

Drainage and sewerage.

Contributors

Metropolitan Working Classes' Association for Improving the Public Health.

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The Metropolitan Working Classes' Association,
FOR IMPROVING THE PUBLIC HEALTH.

[P.]

1.—In the Tract on Ventilation the importance of a constant supply of pure air in rooms, workshops, and houses, has been insisted upon. It has been shown that the causes existing in the neighbourhood of human habitations by which the air is corrupted, and no prevention on the part of the inmates, can secure good air, if these dwellings are surrounded by open drains, reeking dung-heaps, stagnant ponds, and unpaved streets, generating unwholesome gases, which mingle with the common air and force their way into the living and sleeping apartments. It is, therefore, extremely desirable that the people should be instructed not only in the means by which they can keep up a thorough circulation of air within their dwellings, but also in those by which it can be kept free from impurities without. This can only be effected by an efficient and complete system of drainage and sewerage.

"We can be useful no longer than we are well."

DRAINAGE

AND

SEWERAGE.

TENTH THOUSAND.

London:

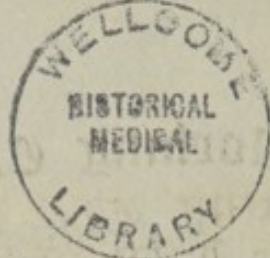
JOHN CHURCHILL, PRINCES STREET, SOHO;

AND

B. WERTHEIM, ALDINE CHAMBERS, PATERNOSTER ROW.

1847.

[PRICE ONE PENNY.]



DRAINAGE AND SEWERAGE.

1.—In the Tract on *Ventilation* the importance of a constant supply of pure air in rooms, workshops, and houses, has been insisted upon. It becomes necessary to shew the various causes existing in the neighbourhood of human habitations by which the air is corrupted. It is obvious that no improvement in the structure of dwellings, and no precaution on the part of the inmates, can secure good air, if those dwellings are surrounded by open drains, reeking dung-heaps, stagnant ponds, and unpaved streets, generating unwholesome gases, which mingle with the common air, and force their way into the living and sleeping apartments of the people. It is, therefore, extremely desirable that the people should be instructed not only in the means by which they can keep up a thorough circulation of air within their dwellings, but also in those by which it can be kept free from impurities without. This can only be effected by an efficient and complete system of *drainage and sewerage*.

2.—The concurrent testimony of all the gentlemen engaged in the Health of Towns' Commission has been, that the ravages of epidemic and contagious diseases may be fairly attributable to bad drainage and bad ventilation. By taking any large town in the kingdom, it will be seen that the localities of epidemic diseases are the close, confined, and uncleansed streets, occupied almost entirely by the poorer classes. It will be observed also, that the track of cholera is nearly identical with that of fever. A map of Leeds is given in the Sanitary Report, which is highly instructive. In the wards badly cleansed and badly drained, the proportional mortality is nearly double that of the better conditioned districts of the town. In the parish of Bethnal Green we find the same results. The mortality from epidemic diseases falls heavily upon the most crowded and worst parts of the district. Dr. Southwood Smith says, "In every district in which fever returns frequently, and prevails extensively, there is uniformly bad sewerage, a bad supply of water, a bad supply of scavengers, and a consequent accumulation of filth." The history of epidemic diseases proves the same thing. The plague, the black death, the jail fever, the camp fever, the

ship fever, have always haunted the abodes of filth; and typhus fever—our modern pestilence—for it attacks annually between 150,000 and 200,000 individuals, and destroys 16,000, is no exception to the rule. Could we trace back every pestilence to its source, we should find the same common origin. The cholera took its rise in a low, swampy part of India; and, after traversing Europe, found a congenial home among the neglected portions of the large towns and cities of this country. There was a time, too, when ague and low typhoid fevers were prevalent in Lincolnshire, to such an extent that ague was said to be a Lincolnshire disease. The traveller hears little of it now. Improvement has stepped in; large drains intersect once dreary swamps, and plains from which emanated deadly vapours, now teem with rich harvests, adding another fact to the interesting chapter of human progress; and shewing that civilization not only increases the comforts of man, but extends the duration of his life.

