. VII., 156.

STEAM BOILERS, utilization of sewage in : See under *Utilization of Sewage*.

STEAM, discharge of, into sewers :

New York City, prohibited in ; proper method of blowing off and blowing down ; (answer to correspondent), Vol. XIII., 563.

Philadelphia : new law prohibiting, Vol. VIII., 297.

Reasons why objectionable : method of discharge through cess-pools ; (answer to correspondent), Vol. XVI., 587.

Rochester, N. Y., efforts in, to prevent, Vol. VI., 227.

Springfield, Mass., efforts in, to prevent, Vol. V., 12.

STEARNS, FREDERIC P., C. E. : Notice of paper by, on Disposal of Sewage in Massachusetts, Vol. XVI., 180. (For index of discussion on above paper, see *Massachusetts, Disposal of Sewage*.)

STEEP GRADIENTS, construction of sewers on : Sir Robert Rawlinson on, Vol. XVII., 90.

STEVENSON, DR. THOMAS : On sewage disposal : extracts from paper before London Medical Officers of Health ; the method of the future, Vol. XII., 28. Brief

STEVENSON, DR. THOMAS—(*Continued.*)

description of scheme for Hendon, submitted by, in conjunction with Prof. Frankland, Vol. XIII., 445.

STILLWATER, Minn.: Résumé of sewerage plans prepared by D. W. Cunningham, Vol. V., 125.

STOCKTON, Cal.: Insane Asylum: Foul condition of disposal works; irrigation recommended by State Engineer Hall; methods and details to be observed, Vol. IX., 329.

STONE SEWER, SQUARE: Arguments in favor of, by an alderman, a doctor and an "expert" at Green Bay, Wis.; editorial comment, Vol. XIV., 463.

STORER'S PROCESS OF PURIFYING SEWAGE, BY AERATION: See under *Aëration* under *Purification of Sewage*.

STORM-WATER :

Amount provided for in sewerage of : Copenhagen, Vol. X., 555; Newark, N. J., Vol. XV., 600; Salford, Eng., Vol. X., 220.

Exclusion of, from sewers : See *Separate vs. Combined System*; also *Roof and Yard Water* under *Separate System*.

Heavy rains : See *Rainfalls, excessive*.

STRATFORD-ON-AVON: Sewerage and disposal works: description; flushing; pumping; irrigation, Vol. XIII., 180. Nuisance from: suit for damages; verdict for plaintiff, Vol. XVII., 282.

STRATFORD, Ont.: Separate system proposed for; (note), Vol. XII., 448.

STREAMS, DISCHARGE OF SEWAGE INTO: See under *Purification of Sewage*; also *Pollution of Streams* under *Disposal of Sewage*.

STREAMS, SMALL, AS SEWERS: See *Brooks*.

STREAMS, TIDAL: See *Estuaries* under *Disposal of Sewage*.

STREATHAM, Eng.: Level pipe sewer at ; description with *one illustration*, Vol. VI., 106.

STREET SWEEPING of liquid mud into sewers : London : decided to be illegal, Vol. IX., 400.

SUB-SOIL DRAINAGE : See under *Separate System* ; see also *Soil Drainage* under *Sewer Construction* ; also *Underdrainage* under *Irrigation* under *Purification of Sewage* ; also *Ground Water*.

SUB-SURFACE IRRIGATION : See under *Purification of Sewage*.

SUDBURY RIVER (Mass.), pollution of, by sewage of Marlboro ; (editorial), Vol. X., 359.

SUEZ CANAL : "in fair way to become a stagnant sewer" ; (note), Vol. VII., 609.

SUGAR, influence of, upon cement : See under *Cement* under *Sewer Construction*.

SUMMER COTTAGES : Disposal from : irrigation recommended in answer to correspondent, Vol. IX., 190.

SUMMER RESORTS : See under *Resorts*.

SWEEPING LIQUID MUD from streets into sewers : London : decided to be illegal, Vol. IX., 400.

SYRACUSE, N. Y.: Intercepting sewers to prevent pollution of Onondaga Creek proposed by citizen, Vol. VII., 297 ; recommended by James T. Gardiner of State Board of Health, Vol. XII., 254. Defective condition of sewerage ; (reference), Vol. XVI., 493.

SYPHONS : See under *Sewer Construction* ; also *Tanks* under *Flushing of Sewers*.

TANCARVILLE CANAL AND SEWER AT HAVRE: "Decauville" apparatus as used at ; Sheet iron sewer syphon under canal ; *three illustrations*, Vol. XVI., 123.

TANNERIES, analyses of waste water from : Glasgow, Vol. XII., 148.

TAUNTON, Mass. : Consideration of disposal urged by Board of Health, Vol. XV., 659. Abstract of lecture on sewage disposal, by Wm. R. Billings, with special reference to that city, Vol. XIII., 615.

THAMES RIVER, (Eng.), pollution of : (See also *Disposal of Sewage* and *Purification of Sewage* under London.)

Description of : By the "Lancet", Vol. VIII., 566.

Blackwall to Erith ; (note), Vol. X., 168. At Twickenham, Vol. XI., 56.

Laws and projects to prevent : brief history of, Vol. X., 122.

Lower portion : Foul condition of ; (note), Vol. XII., 269. Number of open outfalls of sewers between Teddington and Gravesend, Vol. V., 107. Scheme for purification proposed by newspaper correspondent: flushing by water from German ocean, Vol. X., 337.

Metropolitan Sewage Discharge Commission, (or Royal Commission of 1882), on : First report : abstract, Vol. IX., 304 ; general conclusions, Vol. IX., 453. Second (final) report : abstract, Vol. XI., 104 ; conclusions, Vol. XI., 476. Necessity of carrying out recommendations in above urged on Home Secretary by the Common Council of London, Vol. XII., 464.

THAMES VALLEY, LOWER : Sewage Disposal of : Proposed purification works at Mortlake ; treatment proposed by James Manserge and Mr. Melliss, Vol. VIII., 591. Objection by rate-payers of Mortlake to scheme proposed by Main Sewerage Board, Vol. IX., 52, 520 ; above scheme approved by Local Government Board, Vol. IX., 608 ; but rejected by Parliament, Vol. X., 168. General inquiry ordered, Vol. X., 288. Discussion of, by English correspondents, Vol. X., 312, 364. Adoption of scheme proposed by Sir Joseph Bazalgette ; cost, Vol. XI., 149. Dissolution of Main Sewerage Board ; its accomplishments, Vol. XII., 249 ; Vol. XIII., 272.

TIDAL RIVERS : See *Estuaries* under *Disposal of Sewage*.

TIDE-GATES : See *Gates* under *Sewer Construction*.

TIDY, DR. C. MEYMOTT, on sewage disposal : Brief abstract of paper before Society of Arts, Vol. XIII., 560 ; editorial reference to same, Vol. XIV., 55 ; editorial résumé of the paper and discussion thereon, with comments, Vol. XIV., 223 ; notice of, as reprinted in book form, Vol. XVI., 237.

TILTING TANKS, use of, in sub-surface irrigation: See under *Sub-surface Irrigation* under *Purification of Sewage*.

TOLEDO, Ohio : Defective condition of sewers, Vol. V., 541 ; Vol. XVII., 69.

TORONTO, (Can.) :

Defective condition of sewerage ; pollution of the bay : earth closets proposed by the Health Officer, Vol. XII., 74.

Disposal : proposed plan : discharge into lake 30 feet below surface at distance from shore ; (reference only), Vol. XIV., 471 (3d col.).

Progress of sewerage ; (notes in correspondence), Vol. X., 127.

Sewerage Commission : Appointment of, Vol. XIII., 473 ; brief abstract of report of, Vol. XIV., 255 ; taxpayers refuse to authorize construction of trunk sewer recommended ; committee of aldermen and citizens formed to collect evidence ; proposal to discharge into the harbor ; editorial comment and recommendations, Vol. XIV., 587.

TOWLE, STEVENSON, C. E.

Bar Harbor, Maine : Abstract of report by, in conjunction with Wm. E. Worthen, on plans by E. W. Bowditch ; *one illustration*, Vol. XV., 261.

Mount Vernon, N. Y. : Abstracts of plan for sewerage of, Vol. V., 519 ; Vol. XII., 252.

TOWLE, STEVENSON, C. E.—(*Continued.*)

New York City : Notice of official report (as Engineer of Sewers) for 1885, Vol. XIII., 491.

TOWNS, SMALL : See *Small Towns* ; also *Villages*.

TREE ROOTS : See under *Pipe Sewers*.

TRENCH MACHINES : See *Carson's* under *Sewer Construction*.

TRENTON, N. J.:

American House case : a hotel claiming the right to empty sewage into small stream within the town ; decision of the Court of Errors and Appeals ; points established ; comments, Vol. XI., 515.

Estimated cost of sewerage one district : brief description of proposed works, Vol. VI., 132.

Plans and estimates for sewerage system solicited from engineers ; editorial comment, Vol. VIII., 304, 488.

Sewerage question : Opinion of the 'Trenton "State Gazette" that there is no engineer accessible who understands disposal by irrigation sufficiently in detail to give a complete plan ; editorial comment, (note), Vol. VII., 539.

TUB SYSTEM OF REMOVAL : See under *Disposal of Sewage*.

TUNNELS : See under *Sewer Construction*.

TURIN (Italy): Notice of report on sewerage of, Vol. XII., 274.

TYPHOID FEVER :

Germ or poison of : power of irrigation to destroy ; opinion of Mr. Latham (Baldwin?), citing case at Croydon in illustration ; (in review of paper by Chas. Watson Folkard on the Analysis of Potable Water), Vol. VI., 230.

Mortality from, effect of sewerage on : at Bunzlau, Vol. XIV., 587 ; at Frankfort and elsewhere, Vol. VI., 559.

TYPHOID FEVER—(*Continued.*)

Privy vaults and cess-pools, relation of, to : New Haven, Vol. IX., 192.

Sewer gas from street surface ventilators, attributed to, by Dr. Sedgwick Saunders, Vol. V., 522.

UNDERDRAINAGE : See under *Irrigation* under *Purification of Sewage*; also *Subsoil drainage* under *Separate system*; also *Ground Water*; also *Soil Drainage* under *Sewer Construction*.

UNDERGROUND RAILWAYS, SEWERS UNDER : London : Metropolitan : *two illustrations*, Vol. XIII., 585. Special difficulties encountered; *five illustrations*, Vol. XIII., 610. Reference only, with *five illustrations*, Vol. XIV., 9. *Four illustrations*, Vol. XIV., 129.

UTICA, N. Y. : Special case of sewer assessment decided invalid by the Court because of deviation in construction from ordinance authorizing contract, Vol. XV., 681.

