The subject is by the common law entitled to protection against anything as a nuisance, which is offensive to the senses, although no injury to the health results from it, nor any other injury than the discomfort of offensive smells, or of filth and other matters offensive to the sight.

House drains, or branch or main drains, which detain and accumulate deposit, can scarcely fail under ordinary circumstances to give off emanations offensive to the senses, which will make them nuisances within the meaning of the act, and such emanations are often fatal, and are always injurious, by lowering the general tone of health, even when they are so diluted as not perceptibly to produce specific disease.

It cannot be too often impressed on Local Boards, that it is their duty to cause such sewers to be made as may be necessary for effectually draining their district for the purposes of the Public Health Act, and that this duty is not discretionary but compulsory. Nor must it be forgotten that a Local Board may incur penal consequences as well from the improper discharge of their duty, as from the "unlawful omission" of it. Whatever discretion the Act may have allowed with respect to the form of works, or their mode of construction, they must be so executed as neither to create a nuisance, nor incur wasteful expenditure,—the very objects which it was the intention of the Statute to prevent. The legislature having charged Local Boards with the duty of executing its beneficent provisions for the protection of the public health, they are subjected not only to moral, but also to legal responsibility for any private or public injuries which they may occasion, whether by their acts of commission or omission. They may create nuisances by constructing bad works, or by allowing nuisances to accumulate in consequence of constructing no works at all, when, by the Statute, they are under legal obligation to provide them. If they allow nuisances to remain, when they are bound to remove them, they incur legal responsibility for neglect of duty, or, in legal phrase, for "nonfeasance;" if, from insufficient attention or culpable negligence, they create nuisances in the attempt at removal, the offence arising unwittingly or from negligence, they incur responsibility for "misfeasance;" and if they create nuisances by wilful neglect or defiance of previous available information and experience, they incur reponsibility for "malfeasance."

Signed by order of the Board.

C. Macaulay, *Secretary.*

Whitehall, 25th June 1852.

APPENDIX.

(No. 1.)

Elementary Maxims to be kept in view in the Drainage and Cleansing of Towns.

Ascertain, if practicable from any existing or previous experience of storms within the district, with what modifications the tables herein-before given may be applied to the district.

Where drainage works have already been laid down, observe the outfalls and the branches, both in the discharge of pipe water and of rain-water, and the quantity of deposit left; and from such observations judge of the corrections requisite in the sizes of tributary pipes.

In laying down main drains or sewers in any street, let it be ordered at the same time that all cesspools on the premises in such street shall be filled up; that tubular house-drains shall be provided, and that a sufficient flow and sweep of water shall be secured to keep such drains free from deposit.

Provide that blood, semi-fluid offal, garbage, and refuse of every description, which may be capable of safe removal in the drains by suspension in water, from slaughter-houses, markets, shambles, stables, cow-houses, or manufactories, be conveyed into the drains on the principle of the soil-pan apparatus, taking care that such refuse be led as directly as possible into those main-pipes which have the largest, quickest, and most constant flow.

Provide such gullies or openings into the sewers that the surfaces of streets, foot pavements, roads, yards, markets, or open spaces where there is much traffic, or droppings from cattle, or other filth, may be promptly cleansed by means of the jet.

Make proper provision for the ventilation of all sewers and drains in such manner that there may be a free current of air through them in the direction of the sewage flow.

To adjust the drains to the service they will be required to perform, calculate for extraordinary storm-waters in those valley or outlet lines only where it will be necessary to accommodate them.

Take care that in laying socket-jointed pipes great caution is used to give the pipes a full bearing, and not to allow the plain ends of the pipes to "*bind*," or rest solely on the socket, as, by doing so, pipes are frequently broken.

Whilst proper provision is made for the discharge of storm-waters in valley lines, where there is a natural descent, do not provide for taking them into the sewers of streets and places where storm-waters can flow on the surface without inconvenience, and thus, at increased cost, incur the certainty of weakening and impeding the ordinary discharges by the use of sewers too large for them.

To provide an efficient drainage where a natural outfall is wanting for a continuous discharge of sewerage, as in the case of lands near tidal rivers and below high-water mark, pumping should be resorted to; but in order to economise power, cut off the upper districts wherever practicable by a line of catch-water sewer for discharge by gravitation, so as to avoid any unnecessary quantity flowing down to a depth whence it must be pumped up again.

Admit into the soil-drains only the surface-drainage of streets, roads, places of traffic, roofs, yards, &c. which discharge foul water.

Lead the under-drainage of garden grounds and all clean waste water, when it is considerable in quantity, into the pipe-drains for the land.

Allow no private tradesman, or irresponsible person, to make junctions with the public sewers, except under proper regulations and strict superintendence.