3.—The pressure of disease arising from these evils will be best indicated by a reference to the difference of mortality in town and country districts, as also the difference between several neighbourhoods of one town. We find, for instance, that 27 years is the average duration of life in London, and 17 years in Liverpool. Infant life is the most affected by atmospheric impurity; and we find in the purely agricultural districts that out of 1,000 births only 221 die under five years of age; whilst in manufacturing districts the deaths under five years of age are above 385. We find that out of 1,000,000 persons living in the country, where there are only 199 inhabitants to the square mile, there are 19,300 deaths; but in towns where the population to the square mile is 5,108, there occur 27,073 deaths out of 1,000,000—making an excess in the towns over the country districts of 7,773. The rate of mortality in the latter is only one in 52, whilst in the former it is one in 37. In the districts of Leeds, where there are 207 persons to the acre, and where out of 171 streets 109 are decidedly bad, the deaths are one in 23; in other parts of the town, where there are only 84 persons to the acre, and the streets are better conditioned, the deaths are only one in 36. The results of a partial drainage in Leicester are found in the improved health of those occupying the streets which are culverted. There is a difference, amounting to seven years loss of life in the undrained, as compared with the drained districts; and this is confirmed by statements, made relative to Preston, by the Rev. John Clay; and of Chorlton-upon-

Medlock, by Mr. Holland. In the latter place, since the years 1841-2, after the streets were paved and sewered, there has been a diminution of deaths equal to about one-eighth. Many other cases might be cited.

4.—Along with this heavy mortality there is a great amount of sickness, both adding very heavy items to the public burdens. The loss of life we can calculate, but it is impossible to estimate the moral evils which flow from this source. We may, perhaps, reach an approximation to the pecuniary loss arising from these constantly-acting causes of disease and death. We have to take into account the loss of wages and pressure of poor rates—the expense of medical attendance and contributions, levied to support charitable institutions; and as the state of discomfort, produced by insalubrity and filth, has a direct and powerful tendency to foster habits of intemperance, it is clear that a considerable amount of the expense entailed upon the community by this degrading vice is chargeable to neglect of sanitary measures. Like every other neglect, it brings its punishment in the inexorable tax it lays upon society. The largest amount that could be asked to carry out efficient measures of improvement would fall far short of the actual loss now sustained; and in the payment of which all classes have to participate. The bulk of the evil, however, falls chiefly upon the poorer classes, who have little or no choice in their dwellings. Their condition is embittered by its continuance, and it is the duty of the Legislature to see that disadvantages of such magnitude should be removed, and the duty of all classes to take every opportunity of inviting the attention of Government to their existence. But more particularly is it incumbent upon the working classes to cultivate among themselves that knowledge and self-reliance which will enable them to apply every measure of relief to the greatest possible advantage. No Legislature can do anything without the enlightened co-operation of the people they seek to benefit.

5.—It is now all but universally known that wherever there is an accumulation of decaying vegetable and animal matter, there will arise from it effluvium offensive to the senses and injurious to health. Dr. Southwood Smith says, “that the introduction of dead animal matter, under certain conditions, into the living body is capable of producing disease, and even death.” After giving several instructive facts, he adds, “that it is proved by indubitable evidence that this morbid matter is as capable of entering the system when minute particles of it

are diffused in the atmosphere as when it is directly introduced into the blood-vessels by a wound." Numerous cases might be cited where grave-diggers have been attacked with fever, and of persons being suffocated by descending into cess-pools, old wells, &c., filled with hurtful vapours, arising from putrefying animal and vegetable matter. Wherever there is a great assemblage of human beings, there must necessarily be a vast amount of refuse, which, if not regularly removed, soon becomes putrescent. Take a large city, like Glasgow or Liverpool, where, in addition to the number of inhabitants, there is the refuse of so many cattle, and the noxious effluvia arising from manufactories, grave-yards, and slaughter-yards, and we shall cease to wonder that fever scourges the inhabitants periodically, and that the sum of human life should be reduced in the crowded and filthy districts, to between 20 and 30 years less than the average of agricultural districts.