UTILIZATION OF SEWAGE :

“ A B C ” process : See *Native Guano Co.*, below.

Agriculture :

Beddington, Eng. : Land in use for 25 years ; statistics, Vol. XIV., 199.

Berlin : Results very satisfactory, (Durand-Claye) ; crops raised, Vol. VI., 447 ; results not entirely satisfactory (official report), Vol. IX., 547.

Birmingham, Tame and Rea District, (Saltley farm) : Produce ; detailed financial exhibit, Vol. XIV., 500.

Bunzlau (in Silesia), Ger. : Begun in 1559 ; truck garden and meadow, with fruit trees, Vol. VIII., 418 (1st col.).

Carpenter, Dr. Alfred, experiments by, on rye-grass for sewage fields, with report of experience at Beddington ; yield, etc., Vol. XIV., 199. Abstract of argument by, for, Vol. XIV., 56.

UTILIZATION OF SEWAGE :

Agriculture—(*Continued.*)

- English experience in : extract from report of Mass. Drainage Commission ; *one illustration* (of filtration fields at Luton), Vol. XIII., 251, 297.
- Forfar, Scotland : profit from application to 26 acres ; (note), Vol. VI., 164.
- Galton, Douglas, C. B., on : notes on results at Bedford, Doncaster and Reading, Vol. VI., 561.
- Hodgson, J. S. : brief notice of paper by, on sewage farms, Vol. XI., 194.
- Los Angeles, Cal. : distributed by irrigating ditches to several farms (private ?), Vol. XV., 522 ; special farm proposed, Vol. XV., 490.
- Metropolitan Sewage Discharge Commission on, Vol. XI., 373.
- Paris : letting and selling price of the land ; crops ; receipts per acre, Vol. XIII., 375.
- Produce :
 - Artichokes : Paris, Vol. 375.
 - Beets : Berlin, Vol. VI., 447 ; Paris, Vol. XIII., 375.
 - Butter : Reading, Eng., Vol. V., 83.
 - Cabbage : Berlin, Vol. VI., 447 ; Paris, Vol. XIII., 375.
 - Carrots : Berlin, Vol. VI., 447.
 - Celery : Berlin, Vol. VI., 447.
 - Cereals : Beddington, Eng., Vol. XIV., 199 ; Birmingham, Vol. XIV., 500.
 - Chickory : Berlin, Vol. VI., 447.
 - Grass : Bunzlau, Vol. VIII., 418, (1st col.)
 - Ray : Berlin, Vol. VI., 447.
 - Rye : Experiments by Dr. Alfred Carpenter, with report of experience at Beddington, Eng., Vol. XIV., 199.
 - Italian : Birmingham, Vol. XIV., 500.

UTILIZATION OF SEWAGE :

Agriculture :

Produce—(*Continued.*)

Fruit : Berlin, Vol. VI., 447 ; Bunzlau, Vol. VIII., 418.

Garden truck : Birmingham, Vol. XIV., 500 ; Bunzlau, Vol. VIII., 418.

Kohl Rabi : Birmingham, Vol. XIV., 500.

Mangold crops : Beddington, Vol. XIV., 199 ; Birmingham, Vol. XIV., 500 ; Croydon (Norwood farm), Vol. XIV., 80.

Milk : Berlin, Vol. VI., 447 ; Birmingham, Vol. XIV., 500 ; Reading, Vol. V., 83.

Oats : Berlin, Vol. VI., 447.

Rape : Berlin, Vol. VI., 447.

Swedes : Birmingham, Vol. XIV., 500.

Tobacco : Berlin, Vol. VI., 447.

Pullman (Ills): Profitable, Vol. IX., 477. Reasons for alleged commercial success; (editorial), Vol. X., 360, (1st col.); Vol. XIV., 55. Charles Allen on the same, Vol. XVI., 121.

Reading, Eng.: Brief abstract of financial report, Vol. V., 83.

Saltley : See *Birmingham*.

Silos :

Robinson, Prof. Henry, on : brief description, Vol. X., 603.

Vawser, Robert, on advantages of, Vol. XII., 211.

Sludge : See under *Precipitation* under *Purification of Sewage*.

Southam, Eng.: brief description of field; cost, Vol. V., 17.

Stock raising : Birmingham : financial exhibit, Vol. XIV., 500. Paris : number of cows, Vol. XIII., 375.

Reading (Eng.) : brief financial exhibit, Vol. V., 83.

UTILIZATION OF SEWAGE :

Agriculture—(*Continued.*)

Stratford-on-Avon : brief description of field, Vol. XIII., 180.

Cess-pools, contents of : Florence (Italy) : method of removal ; storage tanks ; use by farmers, Vol. X., 243.

Excreta : (See also *Night Soil.*)

Poudrette :

Chemical treatment : Glasgow : after mixture with ashes etc., Vol. XI., 211. Rochdale : new process to be tried ; old a nuisance and expensive, Vol. VI., 373.

Evaporation after treatment with sulphuric acid : Augsburg (Bavaria) : profits, Vol. VII., 394. Birmingham, Vol. X., 193, 504.

Value of human : opinion of Bailey Denton and Chalmers Morton, Vol. XV., 570.

Metropolitan Sewage Discharge Commission (or Royal Commission of 1882) on profits from, Vol. XI., 350 ; on agriculture, Vol. IX., 373.

Native Guano Co., limited : (See also "*A B C*" *Process* under *Precipitation* under *Purification of Sewage*) : Suit of, against the Sewage Manure Co. for offering for sale as "Native Guano" a manure made from town sewage : indicative of commercial success in this method of utilization, Vol. XIV., 80. Notice of show of produce raised by use of "Native Guano" made from Aylesbury sewage, Vol. VI., 492.

Night-soil : D'Urban, Natal : by contract ; conversion into artificial manure ; methods ; cost, Vol. X., 243.

Osier-beds : Watford and Withington, Eng., at : (reference only), Vol. XIII., 63.

Profit from : Misleading statements regarding ; case of Pullman ; (editorial), Vol. XIV., 55. Evils of at-

UTILIZATION OF SEWAGE :

Profit from—(*Continued.*)

tempt to find ; (Robert Vawser), Vol. XII., 211.
Conclusions of Royal Commission on Pollution of
the Thames, Vol. XI., 350.

Robinson, Prof. Henry, on the value of sewage ; (quo-
tation in editorial on sewage disposal), Vol. XI., 451.

Slater, J. W., on : review of treatise by, Vol. XVII.,
202.

Sludge : See under *Precipitation* under *Purification of
Sewage.*

Steam boilers, in ; Proposed by "Local Government
Chronicle ;" comments, Vol. X., 580. Actual prac-
tice in South Staffordshire ; also for washing cast-
ings, Vol. XII., 350.

Wool grease : method of saponifying, Vol. XV., 166.

VAN VRANKEN'S FLUSH-TANK : See under *Tanks*
under *Flushing of Sewers.*

VAUTHIER, M., on the conditions under which the
Waring system might be partially applied to Paris, Vol.
VIII., 446.

VAWSER, ROBERT, C. E., on disposal of sewage ; evil
of seeking a profit in utilization ; silos and ensilage, Vol.
XII., 211.

VENICE : Description of sewage disposal, Vol. XII.,
348.

VENTILATION OF CESS-POOLS : Edward S. Phil-
brick, on, Vol. V., 388.

VENTILATION OF SEWERS :

Archimedean extractors used at Liverpool ; (reference
only), Vol. VI., 230.

Boulnois, H. Percy : reports wanted by, of results of
experiments, and facts in connection with the sub-
ject, Vol. XVI., 523.

VENTILATION OF SEWERS—(*Continued.*)

Carpenter, Dr. Alfred, on : remarks before the Sanitary Institute, Vol. V., 302.

Chimneys, by :

Bazalgette, Sir Joseph : result of experiments by, and opinion of, Vol. VI., 166.

Brighton (Eng.) : Satisfactory, Vol. VI., 166.

Discouraging results of experiments with : extracts from address by Joseph Gordon, Vol. XVII., 38.

Editorial criticism of plans proposed by physicians, Vol. VI., 67 ; Vol. XVI., 234.

English towns, number of, having sewers so ventilated, and general results, Vol. VIII, 87 ; Vol. XIII., 182.

Comstock & Jefferson's method : claim of patent ; *one illustration*, Vol. VI., 313.

Difficulties of : extract from address by Joseph Gordon : discouraging results from factory chimneys ; editorial comment, Vol. XVII., 38.

English towns : tabulated summary of practice in thirty-three, compiled by Alex. J. Turnbull, Vol. V., supplement to No. 3. Abstract of practice in sixty-one cities and boroughs, prepared by Engineer Routhwaite, of Sunderland, Vol. VIII., 87.

Explosions, by : method described by the "Lancet" ; editorial comment, Vol. XV., 397.

Fans, by : advocated by correspondent ; editorial comment, Vol. XVII., 121.

Furnaces or stoves in houses, by means of : plan proposed by the Hamilton (Ont.) "Evening Times" ; editorial criticism, Vol. VII.. 55, 198.

Holabird, Gen. S. A., on practical experience with small pipe sewers at San Francisco, Vol. IX., 44.

Liverpool (Eng.) : reference to methods and extent, Vol. VI., 230.

VENTILATION OF SEWERS—(*Continued.*)

London :

Methods employed : description, with comments by a "Journeyman Plumber," Vol. X., 362.

Metropolitan Board of Works : notice of report by committee of, with editorial comments, Vol. XIII., 487.

Shafts in chimney breasts and walls of houses, Vol. X., 240 ; Vol. XI., 479, 540.

Surface gratings ; complaints of nuisance from ; closure suggested, Vol. V., 512 ; closure of some effected, Vol. XI., 540.

Manholes, through : See *Surface Gratings*, below.

Montreal : Letter from Secretary of Board of Health, asking what method would be best for that city, Vol. XVII., 138 ; editorial comment on above ; advice to employ competent engineer, Vol. XVII., 129.

Movement of air in Sewers :

Chelsea, Mass., (pipe sewers) : observations by W. E. McClintock ; experiments to determine effect on house drain traps, of current caused by flushing, Vol. XVII., 167.

Munich : Summary of conclusions arrived at by Dr. Rozsahegyi from experiments in sewers of, Vol. V., 384. Continuation of experiments on same sewers on very cold days, by Dr. Soyka ; full abstracts, with comparison of the two series, Vol. VII., 76.

Pipe sewers :

Chelsea, Mass.: observations by City Engineer ; effect on house drain traps of air currents caused by flushing, Vol. XVII., 167.