Prefer always a small drain, with a good inclination, to a large drain with a less inclination.

Make all junctions with the largest curves practicable, and allow no junctions whatsoever at right angles.

Join all vertical pipes into the mains at the side, with a curve.

In vertical junctions let the bottoms of the pipes be level with each other.

Use syphon-traps at all times in preference to flap-traps or bell-traps.

Give a large body of water to all water traps.

Place the syphon-trap low, at a little distance below the opening, so that the force of water may effectually discharge its previous contents.

Take care to put cesspits to all road-side openings to prevent the entrance of stones or solid detritus into the gully-shoots or pipe-drains, and let these cesspits be frequently cleansed by water with the jet, and let the solid matters be regularly removed.

Choose those forms of soil-pan apparatus which keep the pan clean, prevent the ingress of hard solids not smaller than the connecting pipe, and afford a sufficient trap with the least quantity of water.

Allow no supplies of water to water-closets or soil-pans, which have not one form or other of self-closing taps or valves.

Take care to protect the upper ends of all drain-pipes by proper grates, or other means, so as to render it impossible for careless or mischievous persons to choke the pipe by a thoughtless or wilful insertion of large solids.

The tests of the completeness of all and every part of the general system of drainage works, combined with waterworks, is, that no matter liable to run into decomposition,—no matter whatsoever,—is detained in them, but that all is received in suspension in water, and kept in constant motion until it is discharged at the outfall; and the chief points of comparative superiority in the works are—the great quantity of matter removed in suspension in water—the rapidity and completeness of its removal—and the small quantity of water with which the removal is effected—and the general low rate of expense.

(No. 2.)

SPECIAL MAXIMS AS TO THE APPLICATION OF WATER.

Allow no water to be conveyed into any premises until assured that means are provided for removing the waste water, and take care that near to every end of a water-pipe there is a drain or return-pipe, and that under every water-tap there is placed a sink.

Take care that a stop-tap is provided upon the service-pipe in each house, so that in the case of breakage or repairs the water may be at once turned off. The best situation for the stop-tap is immediately withinside the house by the frontage wall.

Take care that all piping in exposed situations be well protected against frost. Half-inch deal-box troughing, about $2\frac{1}{2}$ inches clear in the inside,

held to the wall with iron staples, and filled with sawdust, is found to be sufficient.*

Allow no old-fashioned plug-taps, whether bit, stop, or ball, to be made use of, and always reject any tap which can be closed suddenly;—unless this is carefully attended to, the hydraulic shock or ram of water under pressure brought to a sudden state of rest, will not only produce an unpleasant noise, but often ultimately burst the strongest piping. Those taps which are gradually shut by the action of a screw, and called thence "screw-down taps," are the best for domestic purposes.

Look to the adjustments of taps, and of spreaders or valves in soil-pans, to the pressure of water in the lower and upper floors, and at different altitudes.

Allow only those taps which are self-closing to be used for soil-pans and water-closets, unless other means are provided for the prevention of waste of water.

Substitute for lead service-pipes, pipes of tin or of iron protected by enamel; or better still,—as being less subject to oxidation, less liable to breakage from frost, and when air vessels are properly arranged, in less danger of breakage from hydraulic jerks,—well-made earthenware pipes.

Provide air-cushions in the mains at proper stations, where the hydraulic shocks to the general system of pipes might otherwise be severe.

Let the taps be always one eighth of an inch larger in bore than the pipe supplying them; by which means any wire-drawing, or spreading of the water, will be obviated, and the full effect of the discharge of the pipe attained.

Place a fire-plug stand-pipe at every junction of one street with another, and at other points at intervals not exceeding 80 yards. Let the fire-plug boxes or stand pipes be placed close to the curb-stone, and not in either the roadway or footpath, and let the situation of each be indicated by a conspicuous mark.

Let the fronts of public edifices, as well as shop-fronts, and the fronts of houses, be kept clean by jets, at such convenient times as the ratepayers may desire.

For street-cleansing let the same hose and apparatus be used as for the prevention of fires; and let the different sets of apparatus provided, be stationed in different parts of the district, so that a set may always be near at hand in case of fire.

Keep the whole works, house services and waste-pipes, the smallest branches as well as the mains, under one and the same management, and that management a public and responsible one.

(No. 3.)

SPECIAL MAXIMS IN THE CASE OF OFFENSIVE SMELLS FROM HOUSES.

In case of offensive smells, proceeding from any premises, let the surveyor, on noticing it, or on his attention being called to it, proceed to enforce the byelaw thereon, until the smell is removed.