6.—During the autumn of 1846 the town and neighbourhood of Nottingham were visited by a severe epidemic, so as to alarm the authorities. Two villages, adjuncts of that town, were afflicted by severe contagious and malarious fevers to so great an extent that new hospitals had to be opened, as the old ones were filled to repletion and numbers had to be attended at home. The districts above-named were always considered healthy until within a few years, since a large population have gathered there, and the establishment of some works using much water in the cleansing department. This water runs from the works, largely charged with vegetable and animal matter, into the various streams, and as these streams are very sluggish it stagnates and throws off offensive gases. Another cause contributing unquestionably in a greater degree to the insalubrity of the neighbourhood is found in the existence of open manure holes, unpaved streets, and uncovered drains. The evidence given contains a most painful description of the noisome and stinking exhalations, so great indeed that in the hot summer the hay-makers were driven from their work in the adjoining field by the intolerable stench. What exists in this locality is found to exist in every large town in the kingdom. In Leeds, the streams called *becks* running through the town, besides receiving all the used water of dye-houses and manufactories, are the receptacles of every kind of filth, the refuse from pigsties and privies flowing into them. In Bristol, the Frome that runs through the city is so contaminated by the loathsome accumulations it receives on its way that its stench is unbearable in hot weather, and the people

are often turned sick by it. The rivers in many places, as in Leicester, receive the refuse of the towns, and by the construction of mill-weirs and dams for the convenience of manufactures are turned into stagnant ponds of filth; and that which ought to bring cleanliness becomes one of its greatest preventives. In Dumfries where cholera attacked one eleventh, and carried away one seventeenth, of the population, the closes contain pigsties, seventeen being counted by a late observer in one narrow close. What sewers there are empty themselves into a beautiful river from which the inhabitants procure their water for domestic purposes by hand labour. The same observer saw a girl filling her pail within a few yards of one of the sewers which was at the time emptying its filth into the river. In Glasgow a great part of the refuse of the city is poured into the river Clyde; and even in London the Thames is made a common sewer for all the filth of the metropolis. Any one who wishes to procure proof of the existence of such evils may obtain it by going down the Blackwall Railway; on both sides of the line he will see many open drains and choked ditches. Dr. Aldis describes several neighbourhoods in densely populated parts of the metropolis:—"At the back of Ray Street, Clerkenwell, a most offensive and open drain or part of Fleet Ditch passes by the back of the houses and takes its course parallel with Great Saffron Hill, running under West Street where it disappears. The evils from this open sewer are of course most felt in summer when the stench is intolerable. I have noticed similar nuisances in Lock's Fields, Bermondsey, and Rotherhithe." Descriptions like this might be multiplied to almost any extent, but they are too familiar to every reader to render it necessary. Dr. S. Smith gives an appalling account of a place called Punderson's Gardens. Kennington and Camberwell abound in open filthy drains; for a mile by the side of the Brixton Road, bounded by houses of respectable city merchants who pass by it twice daily, there is an open drain of the most offensive description. The space bounded by Oxford Street, Portland Place, New Road, Tottenham Court Road, is one vast cesspool, the sewers being so imperfectly constructed that their contents are almost always stagnant.

7.—Now when the reader reflects, that thousands of working men are closely confined, for perhaps 14 or 15 hours out of the 24, in a room in which the offensive effluvium of some cesspool is mingling with the atmosphere, and that if he opens the window, if it admits of such accommodation, it is only to make

way for the introduction of other poisonous matter arising from the unpaved and unsewered street, though he will cease to wonder at the amount of disease, he will be amazed at the apathy which has allowed these evils not only to exist but to increase. Out of fifty towns which were made the objects of special inquiry by the Health of Towns' Commission scarcely one could be said to have good drainage or sewerage, whilst in seven it was indifferent, and in forty-two it was decidedly bad, as regards the districts inhabited by the labouring classes.

8—One evil attendant upon a want of proper sewerage is the existence of cesspools. The Commissioners have declared it as "their unanimous opinion that no population can be healthy which live among cesspools." These nuisances are not only injurious to health, but they deteriorate the value of property; the foundations of the houses become completely saturated by the foul fluid percolating through the cesspools, and the walls are greatly damaged. The adjacent springs become impregnated by the offensive matter oozing from them, and the water obtained from pumps and wells in a vast number of instances has been rendered useless. In the last Report of the Registrar-General it is stated that in the parish of Marylebone, which is considered at once the wealthiest and most populous in London, half the houses have cesspools remaining for ever unemptied, and a large portion of the parish is without sewers. Lord Ebrington stated, in an admirable lecture delivered at Plymouth, that the house in which his friend Dr. Cookworthy lived was shut up after several deaths had occurred while a school was carried on in it, underneath was found a cesspool, formed by the stoppage of a drain; the accumulation was removed and the house became healthy. The sudden death of Dr. James Johnson, at Brighton, was occasioned by his taking up his residence in a part of the town where the drains are frequently deranged, and it happened that they had been so at the house he selected, immediately before his visit to it. The residents had all been ill with diarrhœa, and this disease attacked the Dr. himself and those attending him the moment they entered it.

