RUDIMENTARY TREATISE ON THE DRAINAGE OF TOWNS AND BUILDINGS: SUGGESTIVE OF SANATORY REGULATIONS CONDUCIVE TO THE HEALTH OF AN INCREASING POPULATION

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OF

TOWNS AND BUILDINGS:

SUGGESTIVE OF

SANATORY REGULATIONS

CONDUCIVE TO THE

HEALTH OF AN INCREASING POPULATION.

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"THE PRACTICAL RAILWAY ENGINEER," AND OF THE "RUDIMENTARY TREATISE ON THE DRAINAGE OF DISTRICTS AND LANDS."

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REVISED AND GREATLY EXTENDED.

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PREFACE.

If a genius in the art of Smoke-dispersion were to suggest the collection of all the smoke of London in one huge chimney, he might possibly gain the approval of a select circle of theorists, but would not be likely to receive the appointment of engineer to a Metropolitan Smoke-Commission. Nor, indeed, if he qualified his proposition so as to embrace a separate chimney for each side of the Thames, or a high level chimney for Hampstead, and a low level one for Whitechapel, would he materially improve his chances. It might be suggested, that these main chimneys must needs be of rather formidable dimensions, somewhat costly in construction, and after all, of questionable utility. The difficulty of inducing the aggregate of metropolitan carbon to pursue its course obediently to two or three outlets without accidental or capricious escape by the way, and the cyclopean functions of these outlets when reached, would occur to the practical mind of London as serious contingencies, and probably frighten it from any further consideration of the project. But even should the scheme win the sanction of individuals in the hope that it might obviate the difficulty of obeying the legislative prohibition against smoke, it could scarcely fail to force the question how to dispose of the emissions of the two or three metropolitan chimneys, so as to prevent a great nuisance in their localities equal to the sum of all the little nuisances that have hertofore pervaded each district of the town. Beyond other objections, however, one would effectually negative the proposal, if it could be shown that, so far from the smoke being simply a matter to be got rid of, it was really a valuable material profitably applicable in the suburban districts surrounding the metropolis, and that its conduction away to two or three distant points would therefore impose the expense of bringing it back for ultimate appropriation.

Is not this supposed case of London smoke a fair parallel with the proposed case of London sewage? It is submitted as such.

Is it necessary, or advisable, or economical, to construct miles of tunnels, and literally *sink* millions of money in order to take to Barking, or other remote districts, and in quantities nearly unmanageable from their immensity, that which may, without offence to our senses, be prepared for profitable use on the lands in other directions around the metropolis?

It is submitted that the answer must be in the negative, if the possibility of so appropriating the sewage be admitted.

Even if this possibility were not already ascertained, would the adoption of the tunnel scheme be justifiable, pending the inquiry, or until it had been fully proved that no system of DISTRICT COLLECTION and treatment of sewage could be innocuously and profitably resorted to?

It is submitted that the answer must still be in the negative.

It is further submitted, that if the evidence in favour of DISTRICT COLLECTION is yet incomplete, it is simply because it has not yet been sought, and that while the soundness of the principle is patent to our common reason, the value of its application is consistent with all experiments hitherto instituted.

In the following pages, the circumstances of site and position of towns generally are described, and the conditions to be observed in order to accomplish the purpose of town-drainage are laid down with reference to these circumstances. By way of illustration, the works constructed for the drainage of London are described at considerable length, and most of the prominent projects for its improvement are referred to. Reports from eminent engineers are quoted, and an attempt is made to present a sketch of the present position of the question, "How may London be effectually drained?"

From some of the recommendations quoted, a dissent is ventured, upon the ground that our evidence as to the best and most profitable disposal of town sewage, although not yet completed, is sufficient to establish the principle of DISTRICT COLLECTION as opposed to that of CONCENTRATION. Upon the treatment of sewage much valuable experience is recorded in the Appendix, and a further pursuit of this subject will, it may be reasonably expected, show us precisely how to deal with the sewage of any town, and, in reference to our own metropolis, dictate the details of arrangement of stations and apparatus for converting its sewage into valuable manure most readily and economically available for agricultural and horticultural purposes.

NOTE.—*Since the Appendix was prepared for press, permission has been obtained in the House of Commons for introducing two bills, one of which is to continue the existence of the Metropolitan Commission of Sewers for another year, with a limitation of its powers, and the other to continue the General Board of Health for two years, with such a revision of its constitution as will place it under the authority of the Home Secretary.*

DRAINAGE.

DIVISION II.

DRAINAGE OF TOWNS AND STREETS.

SECTION I.

Classification of Towns according to Position and Extent.—Varieties of Surface, Levels and Inclinations.—Application of Sewage Manure.—Metropolitan Sewage Manure Company.—Methods of treating Sewage.—Magnitude of London Sewers.—The Fleet Sewer.—Metropolitan Commission of Sewers.—The Tunnel Scheme.—Great London Drainage Bill.—Messrs. Stephenson and Cubitt's Evidence.—General Board of Health.

194. According with our definitions (Part I. p. 1), we propose to treat of the *supply* of *water* to *towns* and *buildings* as a branch of the general subject of *Drainage*, since the purposes of the art cannot be effected without an adequate and regulated supply of water by a combination of natural and artificial agencies, the extended control over which constitutes the purpose of water-supply for all highway, manufacturing, and domestic uses.