San Francisco : "Some points from practical experience" at, by Gen. S. B. Holabird, U. S. A., Vol. IX., 44.

VENTILATION OF SEWERS—(*Continued.*)

Rain-water down-comers (or leaders), by : Carlisle, Eng., Vol. VIII., 87.

Rawlinson, Sir Robert, provides funds for compilation of information on the subject, Vol. XVI., 326, 515.

Rowan, Thomas, method recommended by, in "Disease and Putrescent Air" : criticism of, in review, Vol. XIII., 230.

Sandown, Eng.: Report by Prof. Henry Robinson on case of nuisance at, from surface gratings, cited by Mr. John Walter, M. P., and editorial comment (in reply to Mr. Walter—continued from Vol. IV., 554), Vol. V., 9.

Shafts attached to houses :

Bournemouth, Eng.: (and to trees), Vol. VII., 256.

English towns, in twenty-five, Vol. VIII., 87.

London ; *one illustration*, Vol. XI., 479, 540.

Shafts in chimney breasts and walls of houses : London, Vol. X., 240 ; Vol. XI., 540. 'Proposed for Brighton by Sir Joseph Bazalgette, Vol. VI., 166 ; editorial criticism, Vol. VI., 161.

Shafts in addition to perforated manhole covers : English towns in which successful and others in which not effective, Vol. VIII., 87 ; Vol. XIII., 87.

Shone, Isaac, on : Letter suggested by queries of Mr. John Walter, M. P., Vol. V., 103.

Soil pipes, through : (See also *Furnaces.*)

Hering, Rudolph, advocated by, in report on European sewerage systems ; editorial criticism, Vol. V. 246.

Laws, W. George, advocated by, in paper before Sanitary Institute ; editorial criticism, Vol. VI., 514.

Stratford's apparatus for ventilating and purifying ; patent claim ; *one illustration*, Vol. VI., 333.

VENTILATION OF SEWERS—(*Continued.*)

Surface gratings :

Chelsea, Mass.: Satisfactory, Vol., XV., 545.

London : Complaints of nuisance from ; typhoid fever and throat troubles attributed to this cause by Dr. Sedgwick Saunders ; closure suggested, Vol. V., 522 ; closure of some effected, Vol. XI., 540.

Sandown, Eng.: Nuisance caused by : report by Prof. Henry Robinson, showing probable cause of : editorial comment, Vol. V., 9.

Wind, by self-acting cowls through shafts on sides of houses : Experiments at Chelsea, Eng., reported by George Richardson Strachan in paper before Inst. C. E., Vol. XIV., 250. Proposed by Robert Parker ; editorial criticism, Vol. V., 180.

VENTILATION *VS.* FLUSHING : Reply to correspondent who thinks that " a liberal use of water will prevent the generation of sewer-gas," Vol. V., 98.

VILLAGES : (See also *Small Towns.*)

Disposal of sewage of : James Bateman on : irrigation, Vol. XV., 342.

Sewerage of : Proper method of beginning a movement to secure the (editorial) : Red Bank, N. J., Vol. IX., 239, 328. Plea for the ; editorial, Vol. XII., 345.

VIRCHOW, Prof. Rudolph : Abstract of paper by, on " Purification of Cities and the Employment of their Impurities," Vol. VIII., 33.

WALTER, J., M. P., continuation (from Vol. IV., 555) of editorial reply to, on ventilation of sewers through open gratings in streets, Vol. V., 9.

WALTHAM, Mass.: Brief notice of proposed disposal plans for, Vol. XIII., 232.

WALTHAMSTOW, Eng.:

Flushing of sewers: method recommended: gates in main sewers, Vol. VI., 325.

Separate system a failure at, Vol. VIII., 252.

Sludge pumps; *four illustrations*, Vol. XV., 138.

WARD'S FLEXIBLE PIPE JOINTS: See under *Sewer Construction*.

WARE, Eng.: Sewage farm at Hoddesdon; pollution of the river Lea by: report of action therefor; decision of the court, Vol. XIII., 416.

WARING, COL. GEORGE E., JR., C. E.:

Baumeister, Prof. R., criticism of paper by, Vol. VII., 583.

Binghamton, N. Y.: criticism of adopted plans of Rudolph Hering, Vol. VII., 460, 509.

Buffalo, N. Y.: Examination of routes for intercepting sewers; (note), Vol. VI., 206. Plans submitted to Council; size and estimated cost, Vol. VI., 373. To prepare specifications, Vol. VI., 398. Engaged as consulting engineer during construction, Vol. VII., 183.

Charleston, S. C., plans for sewerage of: résumé of scheme and estimates, Vol. IX., 387.

Keene, N. H., adopts plans prepared by: brief description, Vol. VI., 322. Doubt about completion of the system, Vol. VII., 346. Further descriptions, Vol. VIII., 208; Vol. IX., 124.

Kingston, Jamaica, report on sewerage of; (note), Vol. XVI., 296; abstract of, Vol. XVI., 327.

Manholes, opinion on the omission of numerous, Vol. XIV., 472 (1st col.).

New York City, on his proposed plan for the drainage of, Vol. V., 10; quotation from an article in "Scribner's Monthly" asserting the foul condition of present sewers, Vol. V., 426.

WARING, COL. GEORGE E., JR., C. E.—(*Continued.*)

Norfolk, Va.: Description of sewerage works designed by, Vol. VII., 155. Letter from, denying infringement of the West system patents, Vol. XV., 43. Syphon outlet for low district designed by ; description ; *three illustrations*, Vol. XV., 486.

Norristown, Pa., Insane Asylum : Large square flush tank used by, in irrigation works ; brief description, Vol. XIII., 160.

Patents granted to :

Separate system of sewerage : claims of, with consideration of that relating to automatic flush tanks, showing what would constitute an infringement ; (editorial), Vol. IX., 546 ; letter from, in reference to above, Vol. IX., 572.

Sewering and Draining Towns : brief and claim ; *one illustration*, Vol. VIII., 2d page of Supplement to No. 16.

Philadelphia : Sewerage and Drainage : Extracts from report on, for Census Office, Vol. VI., 24. Requested to examine and report suggestions for its improvement ; (note), Vol. VI., 180.

Washington, D. C.: criticism of his suggestions for the sanitary drainage of, Vol. V., 342. Letter from, replying to above criticism, Vol. V., 404.

Worcester, Mass.: Plan for purification of sewage of, Vol. V., 498. Notice of letter from, to Massachusetts State Board of Health, taking exception to their criticism of his plan, Vol. VI., 29.

“WARING SEWERAGE SYSTEM :”

Baumeister, Prof. R., on, Vol. VII., 506.

De Meijer, Dr. van Overbeek, on, Vol. IX., 236.

Dubuque, Iowa : Recommended for adoption by Sewerage Committee of City Council, Vol. VIII., 231.

“WARING SEWERAGE SYSTEM”—(*Continued.*)

Hering, Rudolph, on, Vol. XVI., 739.

Memphis : See *Memphis* above.

New York State Board of Health urges adoption of, for village of Bath ; editorial criticism, Vol. IX., 611.

Norfolk, Va.: Description by J. H. Humphreys, Vol. VII., 155. Sub-soil drainage, Vol. VII. 247.

Omaha (Neb.) : City Engineer's report on the operation, Vol. IX., 547 ; Vol. XV., 687.

Paris, to be tried in a section of, Vol. VII., 303. “ Note on the conditions under which it might be partially applied to,” Vol. VIII., 446.

Patent and claim for royalty on : See *Patent and Royalty* under *Separate System*.

Rawlinson, Sir Robert on, Vol. V., 451 ; Vol. XVI. 737.

Rosewater, Andrew, on, Vol. IX., 547 ; Vol. XV., 687. Reference to controversy with Colonel Waring in regard to, Vol. XVI., 66.

WARRINGTON, PROF. R.: Abstract of paper before British Medical Association on Nitrification, Vol. XI., 105.

WARRINGTON, ROBERT, on purification of sewage by irrigation, Vol. V., 498.

WASHINGTON (D. C.):

Drainage : Introduction : Brief history and effect on death-rate, Vol. V., 299. Criticism of plans proposed by Gustavus Karweise and Benjamin Severson, Vol. V., 319. Criticism of District Engineers' plan and suggestions by Col. George E. Waring, Jr., Vol. V., 342 ; letter from Colonel Waring replying to above criticism, Vol. V., 404. General discussion of above mentioned plans, Vol. V., 364.

WASHINGTON, D. C.—(*Continued.*)

Georgetown, old sewers in : description of construction and present condition, Vol. V., 544.

Outlet sewer through old canal : size, length, cost ; (note), Vol. V., 521.

Sewerage : Defective condition ; (reference only), Vol. V., 299. Report of Lieutenant Hoxie for 1880-81 ; review, Vol. V., 19 ; report of Capt. R. L. Hoxie for 1882-83 ; review ; proposed plan of sewer assessment ; pipe sewers in cement, Vol. IX., 191.

Sewer Department, establishment of ; appointment of David McComb as engineer, Vol. XV., 463.

WATERBURY, Conn. : Plans for sewerage procured from Eliot C. Clarke and Rudolph Hering ; the latter's plans recommended for adoption ; brief description of same, Vol. VI., 423. Description, by F. Floyd Weld, City Engineer, of sewers constructed after above plans ; *eight illustrations*, Vol. X., 51. Description of receiving and catch basins ; *four illustrations*, Vol. XVI., 151.

WATER COURSES, small natural, as sewers : See *Brooks*.

WATER POWER OF SEWAGE, utilization of :

Boston Main Drainage works ; (temporary), Vol. XII., 148.

Cincinnati, (Walnut Hills) : proposed ; (note), Vol. VII., 539.

Salford, Eng. : in purification works, Vol. X., 220.

WATER SUPPLY, PUBLIC : Construction of sewers before introduction of, held to be unnecessary by Dr. Alfred Carpenter ; editorial criticism, Vol. XVI., 199. Proposed introduction of water in streets not sewered, in Cincinnati ; editorial criticism, Vol. VI., 519.

WATFORD, Eng. : Irrigation on horizontal terraces, and osier beds ; (note), Vol. XIII., 63.

WEDNESBURY, Eng.: Scheme by local authorities to unite four districts in South Staffordshire in one system and purify the sewage; (note), Vol. VII., 221.

WEIRS: for storm-water overflow. See *Storm-water Overflow* under *Sewer Construction*; for purifying sewage by aëration, see under *Aëration* under *Purification of Sewage*.

WELLS: "Drying up" or loss of water from, by sewer construction: See *Soil Drainage* under *Sewer Construction*.

WEST SEWERAGE SYSTEM: See under *Norfolk*.