9.—Another defect calling for remedy, and producing much evil, is the scanty number of privies. In one part of Manchester there are only 33 to a population of 7,000, and one locality is named in Ashton where there are only two privies for 50 families. Many parts of the metropolis are equally badly provided. The Scotch towns are almost destitute of these conveniences, and the want of decency is generally in proportion

to the want of accommodation. In Nottingham there is only one necessary to three or four houses, or to 15 or 20 inhabitants, frequently there is not more than one to five or six houses, and in some instances to eight or ten houses ; and in Leicester whole rows of houses have only one or two privies. These are all of an imperfect description, in exposed situations, and in many cases a cluster of four to six to a whole neighbourhood. Such mal-arrangements militate most grossly against the comfort, morality, and health of the population.

10.—In addition to these evils may be mentioned the practice of interment in towns—the existence of slaughter-yards—and manufactories of various descriptions, which ought not to exist in crowded cities. As these will be made the subject of a separate treatise, it is only necessary to notice them in passing.

11.—No elaborate argument is needed to show that the filthy state of our streets and dwellings is utterly incompatible with habits of personal or domestic cleanliness amongst our poorer population, or even with ordinary feelings of self respect. The love of home—as the legitimate sphere for the exercise of the domestic affections—is the basis of man's social character. In dwellings crowded upon one another, and exposed to the various nuisances described—with tenants wedged in so as to forbid the preservation of even the ordinary decencies, all experience has shewn that it is in vain to expect a sober, moral, well-behaved population. A clean skin, comfortable hearth, and wholesome change of apparel have much more to do with the moralities of life than may at first sight appear. Men soon assimilate their conduct and manners to the habits of those by whom they are surrounded ; and when we look at the way in which thousands are herded together, we must assent to the force of the observation made by Mr. Toynbee—" I must confess," he says, " that the wonder to me is, not that so many of the labouring classes crowd to the gin-shops, but that so many are to be found struggling to make their wretched abodes a home for their family."

12.—The remedies to be applied, and which must now be treated more particularly, are first, an effective system of house drainage and street sewerage ; secondly, thorough scavenging, so that no refuse be allowed to remain in the streets above a day ; and, thirdly, a water-closet, to supersede the present unwholesome and uncleanly privy. The first point of consideration is that of house drainage. This is indispensable to thorough cleanliness. Several gentlemen who have made

it the subject of special inquiry have directed attention to the plan recommended by Mr. Dyce Guthrie—that of employing drain tubes. They are made of common brick clay, and glazed in the inside, so as to give every facility for the passage of the waste communicated to them. By being glazed they prevent the poisonous air escaping, which might otherwise partially ooze through the tile. As the circular shape is that best adapted to resist external pressure, that form has been adopted, having another advantage, it admits of being more readily flushed; and it is not improbable that it would be kept clean by its own action. Fig. 1 represents the form and appearance of Mr. Dyce Guthrie's tubular drains, made of earthenware. Fig. 2 shews the form to be given to lengths which are intended to be placed where unions are required. P. the plug being fixed with pitch, can be removed readily, and a connecting tube attached.

Fig. 1.

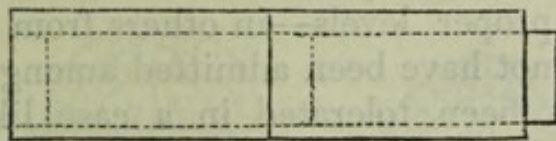
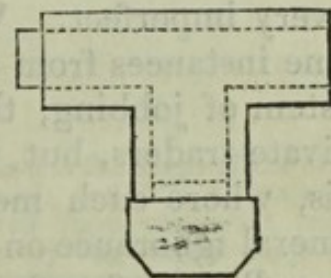


Fig. 2.



P.