195. The means of obtaining water for towns, and of conducting the drainage matters from them vary, mainly, according to their position with reference to the sources of water; and, in a subordinate degree, according to their superficial extent. The sources being those already enumerated in our First Part, viz. rivers, rains, and springs, the command of one or more of these will be presented as the most economical means of deriving the necessary supply for each town under consideration. Towns situated on the banks of tidal rivers, or in near proximity to them, may be

usually sufficiently supplied from these sources, unless some parts of the district extend upward to such elevation above the river-level that the raising of this supply requires expensive artificial power; in which case springs at higher levels may be advisably resorted to, or the drainage waters from superior lands may be so conducted as to assist the supply. Towns which are far distant from rivers are commonly entirely dependent upon springs or drainage waters for their artificial supply.

196. The refuse matters to be discharged from towns and buildings,—consisting of the disintegrated materials of street paving and roads; of superfluous rain water; of excrementitious matters, solid and liquid; of the waste products of combustion; of the refuse of animal and vegetable substances; besides the various waste matters used in manufactures,—require arrangements of different kinds to be provided with regard to the purposes to which these matters may be usefully applied. For such discharges of these matters as are to take place through subterranean channels, one principle is, however, common to all, viz. that the receptacle to which they are conducted must be situated at a level somewhat lower than that from which they are forwarded. The arrangements for this purpose will, therefore, be varied according to the nature of the site of the town. If this be low in relation to the surrounding country, and level, the refuse may be indifferently collected within or without the town, with, however, the advantage in the latter plan of avoiding such exposure of the decomposed matters as tends to pollute the atmosphere, and at the same time saving distance in the transfer of such portions of those matters as are destined for agricultural uses. If the site of the town be a valley with lower ground in the midst of it than is found anywhere without its limits, the readiest point of collection will be the lowest level in the town itself at which the drainage can be united, and artificial power will be required to distribute such matters as are intended for agricultural purposes around the higher ground outside.

From towns which occupy elevated sites, having lower lands around them, the refuse matters and drainage waters should be conducted away at once; or, if found necessary to collect them, a point or points should be selected for this purpose altogether beyond the limits of the town itself.

197. In the several cases here supposed, the question of disposing of the refuse matters should be treated without any reference whatever to the presence of a river through or contiguous to the town, except upon the single consideration that such river, being in all probability situated at the lowest level of the site, may afford facilities, after the refuse has been collected in reservoirs near its banks, for its conveyance in suitable barges or vessels towards the higher lands for which some portion of this refuse is ultimately destined. Former practice in the art of town-draining has indeed regarded the one question of river or no river, as the grand determinal one for the disposal of drainage and refuse matters. How to get rid of the animal ordure created within the walls of a town, was formerly deemed to be satisfactorily answered provided a river flowed beneath, and offered a tide to wash away in boundless wastefulness those matters which, properly applied, will endow barren lands with the richest fertility.

198. Although reluctant to dwell upon the trite subject of the *importance* of draining, we claim attention to this great leading principle in the drainage of towns and buildings, viz. that the ultimate economy of the art comprehends two distinct purposes, whereof the second—the disposal and utility of the refuse matters—is little less in importance than the first—the discharge of these matters from the dwellings and highways of men. And the accomplishment of this second purpose involves the beneficial appropriation of refuse matters so as to make them actually productive, and avoid interference with those healthy uses of inland waters for which they are properly adapted. In illustration of this principle we will endeavour to estimate the value for agricultural purposes of the excrementitious matters

flowing from a town, from which estimate the pernicious effects of discharging those matters into the courses whence the supply of water is derived for the several uses of the population may be readily inferred.

199. The value of manures as promoters of vegetation is known to result from their possession of the essential element, nitrogen, in the form of ammonia, with the subordinate properties of alkalies, phosphates, and sulphates. Now, the experiments of Boussingault and Liebig have furnished us with the means of estimating the quantity of nitrogen contained in the excrements of a man during one year, at 16·41 lbs., upon probable data, and also that this quantity is sufficient for the supply of 800 lbs. of wheat, rye, or oats, or of 900 lbs. of barley. "This is much more than it is necessary to add to an acre of land, in order to obtain, with the assistance of the nitrogen absorbed from the atmosphere, the richest crops every year. By adopting a system of rotation of crops, every town and farm might thus supply itself with the manure which, besides containing the most nitrogen, contains also the most phosphates. By using, at the same time, bones and the lixiviated ashes of wood, animal excrements might be completely dispensed with on many kinds of soil. When human excrements are treated in a proper manner, so as to remove this moisture, without permitting the escape of ammonia, they may be put into such a form as will allow them to be transported even to great distances."* Making reasonable allowance for the reduced quantity produced by children, we shall be safe in assuming the nitrogen thus resulting from any amount of population to be equal to the supply required for affording 2 lbs. of bread per diem for every one of its members! Or assuming an average of 600 lbs. of wheat to be manured by each individual of the population of London; and taking this at two millions, for a rough calculation, the manure thus produced is sufficient to supply the growth of wheat of a total weight of 1200 mil

* Liebig.