WEST TROY, N. Y.: Opposition to proposed sewerage system, Vol. XI., 378. Appointment of Commissioners of Sewers, Vol. XIII., 473.

WHITLOCK, F. H., C. E., on sewer assessments, Vol. XIV., 105.

WICHITA, Kan.: Sewerage plans by Rosewater and Christie; brief description, Vol. XVII., 302.

WILLIAMS, BENEZETTE, C. E.:

Chicago Drainage and Water Supply Commission, appointed Consulting Engineer on, Vol. XIV., 424.

Pullman, Ill.: Brief description by, of sewerage works of, Vol. VI., 206.

Separate *vs.* combined system, on: abstract of paper before Western Society of Engineers, Vol. XI., 413; letter replying to Rudolph Hering's criticism on the above, Vol. XI., 460.

WILLOW TREES ON SEWAGE FARMS: Bowden, Eng., about to be tried at; 8 acres, Vol. XI., 328.

WILMINGTON, Del.: Defective condition of sewers; (reference in review of Board of Health report), Vol. V., 541. Rudolph Hering employed to report on sewerage system, Vol. VII., 202; objection by a citizen to said employment on ground of Mr. Hering's non-residency and non-approval of leaching cess-pools, Vol. VII., 370.

WINNIPEG, Manitoba : Steps toward securing a sewerage system, Vol. V., 159.

WITHINGTON, Eng.: Filtration and osier beds ; cost of preparation per acre, etc.; (note), Vol. XIII., 63.

WOODEN SEWERS : See under *Sewer Construction*.

WOOL GREASE : See under *Utilization of Sewage*.

WORCESTER, MASS.:

Asylum for the insane at : Irrigation disposal at, quoted as good illustration of how near habitation that method may be used without offense, Vol. V., 426.

Disposal of city's sewage : Controversy over pollution of Blackstone River and means of preventing ; State Board of Health Commission nearly ready to report ; city preparing to oppose any plan involving large expense, Vol. V., 13. Legislative hearing on bill to restrain the city from further pollution : abstract of report of evidence and arguments ; editorial comment on the proposed bill ; plan of purification recommended by Col. George E. Waring, Jr.; plan proposed by State Board of Health Commission ; editorial comment on another bill, Vol. V., 498. The case again before the Legislature ; (note), Vol. IX., 503. Consideration by the State Drainage Commission, Vol. X., 432, 487. Precipitation recommended by City Engineer Allen, Vol. XV., 551 ; Vol. XVI., 121.

WORTHEN, WILLIAM E., C. E.: Abstract of report by, in conjunction with Stevenson Towle, on E. W. Bowditch's plans for sewerage of Bar Harbor, Me.; *one illustration*, Vol. XV., 261.

YONKERS, N. Y.: Sewerage question : Offensive condition of sewers complained of, Vol. V., 108. Discussion at public hearing by State Board of Health, Vol. VI., 262. Causes of delay in constructing sewers, Vol. VII., 56. Recommendation of Board of Health that the question be

YONKERS, N. Y.—(*Continued.*)

referred to the people to decide by ballot ; editorial criticism, Vol. VII., 322. Decision of Aldermen not to submit to popular vote but to give public hearing, Vol. VII., 371. Board of Health urges immediate action, Vol. VIII., 135. Plans approved by Common Council and bids received but Aldermen refuse to award contract, Vol. IX., 239. Continued delay; editorial comment, Vol. XII., 187. Necessity for sewer construction argued by the "Statesman;" (note), Vol. XII., 248. Advocacy of sewers by the "Gazette," Vol. XII., 308.

YORK, Eng.: Defective condition of sewers, Vol. XII., 213. Prizes offered for best scheme of sewerage ; (note), Vol. XIII., 32.

The Engineering and Building Record, established in 1877 by its present proprietor and editor, has devoted itself to MUNICIPAL AND DOMESTIC ENGINEERING and the work closely related to the former, of IMPROVING RIVERS AND HARBORS, while it makes brief reference to progress in other branches. To the engineer interested in River and Harbor Improvements, in Docks, in Bridges and Metal construction, in Sewerage, Water-Supply, Pavements, Public Lighting and City Railways, both surface and elevated, and to the architect interested in the problems of Building Construction, Plumbing, Drainage, Heating, Lighting, Ventilation, Elevator and Pneumatic service, this journal should be indispensable. Though giving prominence to practical questions with which the architect and engineer have to deal, it gives every week special Architectural Illustrations, selected by critics and prepared by skilled artists at its own expense; of subjects not elsewhere published, that are intended to be interesting and suggestive to the architectural designer.

Its weekly record of Projected Engineering and Building Undertakings is very complete, covering every portion of the country, secured mainly from special correspondents, and containing important items each week not elsewhere published. Advertisements for proposals regularly appear in its columns from the different departments of the United States Government, and from various municipal and private corporations.

THE ENGINEERING AND BUILDING RECORD,

Prior to 1887, THE SANITARY ENGINEER,

Conducted by HENRY C. MEYER.

DEVOTED TO

ENGINEERING AND ARCHITECTURE

OF SPECIAL INTEREST TO

*Engineers, Architects, Builders, Contractors,
Mechanics, and Municipal Officers.*

The Treatment of Municipal Problems a Prominent Feature.

"It has been of incalculable value to the general public, whose interest it has always served."—*Cincinnati Commercial*.

"It may be regarded as the representative paper devoted to Architecture and Engineering."—*Boston Herald*.

"It stands as a fine example of clean and able journalism."
—*Railroad Gazette*.

"A paper whose excellence and independence merit continued prosperity."—*Railroad and Engineering Journal*.

"Congratulate it upon the enviable position it has attained."
—*American Machinist*.

"1239 VERMONT AVENUE, WASHINGTON, D. C., }
January 9, 1888.

"I have looked at the Index of Volume XVI. It is a marvelous list of knowledge made accessible to the profession at small cost to each subscriber. I congratulate you upon producing for the Building trade one of the most copious and valuable instructors in safe and sanitary building science in all branches ever published.

Faithfully yours,
"M. C. MEIGS."

Published Saturdays at 277 Pearl Street, New York.

\$4 PER YEAR.

10c. PER COPY.

TO those charged with the construction of a large Building of any kind, a Public institution, a Bridge, a Water-Works, Sewerage, Gas or Electric-lighting system, Pavements, or require any work done, it is suggested that they consider the desirability of advertising for proposals for the work and material in **THE ENGINEERING AND BUILDING RECORD**, which makes a speciality of publishing information that is valuable to contractors, a class of business men among whom it circulates in every part of the United States and Canada, and who look to its columns regularly for news that suggests to them possible business.

If any cause induces the restriction of competition to home parties entirely, the practice of some municipalities which advertise such matters in local papers only will be followed. If, on the other hand, it is your desire to obtain the best possible results by reaching parties in every part of the United States and Canada whose special business it is to do any form of contracting work, and who are familiar with most modern methods, you will follow the course first suggested above. While the original outlay to do so is a mere trifle, the experience of others shows that the return in suggestions, advice, first-class workmanship, etc., as a result of large facilities and special adaptability—not to speak of possible advantages in prices obtained—will prove a handsome investment. The various departments of the United States Government, Municipal Authorities, Water-Works, Building Committees, and others intrusted with Public Work, thus use our columns each week.

The rate is 20 cents per line (about 8 words to the line).

THE ENGINEERING & BUILDING RECORD,

PRIOR TO 1887, THE SANITARY ENGINEER.

DEVOTED TO ENGINEERING, ARCHITECTURE CONSTRUCTION AND SANITATION.

MUNICIPAL ENGINEERING A PROMINENT FEATURE.

PUBLISHED SATURDAYS AT NO. 277 PEARL STREET, NEW YORK

\$4 per year. 10 cents per copy. Sold all newsdealers.

Some Details of Water-Works Construction.

By W. R. BILLINGS, Superintendent of Water-Works at Taunton, Mass.
WITH ILLUSTRATIONS FROM SKETCHES BY THE AUTHOR.

INTRODUCTORY NOTE.

Some questions addressed to the Editor of *The Engineering and Building Record* and *The Sanitary Engineer* by persons in the employ of new water-works indicated that a short series of practical articles on the Details of Constructing a Water-Works Plant would be of value; and, at the suggestion of the Editor, the preparation of these papers was undertaken for the columns of that journal. The task has been an easy and agreeable one, and now, in a more convenient form than is afforded by the columns of the paper, these notes of actual experience are offered to the water-works fraternity, with the belief that they may be of assistance to beginners and of some interest to all.

TABLE OF CONTENTS.

CHAPTER I.—MAIN PIPES—

Materials—Cast-Iron—Cement-Lined
Wrought Iron—Salt-Glazed Clay—
Thickness of Sheet Metal—Methods of
Lining—List of Tools—Tool-Box—
Derrick—Calking Tools—Furnace—
Transportation—Handling Pipe—Cost
of Carting—Distributing Pipe.

CHAPTER II.—FIELD WORK—

Engineering or None—Pipe Plans—
Special Pipe—Laying out a Line—
Width and Depth of trench—Time-
Keeping Book—Disposition of Dirt—
Tunneling—Sheet Piling.

CHAPTER III.—TRENCHING AND PIPE-LAYING—

Caving—Tunneling—Bell-Holes—
Stony Trenches—Feathers and Wedges
—Blasting—Rocks and Water—
Laying Cast-Iron Pipe—Derrick Gang
—Handling the Derrick—Skids—Ob-
structions Left in Pipes—Laying Pipe
in Quicksand—Cutting Pipe.

CHAPTER IV.—PIPE-LAYING AND JOINT-MAKING—

Laying Cement-Lined Pipe—"Mud"
Bell and Spigot—Yarn—Lead—
Jointers—Roll—Calking—Strength of
Joints—Quantity of Lead.

CHAPTER V.—HYDRANTS, GATES, AND SPECIALS—

CHAPTER VI.—SERVICE PIPES—

Definition—Materials—Lead vs.
Wrought Iron—Tapping Mains for
Services—Different Joints—Compres-
sion Union—Cup.

CHAPTER VII.—SERVICE-PIPES AND METERS—

Wiped Joints and Cup-Joints—The
Lawrence Air-Pump—Wire-drawn Sol-
der—Weight of Lead Service-Pipe—
Tapping Wrought-Iron Mains—Ser-
vice-Boxes—Meters.

HANDSOMELY BOUND IN CLOTH.

Sent (post-paid) on receipt of \$2.00. Address,

BOOK DEPARTMENT, THE ENGINEERING AND BUILDING RECORD,
277 Pearl Street, New York.