13.—Mr. James Simpson, of Edinburgh, has had in course of experiment for a length of time a tubular drain, executed under the plans of Mr. Guthrie. The drain consists of a cast iron pipe, $2\frac{1}{2}$ inches in diameter, laid through the under flat of the house, from the back to the front area, in length 60 feet, and having a declivity of 12 inches in that length. This $2\frac{1}{2}$ inch drain has been substituted for the former drainage of the house, which was a box drain of the usual construction, 12 inches square; and now the whole of the surface water from the back area ground, the rain water from the roof, the foul water from the kitchen sink, the deposits of the water closets, and the water from baths, &c., are all conducted into this pipe by branch pipes connected with every flat or floor. At first it was flushed monthly, but that has been discontinued, its action has been perfect, and no accumulation of any kind made. The experiment seems conclusive. To insure thorough cleanliness, a sink ought to be in every dwel-

ling, communicating with a drain, by which the refuse might be carried away without the necessity of any inmate taking it past the threshold. When this is united, as it must be to make it complete, with a constant supply of water, it will incalculably improve the domestic economy of our dwellings.

14.—These house drains should have a communication with well formed sewers running through every street, and placed with a sufficient fall to admit of the refuse of the courts and bye streets finding its way into the main sewer by the force of gravitation alone. This connection ought to be made compulsory, and under the personal inspection of a competent officer. At present, opening a drain into a sewer in many instances is treated as an offence, or has to be paid for as a privilege. If it be right for the Legislature to interfere in the construction of houses, to lessen the risk of accidents by fire, it is equally their duty to make provision against the loss of that which is even more important than property—the public health.

15.—The present construction of sewers, where they exist, is very imperfect. Vast sums of money have been wasted in some instances from taking improper levels—in others from a system of jobbing, that could not have been admitted amongst private traders, but which has been tolerated in a case like this, where such momentous interests are involved, from the general ignorance on the subject. Every principle of economy as well as of safety demands that a system should be established by which the street cleansing and paving, the drainage and sewerage, and the supplies of water should form parts of one machinery, instead of being divided into several companies, having irresponsible powers, doing the business very imperfectly; and from so many capitals being employed, and other causes, charging most exorbitantly for very inefficient measures. This will be shewn in a subsequent address more fully. But it will be right to say here that the estimated cost of all the great sanitary improvements suggested—water pipes, and an ample supply of water, main sewers, secondary drains, house drains, water closets, ventilating apparatus, scavenging, widening of streets, rent of public parks and gardens, salary of public inspectors of health, interest and fund for the repayment of capital—all this may be well done, for $3\frac{1}{2}$ d. per week, to each tenement, over and above the present rent. Let the working man consider the advantages here enumerated, and which he is now compelled to look upon as luxuries, attainable only by the rich, and all

within his own reach for a sum of $3\frac{1}{2}$ d. per week—provided all parties are agreed.

16.—The construction of the sewers ought to be under the direction of properly appointed and responsible officers. The old, imperfectly formed, and flat-bottomed sewers should be entirely superseded by the egg-formed sewer, as admitting of much less chance of deposit—in fact, scarcely of any. This is of great importance in the transmission of the refuse containing so much solid matter—the main principle in their construction being to make these conduits so as to convey away the refuse matter, and not reservoirs or receptacles of filth. To secure this object, they should be so formed as to admit of being flushed, or thoroughly scoured with water. The oval shape, as delineated in the diagram, is decidedly the best adapted for cleansing by a stream of water, and confessedly much better than the old form. For substances which would be deposited on the flattened surface 3, would be carried in suspension on the sharper curve 4.