All smells whatsoever from soil-pans, house-drains, or main-drains, denote neglect or defective engineering arrangements requiring correction.

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* Gutta percha (which is a very slow conductor of heat) being used for pipes, water is little liable to freeze in them, and if it does they yield, and do not burst; neither are such pipes liable to injury from chemical action. They are, however, rather expensive, unless such as those of very small size, described at page 118, are employed.

(No. 4.)

BYELAWS FOR THE DIRECTION OF OFFICERS OF LOCAL BOARDS IN THE EXECUTION OF NEW WORKS.

The following byelaws have been prepared in conformity with the principles herein-before expounded.

With a view to the utmost promotion of these important works of sanitary improvement, it is above all things desirable that every guarantee should be afforded to the public for the permanent efficiency and economy of the necessary works, and that every facility for their execution should be given by removing the pressure of immediate payment.

For the efficiency of the work, and the protection of the householder as well as the public, it should be required that the surveyor, either himself, or by a clerk of the works, shall inspect, without fee, every new house-drain before it is covered in, and see that it is in every respect conformable to the regulations of the Local Board, and the requirements of the Public Health Act. Every care should be taken to select superior workmen of good character, which precaution would remove much of the objection that is felt to the admission of strangers into houses.

Contracts (of which forms of specifications are hereunto annexed) should be obtained for the supply of all materials—drain and water pipes, water-closet basins, taps, sinks, syphons, and other matters, according to specifications; and on application for the construction of house-drains, estimates should in each case be made of the cost of emptying and filling up cesspools, putting in drains, laying on water, performing such other works as may be necessary, and making good whatever may be disturbed.

The total cost should, wherever practicable and desired, be distributed over a period of years, and payment obtained, as a private improvement rate, by a fixed annual charge of principal and interest, including the expense of the maintenance of the work, in order that the outlay may press equally and fairly upon all benefited. This annual charge, added to the amount of sewer-rate, would cover all repairs, alterations, or clearances of stoppages that might be necessary, and entirely protect the owner or tenant from any annoyance, cost, or liability from the drains during the period fixed, except from damage or obstruction wilfully or mischievously occasioned, for the reparation of which alone he would be called upon to pay.

By such means the best security would be afforded for the efficient and economical execution of the work, and for its ready adoption by the public.

(No. 5.)

BYELAWS AND REGULATIONS RECOMMENDED TO BE OBSERVED BY THE SURVEYOR IN RESPECT TO THE PREPARATION OF PLANS AND THE SUPERINTENDENCE OF WORKS OF HOUSE DRAINAGE.

In the case of house-drainage to existing buildings, whether by order of the Local Board, or on the application of private parties, copies of the detail plan and levels of the whole block of buildings of which those in question form a part, should in every instance be supplied from the office; and if not already obtained, the surveyor should forthwith furnish it.

He should then examine, plan in hand, the whole of the particulars of the property of which a knowledge is required, and report its capabilities for combined or separate drainage, its supply of water or facility for obtaining it, the state of the paving or other surface, the provision of dust-bins and other means of cleansing, adding the information necessary for a decision as to the interests affecting the property.

Being in possession of the complete plan of the particular block in each case, he should determine the plan of drainage most advisable, instead of working by piecemeal with limited information.

In determining the direction and arrangement of the drainage, the surveyor should pay the utmost attention to secure, as far as practicable, the shortest course, the greatest inclination, and the readiest combination of the branch-drains and traps.

Having decided on the most advisable arrangement, he should then compute the area of the surface to be drained, and determine by the table the graduated sizes of the drain. Every inlet to the drains of each house should be accurately marked, and the dimensions of the branches therefrom carefully fixed.

In the execution of the work in public places, the excavations should be securely protected when necessary, and properly lighted and watched.

Excavations of the exact form and depth for each line of drainage should be made and tested before any pipes are laid; and if any irregularities occur in the foundation, they should be made sound and even with clay, clean gravel, or other approved material well rammed.

When the pipes have been laid, the sides should be carefully filled in, and well rammed to keep them in place before they are covered, and the work of filling in the trenches commenced. The levels and workmanship of the pipe-laying should then be tested before they are covered in. The best materials and workmanship only should be allowed: any imperfection in either must be immediately remedied. The directions of the surveyor as to qualities of materials and workmanship must be strictly attended to, and no other forms or description of materials and apparatus should be permitted without his previous inspection and approval.

No junctions or curves, other than those approved by the surveyor, should on any account be allowed.

No pipe should join another of larger size without one or more intermediate tapering lengths. All openings should be trapped,* and, where practicable, at or near their inlet. As a general rule the syphon should be of the same bore as the drain.