COMMITTEES intrusted with the erection of Public Buildings or the Construction of any Engineering Works, should advertise for proposals in *The Engineering and Building Record*. They will reach Contractors in every State and Territory, likewise in Canada. The advantage of competition thus secured is obvious.

CONTRACTORS for Municipal and Government Work and Manufacturers of Engineering and Building Supplies will find every week in the Proposal advertisements and Contracting News columns of THE ENGINEERING AND BUILDING RECORD important items indicating the wants of U. S. Government, Municipal Authorities, Water Companies, and Building Committees of Public Buildings. Information will be found there each week not elsewhere published.

WATER-WASTE PREVENTION:

Its Importance and the Evils Due to its Neglect.

With an account of the Methods adopted in various Cities in Great Britain and the United States.

By HENRY C. MEYER, Editor of the THE ENGINEERING & BUILDING RECORD.

With an Appendix.

EXTRACT FROM PREFACE.

During the summer of 1882 the Editor of THE SANITARY ENGINEER carefully investigated the methods employed in various cities in Great Britain for curtailing the waste of water without subjecting the respective communities to either inconvenience or a limited allowance. The results of this investigation appeared in a series of articles entitled "New York's Water-Supply," the purpose being to present to the readers of THE SANITARY ENGINEER such facts as would stimulate public sentiment in support of the enforcement of measures tending to prevent the excessive waste of water so prevalent in American cities, and especially the city of New York, which was then suffering from a short supply. Numerous requests for information, together with the recent popular agitation in connection with a proposition to increase the powers of the Water Department of New York City with a view to enabling it to restrict the waste of water, have suggested the desirability of reprinting these articles in a more convenient and accessible form, with data giving the results of efforts in this direction in American cities since the articles first appeared, so far as they have come to the author's notice.

TABLE OF CONTENTS:

- | | |
|--|--|
| CHAPTER I.—CONDITION OF NEW YORK'S WATER-SUPPLY. —Mr. Thomas Hawksley on Advantages of Waste-Prevention; Condition of Water-Supply in England Thirty Years Ago; Means Adopted to Prevent Waste in Great Britain; Norwich the First City in England to Adopt Measures of Prevention; London: the Practice There. | CHAPTER VI.—NEW YORK. —Measures Adopted by the Department of Public Works prior to 1882. |
| CHAPTER II.—GLASGOW. —District Meters Tried as an Experiment; Results of Experiments; Prevalence of Defective Fittings; Testing and Stamping of Fittings; Rules Governing Plumbers' Work. | CHAPTER VII.—GENERAL CONCLUSIONS. —Points to be considered in Adopting Measures for Large Cities. |
| CHAPTER III.—MANCHESTER. —History of Waste-Prevention Measures; Methods of House-to-House Inspection; Duties of Inspectors; Methods of Testing and Stamping Fittings. | APPENDIX.—POINTS SUGGESTED IN THE CONSIDERATION OF VARIOUS METHODS. —Water-Waste Prevention in Boston in 1883 and 1884; Results Attained; Waste-Prevention in New York City. Liverpool Corporation Water-Works Regulations; Glasgow Corporation Water-Works Regulations; Description of Standard Fittings; Penalties for Violations; Cistern vs. Valve-Supply to Water-Closets in New York City; New York Board of Health Regulations concerning Water-Supply to Water-Closets; Letters from Water-Works Authorities sustaining the action of the New York Board of Health in Requiring Cistern-Supply to Water-Closets; Extracts from Report of Boston City Engineer on Wasteful Water-Closets; Proposed Water-Rates on Water-Closets in New York; Resolutions of the New York Board of Health endorsing the proposed Water-Rates for Water-Closets; Excerpts from Articles explaining Methods of Arranging Water-Supply to Water-Closets to secure the Minimum Water-Rate in New York (with illustrations). |
| CHAPTER IV.—LIVERPOOL. —Change from Intermittent to Constant Supply; Method of Ascertaining Locality of Waste by Use of District Meters; Method of House Inspection; Method of Testing Fittings. | |
| CHAPTER V.—PROVIDENCE AND CINCINNATI. —Review of Measures to Prevent Water-Waste in the United States prior to 1882; Providence, R. I.: Results following the General Use of Meters; Cincinnati: Methods of House Inspection with the Aid of the Water-phonc; Results Attained. | |

Large 8vo. Bound in Cloth, \$1.00.

* * * Sent post paid on receipt of price. Address,

BOOK DEPARTMENT,
THE ENGINEERING AND BUILDING RECORD,

No. 277 Pearl Street, New York.

WATER-WASTE PREVENTION.

By HENRY C. MEYER, Editor of the THE ENGINEERING & BUILDING RECORD.

PRESS COMMENTS.

"Mr. Meyer is competent authority to speak on a subject of very great importance in all cities and one regarded with too much apathy by the public. Furthermore he has given the matter special study, and the facts detailed are the results of investigation. * * * His suggestions are eminently practicable and sensible, and should commend themselves to the judgment of every one interested in the subject."—*Troy Times*.

"The economies of this subject deserve the steady attention of tax-payers and municipal officers. It should be borne in mind that waste of water is more than prodigal. It is dangerous to the safety of a city."—*Cincinnati Commercial Gazette*.

"The author of this timely book is particularly adapted to deal with the questions he discusses. But few have given the subject so much attention, and no one could treat it more impartially. He is not only intimately acquainted with the water-supply of American cities, but has personally investigated the plans adopted for curtailing water-waste in various cities in Great Britain, the results of these investigations appearing in this work.

"As our cities increase in population, and new cities spring up, the demand for more water correspondingly increases. At the same time the water-supply is diminishing, and that which would otherwise be available is rendered unfit for use by the contamination of sewage and the refuse of manufactories. It is conceded that the inhabitants of a city should be supplied with all the water they can use. It is not with the use, but with the waste of water that the author deals.

"No patented appliances are recommended, but such simple means as are free to all. We recommend the careful reading of this little book to every resident of a city who is interested in its water-supply, and particularly to those who, by virtue of vested authority, have to some extent the matter of water-waste prevention in their hands."—*American Machinist*.

"A valuable work, which really affects every urban resident. * * * There is not a city in the world in which the rate-payers are not taxed unnecessarily to pay for pumping water which runs to waste, and any work throwing light upon this problem, without subjecting the community as a whole to inconvenience, must be a valuable treatise."—*Ottawa Daily Press*.

"A little work whose worth cannot be justly estimated. * * * It presents an interesting subject for examination and reflection to every citizen."—*Houston Post*.

"A work that should be read and studied by every one."—*Savannah News*.

"Though small in size it is a work which represents a good deal of solid work. With the amount of information which it contains it ought to prove of no small use to the city governments of the country. It is a *vade mecum* for water-commissioners, and will be a valuable little text-book for every water board in America. Briefly, Mr. Meyer's object is to show by a comparison between the systems and results in different cities in America and England how much money is annually wasted in the shape of water in our larger cities for the want of proper precautions and how those precautions had best be taken. * * * Mr. Meyer's book is well got up, his arguments concisely stated, and his facts and figures well tabulated and arranged, the result being the production of a work which carries conviction with it, and which ought to be of no small value to the larger cities of the country in the future."—*Minneapolis Tribune*.

"This volume is a most seasonable contribution to hydraulic and economic literature. Its author has personally and carefully investigated the problem from a practical standpoint in both England and America, and speaks with authority and backs his statements by official figures.

"The work treats generally of the condition of the water-supply of New York, and the methods tested or adopted for the prevention of waste in Glasgow, Manchester, and Liverpool, and in our own cities of Providence, Cincinnati, Boston, and New York. The data are derived from the most authoritative sources, and presented in a shape that must carry conviction with it."—*Engineering News*.

"Once get a property-owner convinced of the evils of water-waste, and this book will tell him all he wants to know about preventing it."—*Philadelphia Bulletin*.

"One of the best and most useful publications now before the public. * * * A copy of this timely publication ought to be in the hands of all water company and city officials and plumbers, and even water consumers might read it with profit."—*Memphis Appeal*.

"It is worthy of close attention. Mr. Meyer discloses the true spirit of the disinterested investigator."—*Hartford Evening Post*.

"As a brief, concise treatise upon this subject the work is of the utmost value, the author making no unproven assertions, but bringing the systems and experiences of other cities to illustrate and enforce his statements. In giving this book to the public the author is deserving of praise as a true and practical economist, whose efforts will be appreciated by thinking men, if not by the public at large."—*Inland Architect and Builder*.

Boo., bound in cloth, \$1.00. Sent post-paid on receipt of price.

Address, BOOK DEPARTMENT,
THE ENGINEERING AND BUILDING RECORD,

P. O. Box, 3037.

No. 277 Pearl Street, New York.

Obtainable at London Office, 92 and 93 Fleet Street, for 5s.

SECOND EDITION.

Plumbing and House-Drainage Problems;

OR,

Questions, Answers, and Descriptions from THE SANITARY ENGINEER.

With 142 Illustrations.

[FROM THE PREFACE.]

“A feature of THE SANITARY ENGINEER is its replies to questions on topics that come within its scope, included in which are Water-Supply, Sewage Disposal, Ventilation, Heating, Lighting, House-Drainage, and Plumbing. Repeated inquiries concerning matters often explained in its columns suggested the desirability of putting in a convenient form for reference a selection from its pages of questions and comments on various problems met with in house-drainage and plumbing, improper work being illustrated and explained as well as correct methods. It is therefore hoped that this book will be useful to those interested in this branch of sanitary engineering.”

TABLE OF CONTENTS :

DANGEROUS BLUNDERS IN PLUMBING.

Running Vent-Pipe in Improper Places—Connecting Soil-Pipes with Chimney-Flues—By-Passes in Trap-Ventilation, etc. *Illustrated.*
A Case of Reckless Botching. *Illustrated.*
A Stupid Multiplication of Traps. *Illustrated.*
Plumbing Blunders in a Gentleman's Country House. *Illustrated.*
A Trap Made Useless by Improper Adjustment of Inlet and Outlet Pipes. *Illustrated.*
Unreliability of Heated Flue as a Substitute for Proper Trapping. *Illustrated.*
Need of Plans in Doing Plumbing-Work.

HOUSE-DRAINAGE.