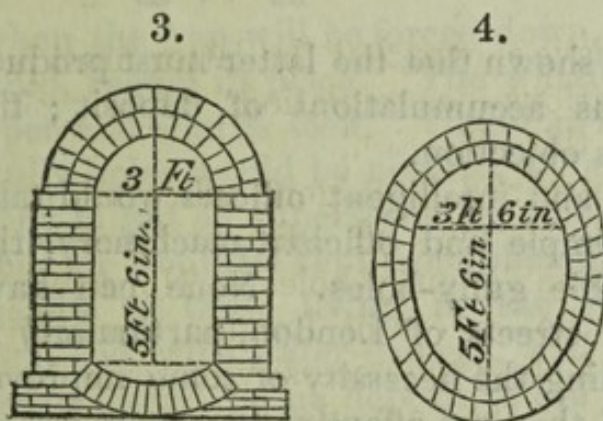
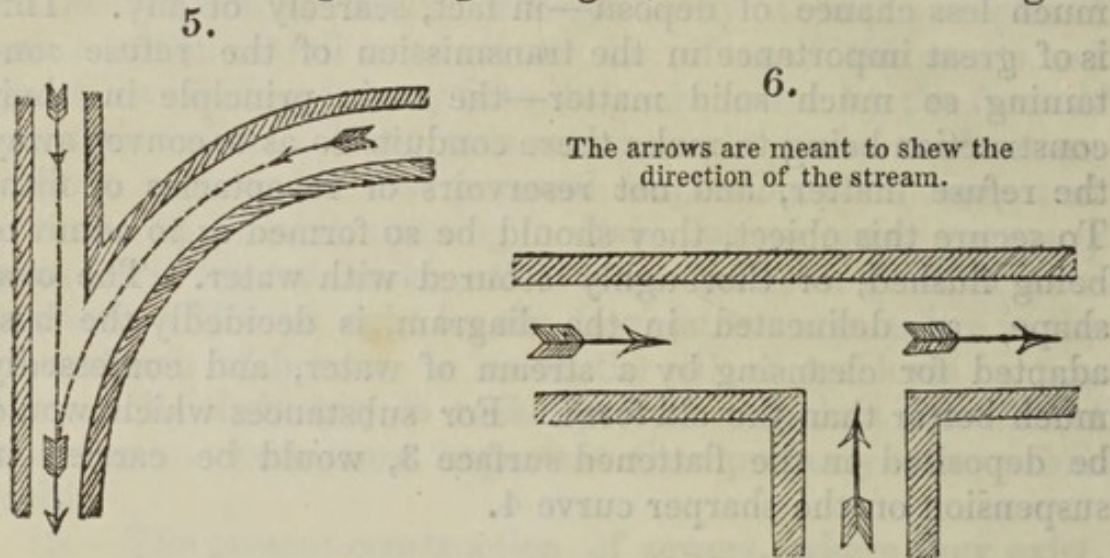


Fig 3 is the shape of the old sewers; and Fig. 4. the improved form suggested, and in every way better adapted for the purpose.

The superiority of the arch is so well known that there is no need to insist upon its security or strength when used in the building of sewers. The sides being so arched would stand better in loose or clayey ground than the straight wall, and would be more economical in construction. Unless they are continually scoured with water, deposits will take place, and obstruct the free passage of the refuse, which would then stagnate in these subterranean lakes or pools, and create the evils they are intended to remove. In the Holborn and Finsbury districts a plan of flushing the sewers has been adopted, and, after careful inspection, very strongly recommended by the commissioners. The public are indebted to Mr. Roe, the civil engineer, for its invention. The plan is to have, at certain convenient distances in the sewers, cast-iron gates, called flushing gates; when closed they stop the water ordinarily

flowing through them. When a great force of water is accumulated, the gates are opened, and, rushing forth in freedom, it sweeps away the whole deposits.

17.—Another improvement has been suggested, that of building sewers to meet by a curve, as shewn in Fig. 5, instead of meeting at right angles, as exhibited in Fig. 6.

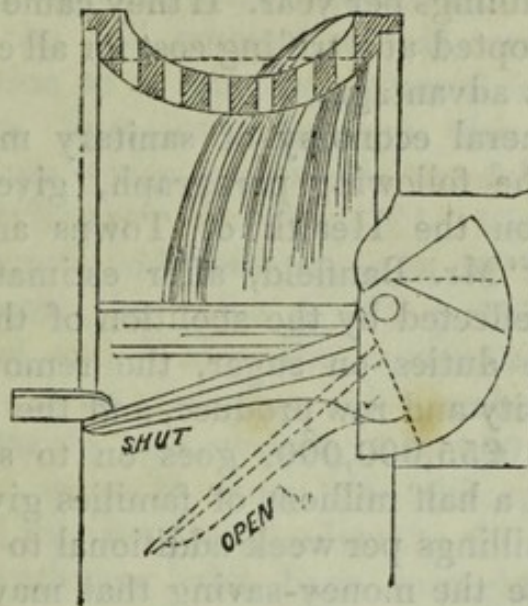


Writers on hydraulics have shown that the latter must produce eddies, and form injurious accumulations of deposit; the former plan will obviate this objection.