City and Country House-Drainage—Removal of Ground-Water from Houses—Trap-Ventilation—Fresh-Air Inlets—Drain-Ventilation by Heated Flues—Laying of Stoneware Drains. Requirements for the Drainage of Every House. Drainage of a Saratoga House. *Illustrated.*
Ground-Water Drainage of a Country-House. *Illustrated.*
Ground-Water Drainage of a City House. *Illustrated.*
Fresh-Air Inlets.
The Location of Fresh-Air Inlets in Cities. *Illustrated.*
Fresh-Air Inlets. *Illustrated.*
Air-Inlets on Drains.
The Proper Way to Lay Stoneware Drains.
Risks Attending the Omission of Traps and Re-lying on Drain-Ventilation by Flues. *Illustrated.*
The Tightness of Tile-Drains
Danger of Soil-Pipe Terminals Freezing unless Ends are without Hoods or Cows.
Objection to Connecting Bath-Waste with Water-Closet Trap.
How to Adjust the Inlets and Outlets of Traps. *Illustrated.*
How to Protect Trap when Soil-Pipe is used as a Leader.
Size of Ventilating-Pipes for Traps.
How to Prevent Condensation Filling Vent-Pipes.
Ventilating Soil-Pipes.
How to Prevent Accidental Discharge into Trap Vent-Pipe.
Why Traps should be Vented.

MISCELLANEOUS.

Syphoning Water through a Bath-Supply. *Illustrated.*
Emptying a Trap by Capillary Attraction. *Illustrated.*
As to Safety of Stop-Cocks on Hot Water Pipes.
How to Burnish Wiped Joints.
Admission to the New York Trade Schools.
Irregular Water Supply. *Illustrated.*
Hot Water from the Cold Faucet, and how to Prevent it. *Illustrated.*
Disposal of Bath and Basin Waste Water.
To Prevent Corrosion of Tank Lining.
Number of Water Closets Required in a Factory.
Size of Basin Wastes and Outlets.
Tar Coated Water Pipe Affect Taste of Water.
How to Deal with Pollution of Cellar Floors.
How to Heat a Bathing Pool.
Objections to Galvanized Sheet Iron Soil Pipe.
To Prevent Rust in a Suction Pipe.
Automatic Shut Off for Gas Pumping Engines when Tank is Full. *Illustrated.*
Paint to Protect Tank Linings.
Vacuum Valves not always Reliable.
Size of Water Pipes in a House.
How to Make Rust Joints.
Covering for Water Pipes.
Size of Soil Pipe for an ordinary City House.
How to Construct a Sunken Reservoir to Hold Two Thousand Gallons.
Where to Place Burners to Ventilate Flues by Gas Jets. *Illustrated.*
How to Prevent Water Hammer.
Why a Hydraulic Ram does not Work.
Air in Water Pipes.
Proper Size of Water Closet Outlets.
Is a Cement Floor Impervious to Air?
Two Traps to a Water Closet Objectionable.
Connecting Bath Wastes to Water Closet Traps. *Illustrated.*
Objections to Leaching Cesspool and need of Fresh Air Inlet.
The Theory of the Action of Field's Syphon.
How to Disinfect a Cesspool.
Drainage into Cesspools.
Slabs for Pantry Sinks—Wood vs. Marble.
Test for Well Pollution.
Cesspool for Privy Vault.

PLUMBING AND HOUSE-DRAINAGE PROBLEMS.

Corrosion of Lead Lining.
Size of Flush Tank to deal with Sewage of a Small Hospital.

Details of the Construction of a House-Tank. *Illustrated.*

The Construction of a Cistern under a House. To Protect Lead Lining of a Tank, and Cause of Sweating.

Stains on Marble.

Lightning Strikes Soil Pipes.

Will the Contents of a Cesspool Freeze?

Bad Tasting Water from a Coil. *Illustrated.*

How to Fit Sheet Lead in a Large Tank.

Why Water is "Milky" When First Drawn.

Material for Water Service Pipes.

Carving Tables. *Illustrated.*

Is Galvanized Pipe Dangerous for Soft Spring Water.

How to Arrange Hush Pipes in Cisterns to Prevent Syphoning Water Through Ball Cock.

Depth of Foundations to Prevent Dampness of Site.

Where to Place a Tank to get Good Discharge at Faucet.

Self Acting Water Closets. *Illustrated.*

Wind Disturbing Seal of Trap.

How to Draw Water from a Deep Well.

Cause of Smell of Well Water.

Absorption of Light by Gas Globes.

Defective Drainage. *Illustrated.*

Fitting Basins to Marble Slabs. *Illustrated.*

Intermediate Tanks for the Water Supply of High Buildings. *Illustrated.*

How to Construct a Filtering Cistern. *Illustrated.*

Objections to Running Ventilating Pipe Into Chimney-Flue.

Size of Water Supply Pipe for Dwelling House.

Faulty Plan of a Cesspool. *Illustrated.*

Connecting Refrigerator Wastes with Drains. *Illustrated.*

Disposing of Refrigerator Wastes. *Illustrated.*

Pumping Air From Water Closet into Tea Kettle as Result of Direct Supply to Water Closets. *Illustrated.*

Danger in Connecting Tank Overflows with Soil Pipes.

Arrangement of Safe Wastes. *Illustrated.*

The kind of Men Who do not Like the *Sanitary Engineer*

What is Reasonable Plumbers' Profit.

HOT WATER CIRCULATION IN BUILDINGS.

Bath Boilers. *Illustrated.*

Setting Horizontal Boilers. *Illustrated.*

How to Secure Circulation Between Boilers in Different Houses. *Illustrated.*

Connecting One Boiler with Two Ranges. *Illustrated.*

Taking Return Below Boiler. *Illustrated.*

Trouble with Boiler.

An Ignorant Way of Dealing with a Kitchen Boiler. *Illustrated.*

Returning into Hot Water Supply Pipe. *Illustrated.*

Where should Sediment Pipe from Boiler be connected with Waste-Pipe?

Several Flow Pipes and one Circulation Pipe. *Illustrated.*

How to Run Pipes from Water Back to Boiler. *Illustrated.*

Hot Water Circulation when Pipes from Boiler pass under the Floor. *Illustrated.*

Heating a Room from Water Back.

The Operation of Vacuum and Safety Valves. *Illustrated.*

Preventing Collapse of Boilers.

Collapse of a Boiler. *Illustrated.*

Explosion of Water Backs.

A Proposed Precaution against Water Back Explosions. *Illustrated.*

The Bursting of Kitchen Boilers and Connecting Pipes. *Illustrated.*

Giving out of Lead Vent Pipes from Boilers in an Apartment House. *Illustrated.*

Connecting a Kitchen Boiler with One or More Water Backs. *Illustrated.*

New Method of Heating Two Boilers by One Water Back. *Illustrated.*

Plan of Horizontal Hot Water Boiler. *Illustrated.*

HOT WATER SUPPLY IN VARIOUS BUILDINGS.

Kitchen and Hot Water Supply in the Residence of Mr. W. K. Vanderbilt, New York. *Illustrated.*

Kitchen and Hot Water Supply in the Residence of Mr. Cornelius Vanderbilt, New York. *Illustrated.*

Kitchen and Hot Water Supply in the Residence of Mr. Henry G. Marquand, New York. *Illustrated.*

Kitchen and Hot Water Supply in the Residence of Mr. A. J. White. *Illustrated.*

Hot Water Supply in an Office Building. *Illustrated.*

Kitchen and Hot Water Supply in the Residence of Mr. Sidney Webster. *Illustrated.*

Plumbing and Water Supply in the Residence of Mr. H. H. Cook. *Illustrated.*

Large 8vo. cloth, \$2.00.

Address,

BOOK DEPARTMENT,

THE ENGINEERING AND BUILDING RECORD,

No. 277 Pearl Street, New York.

A COLLECTION OF DIAGRAMS
 Representing the General Plan of
Twenty-Six Different Water-Works,
 Contributed by Members of the
NEW ENGLAND WATER-WORKS ASSOCIATION,
 And Compiled by a Committee.
 1887.

INTRODUCTION.

OFFICE OF SECRETARY,
 NEW BEDFORD, MASS., November 1, 1887.

THIS collection of diagrams is the result of the persistent efforts of Messrs. William B. Sherman, of Providence, R. I., and Walter H. Richards, of New London, Conn., who, as a Committee on Exchange of Sketches, have secured these drawings from members of the Association. The following extract from a report presented by these gentlemen at the Manchester, N. H., meeting in June, 1887, will explain in part the origin of the collection:

“ In answer to circular letters sent out to members, there were received rough sketches of general plans of twenty-three water-works represented in the Association. Having this data on hand, though crude in many particulars, it was decided to put the same into available shape for the benefit of the members. This has been accomplished by the Committee without cost to the Association. From these rough sketches—revised, reduced to uniform size of 10 by 15 inches—a set of tracings has been made, and a sample folio of blue prints prepared. This folio and set of tracings are herewith presented as forming the main part of this report.”

Since the Manchester meeting three more subjects have been received and subscriptions for sets of reproductions from the tracings have been called for. The ready response to the call is evidence of the value of the Committee's work, and arrangements were made with *The Engineering & Building Record* for publication in this present form.

R. C. P. COGGESHALL,
 Secretary, New England Water-Works Association.

Published by THE ENGINEERING & BUILDING RECORD.

INDEX.

PLATE I.—Boston, Mass. “ II.—Burlington, Vt. “ III.—Cambridge, Mass. “ IV.—Fall River, Mass. “ V.—Fitchville, Mass. “ VI.—Knoxville, Tenn. “ VII.—Lawrence, Mass. “ VIII.—Manchester, N. H. “ IX.—Meriden, Conn. “ X.—Middletown, Conn. “ XI.—Milford, Mass. “ XII.—Nantucket, Mass. “ XIII.—Natick, Mass.		PLATE XIV.—New Bedford, Mass. “ XV.—New London, Conn. “ XVI.—New Orleans, La. “ XVII.—Pawtucket, R. I. “ XVIII.—Plymouth, Mass. “ XIX.—Quincy, Mass. “ XX.—Spencer, Mass. “ XXI.—Springfield, Mass. “ XXII.—Taunton, Mass. “ XXIII.—Waterbury, Conn. “ XXIV.—Wilmington, N. C. “ XXV.—Woonsocket, R. I. “ XXVI.—Worcester, Mass.
--	--	--

Address, BOOK DEPARTMENT,
 THE ENGINEERING & BUILDING RECORD,
 P. O. Box 3037. No. 277 Pearl Street, New York.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

Now appearing in THE ENGINEERING AND BUILDING RECORD.