18.—Properly appointed and intelligent officers would take care to obviate, by some simple and efficient machinery, the present highly objectionable gully-holes. None can have walked any distance in the streets of London, particularly in warm weather, without feeling the necessity of some improvement in this particular. If they are offensive to a mere passer by, what must they be to the residents of the houses within a few yards of a gully, from whence stinking fumes are continually steaming up—the inhabitants taking in large doses of an atmosphere as injurious as that arising from stagnant marshes and ponds; and not the less fatal to health, notwithstanding those who imbibe it have become so used to it that it has ceased to be a sensible annoyance. In Dean Street, Fetter Lane, are seven gully holes in 55 yards. Instances are numerous where families have always been ailing who live in close proximity to these outlets, from the poison of the sewers; and butchers and fishmongers complain of their meat becoming tainted. A system of trapping that would be equally applicable to house drains, and would admit of the passage of the fluid refuse, away from the houses and streets but keep down the stink, is desirable. The following trap for street sewers was suggested by Mr. Flockton, and a modification of it by Mr.

Bingham, of Reading, is now in use in that town. The water rushing in through the grating at *a* will rise to the level of *b*.

Fig. 7. *a.*



when the trap will be forced down, and, after the passage of the fluid, regain its place. The relative position of the trap when open and shut is seen. Under an improved system much fewer gully holes would be necessary ; and there is little doubt that they might be superseded by other simple plans, by which the foul air would be kept from offending the senses, or injuring the health of those living in the streets. If the sewers were supplied with water enough, and so built and laid out that there should be no deposit, there would be no gas, for it has been recently proved that flowing sewer water does not contain any offensive gas whatever : it contains a disagreeable animal odour, but that is all.

19.—A thorough system of street sweeping or scavenging is indispensable to efficient sanitary reform. Mr. Whitworth, of Manchester, invented a machine which, by the labour of one man and a horse, will sweep a length of street which could only be swept by the labour of between 30 and 40 men ; and he offered to sweep twice by this apparatus for the price paid for sweeping once by the present methods ; but so great is the opposing interest that, notwithstanding its success has been fully proved, only three out of the eighty petty jurisdictions in London would venture upon a trial. Under proper and responsible official superintendence, it is conceived impossible that such neglect of public, to the supposed advantage of private, interests could continue.

20.—Another very important matter belongs to our present subject, the substitution of water closets for the present privies. The Water Company of Nottingham are glad to put water closets in the houses of tenants at a rental above £100, on the payment of ten shillings per year. If they came into general use, they could be adopted at a trifling cost for all classes of tenants, and with obvious advantage.

21.—The general economy of sanitary measures may be estimated from the following paragraph, given by Dr. Guy in his lecture on the Health of Towns and contained in Appendix G. “Mr. Banfield, after estimating the savings which might be effected by the abolition of the corn laws, the reduction of the duties on sugar, the removal of duties on articles of necessity and raw produce, and the disuse of intoxicating drinks at £55,000,000, goes on to say ‘this divided amongst five and a half millions of families gives £10 10s. per annum or five shillings per week additional to each. I am inclined to estimate the money-saving that may be achieved by improving the Health of Towns at a sum equal to this.’” Several similar calculations have been made which in all probability, startling as they may appear at first sight, are below the actual loss. Dr. Lyon Playfair has calculated that the saving in Manchester would not be less than £1,000,000, and Mr. Hawkesley estimates the saving at Nottingham at not less than £300,000. The following paragraph from Dr. S. Smith’s evidence will also be instructive. “The Bethnal Green and Whitechapel Unions incurred an extra expense for fever cases for the quarter ending Lady-day, 1838, the one of £216 19s., the other of £400, making a total of £616 19s.; and being at the rate of £2,467 16s. a year.” And “of the total number who received parochial relief in most of the districts, a very large proportion received it in consequence of their being ill with fever; but in one district, namely, St. George’s, Southwark, out of 1467 persons who received parochial relief, 1276—that is, the whole number with the exception of 191—are reported to have been ill with fever.”