- I.—Introduction. Issue of November 27, 1886.
- II., III., IV.—Erection of the Towers of St. Patrick's Cathedral in New York City. Seven Illustrations. Issues of December 4, 11, and 18, 1886.
- V.—Improvements in Dredging Machinery. Thirteen Illustrations. Issue of December 25, 1886.
- VI.—Dumping-Scows. Thirteen Illustrations. Issue of January 1, 1887.
- VII., VIII., IX., X., XI.—The Equitable Building in New York City. Thirteen Illustrations. Issues of January 8, 22, 29, February 5 and 12, 1887.
- XII.—Carson's Trench Machine. Four Illustrations. Issue of February 10, 1887.
- XIII.—Raising the Old Court-House in Boston. Three Illustrations. Issue of March 5, 1887.
- XIV.—Cram's Steam Pile-Hammer. Five Illustrations. Issue of March 12, 1887.
- XV.—The Equitable Building, New York City. Three Illustrations. Special Hoisting Engine and Derrick. Issue of March 26, 1887.
- XVI.—The Equitable Building, New York City. One Illustration. Shoring of Column. Issue of April 9, 1887.
- XVII.—Bridge-Erecting and Hoisting-Engine used on the Suburban Elevated Railway, New York City. Three Illustrations. Issue of April 30, 1887.
- XVIII.—Traveler for Erecting Columns and Transverse Girders, Kings County Elevated Railway, Brooklyn, N. Y. Four Illustrations. Issue of June 4, 1887.
- XIX.—Excavating Apparatus used on the Tancarville Canal and Sewer, Havre, France. Three Illustrations. Issue of July 2, 1887.
- XX.—Tipple Cars on the New Croton Aqueduct. Six Illustrations. Issue of August 13, 1887.
- XXI.—Derrick, Foot Block and Sheaves at Shaft 14 on the New Croton Aqueduct. Two Illustrations. Issue of September 17, 1887.
- XXII.—The Potomac Flats Dredging Plant. Nine Illustrations. Issue of October 8, 1887.
- XXIII.—The Tube-Riveting Machines at the Forth Bridge. Two Illustrations. Issue of October 22, 1887.
- XXIV.—The Lockwood Dredge, Cape Cod Ship Canal. Eight Illustrations. Issue of November 5, 1887.
- XXV.—Location of Plant at Shatts on the New Croton Aqueduct. Two Illustrations. Issue of November 12, 1887.
- XXVI.—Material Lock used in the Pneumatic Caissons at the Forth Bridge. Illustrated. Issue of December 3, 1887.
- XXVII.—Six-Ton Universal Traveling Crane for Elevated Railroad Erection. Illustrated. Issue of December 17, 1887.
- XXVIII.—Head-House on the New Croton Aqueduct at Shaft 22. Illustrated. Issue of December 24, 1887.
- XXIX.—The New Harlem River Bridge. Illustrated. Issue of January 21, 1888.
- XXX.—Erection of Poughkeepsie Bridge, No. 1. Illustrated. Issue of March 3, 1888.
- XXXI.—Oil Rivet Furnace at the Forth Bridge Works. Illustrated. Issue of April 21, 1888.
- XXXII.—Erection of Poughkeepsie Bridge, No. 2. Masonry. Illustrated. Issue of May 5, 1888.
- XXXIII.—Erection of Poughkeepsie Bridge, No. 3. False Work. Illustrated. Issue of May 12, 1888.
- XXXIV.—Erection of Poughkeepsie Bridge, No. 4. Travelers. Illustrated. Issue of May 19, 1888.
- XXXV.—Erection of Poughkeepsie Bridge, No. 5. Riveting Traveler, Derrick, and General Plant. Illustrated. Issue of May 26, 1888.
- XXXVI.—Erecting Traveler on Kettle Creek Trestle. Illustrated. Issue of June 2, 1888.
- XXXVII.—Erection of Central Viaduct, Draw Span, Cleveland, O. Illustrated. Issue of June 9, 1888.
- XXXVIII.—The 70-foot Caissons at the Forth Bridge. Illustrated. Issue of June 9, 1888.
- XXXIX.—Raising an Engine at Poughkeepsie Bridge erection. Illustrated. Issue of June 16, 1888.
- XL.—The Hydraulic Spade at the Forth Bridge Works. Illustrated. Issue of June 30, 1888.
- XLI.—Harlem River Bridge Erection, No. 2. Masonry. Illustrated. Issue of July 7, 1888.
- XLII.—Harlem River Bridge Erection, No. 3. Cement and Concrete. Illustrated. Issue of July 14, 1888.
- XLIII.—Harlem River Bridge Erection, No. 4. Hoisting Apparatus; Revolving Derrick. Illustrated. Issue of July 21, 1888.
- XLIV.—Harlem River Bridge Erection, No. 5. Hoisting Apparatus; Floor Travelers. Illustrated. Issue of July 28, 1888.
- XLV.—Harlem River Bridge Erection, No. 6. Derrick Details and Shipping. Illustrated. Issue of August 11, 1888.
- XLVI.—Harlem River Bridge Erection, No. 7. Support of Segments, Field Riveting, etc. Illustrated. Issue of September 1, 1888.
- XLVII.—Head-House on New Croton Aqueduct at Shatts Nos. 1, 2. Illustrated. Issue of September 8, 1888.
- XLVIII.—Lever Truck for Handling Bridge Material. Illustrated. Issue of September 15, 1888.
- XLIX.—Bismarck Bridge, Erecting Traveler. Illustrated. Issue of November 2, 1888.
- L.—Details of Head House, New Croton Aqueduct. Illustrated. Issue of November 17, 1888.
- LI.—Suspended Tipple for Dumping Cars on the New Croton Aqueduct, N. Y. Illustrated. Issue of December 15, 1888.
- LII.—A Viaduct Erecting Traveler. Illustrated. Issue of December 22, 1888.
- LIII.—Rops and Lackle. Illustrated. Issue of December 29, 1888.
- LIV.—Power used for Operating Plant on the New Croton Aqueduct. Issue of January 10, 1889.
- LV.—Special Methods of Handling Material on the New Croton Aqueduct. Issue of February 16, 1889.
- LVI.—Railway Bridge Erection in Peru. Part I. The Erection of a 200-foot Span. Illustrated. Issue of February 23, 1889.
- LVII.—Railroad Bridge Erection in Peru. The Erection of a 165-foot Span. Illustrated. Issue of March 2, 1889.
- LVIII.—Erection of Omaha Bridge, Part I. General Description and Erecting Travelers. Issue of March 9, 1889.
- LIX.—Erection of Omaha Bridge, No. II False Work in Chanoel Span. Illustrated. Issue of March 16, 1889.
- LX.—Building the Centre Pier of Railway Draw-bridge. Illustrated. Issue of March 23, 1889.
- LXI.—The Sugar River Bridge Erection, False Work. Illustrated. Issue of March 30, 1889.
- LXII.—Erection of Canadian Pacific Railway Depot, Montreal, P. Q. Illustrated. Issue of April 27, 1889.
- LXIII.—Erection of a Plate Girder Bridge. Illustrated. Issue of May 13, 1889.
- LXIV.—The Boylston Street Bridge, Boston, Mass. Illustrated. Issue of June 8, 1889.
- LXV.—The Boylston Street Bridge (Continued). Illustrated. Issue of June 22, 1889.
- LXVI.—Erection of Harvard Bridge, Boston Mass. Illustrated. Issue of June 29, 1889.
- Nos. 1. to XVII. only obtained in Vol. XV. of THE ENGINEERING AND BUILDING RECORD. Price \$3.00.

BOOK DEPARTMENT,

THE ENGINEERING & BUILDING RECORD,
277 Pearl Street, New York.

NOW READY! PRICE, \$3.00. POSTAGE PAID.

Steam-Heating Problems;

OR,

Questions, Answers, and Descriptions

RELATING TO

STEAM-HEATING AND STEAM-FITTING,

FROM

THE SANITARY ENGINEER.

With One Hundred and Nine Illustrations.

PREFACE.

THE SANITARY ENGINEER, while devoted to Engineering, Architecture, Construction, and Sanitation, has always made a special feature of its departments of Steam and Hot-Water Heating, in which a great variety of questions have been answered and descriptions of the work in various buildings have been given. The favor with which a recent publication from this office, entitled "Plumbing and House-Drainage Problems," has been received suggested the publication of "STEAM-HEATING PROBLEMS," which, though dealing with another branch of industry, is similar in character. It consists of a selection from the pages of the THE SANITARY ENGINEER of questions and answers, besides comments on various problems met with in the designing and construction of steam-heating apparatus, and descriptions of steam-heating work in notable buildings.

It is hoped that this book will prove useful to those who design, construct, and have the charge of steam-heating apparatus.

CONTENTS:

BOILERS.

On blowing off and filling boilers.
Where a test-gauge should be applied to a boiler.
Domes on boilers: whether they are necessary or not.
Expansion of water in boilers.
Cast *vs.* wrought iron for nozzles and magazines of house-heating boilers.
Pipe-connections to boilers.
Passing boiler-pipes through walls; how to prevent breakage by settlement.
Suffocation of workmen in boilers.
Heating-boilers. (A problem.)
A detachable boiler-lug.
Isolating-valve for steam-main of boilers.
On the effect of oil in boilers.
Iron rivets and steel boiler-plates.
Proportions for rivets for boiler-plates.
Is there any danger in using water continuously in boilers?
Accident with connected boilers.
A supposed case of charring wood by steam-pipes.
Domestic boilers warmed by steam.

VALUE OF HEATING-SURFACES.

Computing the amount of radiator-surface for warming buildings by hot water.

Calculating the radiating-surface for heating buildings—the saving of double-glazed windows.
Amount of heating-surface required in hot-water apparatus boilers and in steam-apparatus boilers.
Calculating the amount of radiating-surface for a given room.
How much heating-surface will a steam-pipe of given size supply?
Coils *vs.* radiators and size of boiler to heat a given building.
Calculating the amount of heating-surface.
Computing the cost of steam for warming.

RADIATORS AND HEATERS.

A woman's method of regulating a radiator (covering it with a cosey).
Improper position of radiator-valves.
Hot-water radiator for private houses.
Remedying air-binding of box-coils.
How to use a stove as a hot-water heater.
"Plane" *vs.* "Plain" as a term as applied to outside surface of radiators.
Relative value of pipe on cast-iron heating surface.
Relative value of pipe on steam-coils.

STEAM-HEATING PROBLEMS.

Warming churches (plan of placing a coil in each pew).
Warming churches.

PIPE AND FITTING.

Steam-heating work—good and indifferent.
Piping adjacent buildings: pumps *vs.* steam-traps.
True diameters and weights of standard pipes.
Expansion of pipes of various metals.
Expansion of steam-pipes.
Advantages claimed for overhead piping.
Position of valves on steam-riser connection.
Cause of noise in steam-pipes.
One-pipe system of steam-heating.
How to heat several adjacent buildings with a single apparatus.
Patents on Mills' system of steam-heating.
Air-binding in return steam-pipes.
Air-binding in return steam-pipes, and methods to overcome it.

VENTILATION.

Size of registers to heat certain rooms.
Determining the size of hot-air flues.
Window ventilation.
Removing vapor from dye-house.
Ventilation of Cunard steamer "Umbria."
Calculating sizes of flues and registers.
On methods of removing air from between ceiling and roof of a church.

STEAM.

Economy of using exhaust steam for heating.
Heat of steam for different conditions.
Superheating steam by the use of coils.
Effect of using a small pipe for exhaust steam-heating.
Explosion of a steam-table.

CUTTING NIPPLES AND BENDING PIPES.

Cutting large nipples—large in diameter and short in length.
Cutting crooked threads.
Cutting a close nipple out of a coupling after a thread is cut.
Bending pipe.
Cutting large nipples.
Cutting various sizes of thread with a solid die.

RAISING WATER AUTOMATICALLY.

Contrivance for raising water in high buildings.
Criticism of the foregoing and description of another device for a similar purpose.

MOISTURE ON WALLS, ETC.

Cause and prevention of moisture on walls.
Effect of moisture on sensible temperature.

MISCELLANEOUS.

Heating water in large tanks.
Heating water for large institutions and high city buildings.
Questions relating to water-tanks.

Faulty elevator-pump connections.
On heating several buildings from one source.
Coal-tar coating for water-pipe.
Filters for feeding house-boilers. Other means of clarifying water.
Testing gas-pipes for leaks and making pipe-joints.
Will boiling drinking-water purify it?
Differential rams for testing fittings and valves.
Percentage of ashes in coal.
Automatic pump-governor.
Cast-iron safe for steam-radiators.
Methods of graduating radiator service according to the weather.
Preventing fall of spray from steam-exhaust pipes.
Exhaust-condenser for preventing fall of spray from steam-exhaust pipes.
Steam-heating apparatus and plenum (ventilation), system in Kalamazoo Insane Asylum.
Heating and ventilation of a prison.
Amount of heat due to condensation of water.
Expansion-joints.
Resetting of house-heating boilers—a possible saving of fuel.
How to find the water-line of boilers and position of try-cocks.
Low-pressure hot-water system for heating buildings in England (comments by *The Sanitary Engineer*).
Steam-heating apparatus in Manhattan Company's and Merchants' Bank Building, New York.
Boilers in Manhattan Company's and Merchants' Bank Building, with extracts from specifications.
Steam-heating apparatus in Mutual Life Insurance Building on Broadway.
The setting of boilers in Tribune Building, New York.
Warming and ventilation of West Presbyterian Church, New York City.
Principles of heating-apparatus, Fine Arts Exhibition Building, Copenhagen.
Warming and ventilation of Opera-House at Ogdensburg, N. Y.
Systems of heating houses in Germany and Austria.
Steam-pipes under New York streets—difference between two systems adopted.
Some details of steam and ventilating apparatus used on the continent of Europe.

MISCELLANEOUS QUESTIONS.

Applying traps to gravity steam-apparatus.
Expansion of brass and iron pipe.
Connecting steam and return risers at their tops.
Power used in running hydraulic elevators.
On melting snow in the streets by steam.
Action of asher street fillings on iron pipes.
Arrangement of steam-coils for heating oil-stills.
Converting a steam-apparatus into a hot-water apparatus and back again.
Condensation per foot of steam-main when laid under ground.
Oil in boilers from exhaust steam, and methods of prevention.

Address, BOOK DEPARTMENT,
THE ENGINEERING AND BUILDING RECORD,

No. 277 Pearl Street, New York.

Obtainable at London Office, 92 and 93 Fleet Street, for 15s.

HOT-WATER HEATING AND FITTING;

OR,

WARMING BUILDINGS BY HOT-WATER.

A DESCRIPTION OF

Modern Hot-Water Heating Apparatus—The Methods of their Construction and the Principles involved.

WITH OVER TWO HUNDRED ILLUSTRATIONS, DIAGRAMS AND TABLES.

BY WILLIAM J. BALDWIN, *M. Am. Soc. C. E.*,

Member American Society Mechanical Engineers,

AUTHOR OF "STEAM-HEATING FOR BUILDINGS," ETC., ETC.

Graphical methods are used to illustrate many of the important principles that are to be remembered by the Hot-Water Engineer.

The volume is 8vo., of 385 pages, besides the index ; handsomely bound in cloth, and will be sent postpaid on receipt of \$4.00

Among the questions treated are the following :

Laws of Hot-Water Circulation.

Flow of Water in the Pipes of an Apparatus.

Graphical Illustration of the Expansion of Water.

Graphical Illustration of the Theoretical Velocity of Water in Flow-Pipes.

Efflux of Water Through Apertures.

Passage of Water Through Short Parallel Pipes.

Passage of Water Through Long Pipes.

Friction of Water in Long Pipes.

Quantity of Water that will Pass through Pipes under Different Pressures.

Diminution of the Flow of Water by Friction in Long Pipes.

Loss of Pressure by Friction of Elbows and Fittings.

How the Friction of Elbows and Fittings may be Reduced to a Minimum.

Flow of Water through the Mains of an Apparatus, Considered under its Various Practical Conditions.

How to Find the Total Head Required when the Quantity of Water to be Passed and the Size and Length of the Pipes are Known.

How to Find the Quantity of Water in U. S. Gallons, that will Pass through a Pipe when the Total Head and Length and the Diameter of the Pipe is Known.

To Find the Diameter of the Pipes for a Given Passage of Water.

How to Find the Direct Radiating Surface required for Buildings.

How Heat is Lost from the Rooms of a Building.
Simple Formula for Finding the Radiating Surfaces for Buildings.
Experiments by Different Authorities on Radiating Surfaces.
To Find the Amount of Water that should Pass through a Radiator for
a Certain Duty.
How to Determine the Size of Inlet and Outlet Pipes for Hot-Water
Radiators.
Diagrams Giving Graphical Methods for Finding the Diameters and
Lengths of Flow and Return Pipes for Hot-Water Apparatus.
Proportioning Coils and Radiators of an Apparatus for Direct Radiation.
Description of Different Systems of Piping in Use.
Proportioning an Apparatus for Indirect Heating.
Illustrations of Boilers.
Hot-Water Heating in the State, War, and Navy Department Building.
Hot-Water Heating in Private Residences.
Boilers Used for Hot-Water Heating.
Direct Radiators Used for Hot-Water Heating.
Indirect Radiators Used for Hot-Water Heating.
The Effect of Air-Traps in Hot-Water Pipes.
Expansion Tanks—and How they should be Prepared.
Danger of Closed Expansion Tanks.
The Various Valves Used for Hot-Water Heating.
Air-Vents Used for Hot-Water Radiators.
Automatic Regulators Used in Hot-Water Heating.
Special Fittings for Hot-Water Heating.
How to Conduct Tests of Hot-Water Radiators.
Method of Connecting Thermometers with Hot-Water Pipes and
Radiators.
Tables of Contents of the Pipes of an Apparatus.
Table of Co-efficients of the Expansion of Water from Various Sources,
With an Ample Table of Contents from which the above Items
were Selected; also an Alphabetically Arranged Index, the Whole
Containing a Large Amount of Useful Information of Great Value
to the Engineer, Architect, Mechanic and Householder. No Archi-
tect, Engineer, Steam-Fitter or Plumber throughout the United
States should be without a copy of this book. It is written in the
simple style of Mr. Baldwin's former book, "Steam Heating for
Buildings," and is within the ready comprehension of all.

Address, BOOK DEPARTMENT,

THE ENGINEERING & BUILDING RECORD,

277 Pearl Street, New York.

Obtainable at the London Office, 92 and 93 Fleet Street, for 20s.

THE PRINCIPLES
OF
VENTILATION AND HEATING
AND
THEIR PRACTICAL APPLICATION.

By
JOHN S. BILLINGS, M. D., LL.D. (Edinb.),
Surgeon U. S. Army.

PROFUSELY ILLUSTRATED.

This interesting and valuable series of papers, originally published in THE SANITARY ENGINEER, have been re-arranged and re-written, with the addition of new matter.

The volume is published in response to the general demand that these important papers should be issued in a more convenient and permanent form, and also because almost all the reliable literature on this subject has been furnished by English Authors, and written with reference to the climate of England, which is more uniform and has a higher proportion of moisture. The need of a book based upon the conditions of the American climate is therefore apparent.

The following will indicate the character of the subject-matter:

Expense of Ventilation—Difference Between "Perfect" and Ordinary Ventilation—Relations of Carbonic Acid to the Subject—Methods of Testing Ventilation.

Heat, and some of the Laws which govern its Production and Communication—Movements of Heated Air—Movements of Air in Flues—Shapes and Sizes of Flues and Chimneys.

Amount of Air-Supply Required—Cubic Space.

Methods of Heating: Stoves, Furnaces, Fire-Places, Steam, and Hot-water.

Scheduling for Ventilation Plans—Position of Flues and Registers—Means

of Removing Dust—Moisture, and Plans for Supplying It.

Patent Systems of Ventilation and Heating—The Ruttan System—Fire-Places—Stoves.

Chimney-Caps—Ventilators—Cows—Syphons—Forms of Inlets.

Ventilation of Halls of Audience—Fifth Avenue Presbyterian Church—The Houses of Parliament—The Hall of the House of Representatives.

Theatres—The Grand Opera-House at Vienna—The Opera-House at Frankfort-on-the-Main—The Metropolitan Opera-House, New York—The Madison Square Theatre, New York—The Criterion Theatre, London—The Academy of Music, Baltimore.

Schools.

Ventilation of Hospitals—St. Peterburgh Hospital—Hospitals for Contagious Diseases—The Barnes Hospital—The New York Hospital—The Johns Hopkins Hospital.

Forced Ventilation—Aspirating-Shafts—Gas-Jets—Steam Heat for Aspiration—Prof. Trowbridge's Formulæ—Application in the Library Building of Columbia College—Ventilating-Fans—Mixing-Valves.

The book is free from unnecessary technicalities and is not burdened with scientific formulæ.

It is invaluable to Architects, Physicians, Builders, Plumbers, and those who contemplate building or remodeling their houses.

SOLD BY ALL BOOKSELLERS.

Large 8vo. Handsomely Bound in Cloth. Price \$3.00, Postage Paid.

Address,

BOOK DEPARTMENT,
THE ENGINEERING AND BUILDING RECORD,

No. 277 Pearl Street, New York.

OBTAINABLE AT LONDON OFFICE, 92 AND 93 FLEET STREET, FOR 15 SHILLINGS.