22.—All true economy points to these sanitary improvements as desirable. It is not only a question of practical benevolence:—we not only see the good in the realization of assured physical comforts, the decrease of disease, and diminution of the public burdens; but we find they point, if not to more obvious, to more immediate sources of profit, by applying the refuse of our towns to agricultural purposes, instead of letting it run to poison our rivers, or remain to infect the atmos-

phere. The waste of manure is immense; while it is apparent on the most cursory glance that a revenue might be derived from this one source that would materially assist in paying the expenses of an efficient machinery for supplying water, and carrying away the refuse of dwellings and streets. It is impossible to estimate the full amount of this annual waste; but some approximation to it may be gathered from the evidence referred to more than once through this pamphlet. In Flanders, it appears, where manure is carefully collected, the *excreta* of an adult are valued at £1 17s. Taking into account the numerous additions made in our large towns, we may safely estimate the value at £2 per head; and then, taking in England and Wales, the population at 5,000,000, supposing there are no more than this number who are guilty of this waste, then we lose annually £10,000,000. It would occupy too much space to enter into this question. It is, however, essential that we should advert to the valuable suggestions of those gentlemen who have brought their enlarged experience to bear upon it, and who urge the desirableness of carrying the sewer water in its liquid state to fertilize the soil. We know that large quantities of water can be carried to great distances by machinery; and that by similar means the refuse of the sewers might be carried at a cost of 2½d. per ton, whilst the cost of cartage for solid manure would cost 4s. per ton. We find also from a very high authority, Mr. James Smith, of Deanston, that the distribution of the sewer water, in the most valuable—the liquid form, holding a quantity of valuable salts in solution, and a proportion of less valuable matters in suspension, and all these necessary as the food of plants, would only cost 6s. per ton, whilst in the solid form it costs about £3. This experiment has been tried in a farm near Glasgow. A spirited agriculturist found it worth his while to construct machinery, and lay down pipes over a farm of 300 acres, at a cost of 30s. per acre, to distribute the liquid manure by means of hose, and a steam-engine already in use for other purposes. And it is proved beyond doubt that the manure thus applied, by sinking into the soil, is not only better for agricultural purposes, but is less offensive than when laid on in its solid state, waiting for the rain to dissolve and blend it with the earth it is intended to nourish and improve. The following extract from the evidence of Mr. Smith is exceedingly important:—“I have ascertained that the quantity of sewer water due to a town of 50,000 inhabitants amounts to about 1,190,080,946 gallons per annum, which

quantity will yield an annual application of 17,920 gallons per acre, to an extent of 66,410 acres. Taking the average cost of guano and farm-yard manure at £2 per acre, and deducting 12s. 9d., the cost of the application of the sewer water, there will appear a saving due to the sewer water of £1 7s. 3d. per acre; allowing one-half thereof to go to the farmer, there will remain a free income due to the sewer water of £45,241, which is nearly £1 per head of the population."

23.—A company has been formed and incorporated by Act of Parliament, under the title of the Metropolitan Sewage Manure Company, for the purpose of collecting and pumping into the country the water of some of the principal Westminster sewers. The promoters of this undertaking anticipate a handsome profit, which they will have well deserved should they succeed in thus combining the advantage of town and country—conferring health on the one and abundance on the other. All classes must watch this great experiment with lively interest: if successful, it will be to agriculture what the first railroad was to locomotion.

24.—It will thus be seen that every consideration of humanity, prudence, and economy point to sanitary regulations as the greatest amongst our social reforms. Science, which has done so much to ameliorate man's social condition, which has enabled him to turn the wilderness into a garden, and to shape the granite rock into the magnificent temple; which by the power of steam, is binding town to town, and bringing nations into closer communion, offers the means by which we can remove the causes of disease, sweep away the refuse of our towns, to replenish the earth, and bring back to our dwellings abundance of clear pure water. Without an efficient water supply all schemes of sewerage and drainage would be in vain; in fact, be evils instead of blessings. But that important subject will require a separate address, which will form No. 5 of the present series.

The Committee of the Metropolitan Working Classes' Association meets at half-past Eight o'clock in the Evening, on the last Friday in every month, at No. 29, Great Marlborough Street. The Sub-Committee meets every fortnight at the house of the Treasurer, Joseph Toynbee, Esq., 12, Argyll Place, Regent Street.

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