Where syphons are inserted, bell traps should be disallowed; but where there are good bell-traps with covers securely fixed, syphons need not be added.

Whenever whole socket pipes are used with cement joints, they should be put together "dry," and the joints afterwards filled round with approved cement; and the utmost care taken that no rubbish or obstruction of any kind be left in the drains.

Every inlet should be securely protected.

All old drains and cesspools, when done with, should at once be emptied and abolished, every care being taken that this work is performed in such a manner, and with such appliances, as to cause as little annoyance as possible.

Their site should be filled in with dry rubbish or earth, well rammed.

Every portion of the work before covering in should be inspected by the surveyor, who should add to the plan his certificate of the work having been so examined, and found to be of proper materials and workmanship, and to be correctly laid in every respect.

A book should be kept in which every application for a drain should be entered; and another book in which all complaints should be entered.

No private work of drainage should be allowed to be put in connexion with the sewers without a previous examination and certificate by the

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* Except rain-water pipes, the openings or heads of which may be so situated that no inconvenience would arise from any effluvium from them. In these cases traps should be omitted, as the pipes would serve as excellent ventilators of the drains.

surveyor, to the effect that it has been properly laid, that the adequate covers to the inlets have been fixed, and that no danger of stoppage or inconvenience is likely to arise from it.

The inclinations and sizes of the drains, and the depth beneath any fixed contiguous point, to which reference can be readily made, should be invariably recorded upon the plan: the name of the contractor or other party executing the work, with the date of its commencement and completion should be also noted thereon, and entered in an office register containing all the particulars of the work. A section of the work, exhibiting the nature of the ground which has been met with in the excavations, should be recorded at every fifty feet distance.

Whenever any new private drainage should not have been completed in every respect according to the rules laid down, or any old drains or cesspools shall not have been removed, the facts should be at once reported to the Local Board, and its directions asked thereon.

BYELAWS as to the SURVEYOR'S DUTIES as to TOWN DRAINAGE.

Before the water-mains or the sewers are carried to their proper points at the backs of houses (or, where unavoidable, through the streets), the surveyor should make a house-to-house inquiry, and ascertain the state of the respective houses with relation to their water supply and conveniences for cleansing. He should do this by inspection as well as by inquiry of the occupiers, and should give them verbal explanations as to the nature and progress of the main works, and what their own houses require, and as to the contract prices for works executed out of private improvement rates. He should also, for his report to the Local Board, make entries of the works required for each house, and of works in preparation.

He should next advise with the owners of the worst-conditioned houses as to the works required, and ascertain whether they would prefer to have the works executed by the public contractor or by tradesmen of their own, to whom he should forward instructions as to the particulars of works required by the Local Board.

Having thus ascertained the requisite particulars and made his estimate, he should make his report to the Local Board, obtain their orders thereon, and endeavour to complete, the notices and orders to occupiers for the required house works, so that the house-drains and water-services may, as far as possible, be completed with the mains when the trenches are yet open. The expenses of re-opening the trenches and making good the pavement may thus be saved.

A record should be kept at the surveyor's office of the course of house-drains, sufficient to furnish accurate information in the event of stoppages.

When the house-drains are laid down by a private tradesman, a certificate should be signed by him. It is very desirable that Local Boards should in all cases where works are done by private persons, require and preserve a certificate, to be signed by the tradesman that the work has been done by him.

The surveyor, or his officer, should also sign a certificate attesting the fact of a due examination of the work having been made, and that it is sufficient, and stating the time when it was examined.

INSTRUCTION to SURVEYOR as to combined PRIVATE WORKS for the SUPPLY of HOUSES with WATER, the REMOVAL of WASTE WATER, and the general ABOLITION of CESSPOOLS.

"The general object of the Public Health Act is to ensure that a constant supply of pure water shall be carried into every house, and that means shall be provided, by return-pipes and house-drains, for carrying away all waste foul water from thence, and for preventing damp.

Other main objects of the Act which it is the duty of the Local Board to execute, are, to ensure that no ordure shall remain in or near premises, to abolish all cesspools, and to prevent the saturation of the soil and foundations of dwellings with foul matter, so as to avoid the creation of noxious vapours to the injury of the health of the inmates of the houses, or the deterioration of the air of the town.

The Local Board have now provided the main public works to facilitate the accomplishment of these objects for the service of the inhabitants. A proper supply of water has been obtained, and will be brought in mains, laid in a convenient direction for all the premises in the street where your house is situated, for the delivery of a constant supply into your house, by a service pipe and proper tap. This supply will serve for all domestic purposes, and for the use of a water-closet in the place of the cesspool, which is directed to be filled up. The Local Board have also completed the main drains and public sewers, for the removal of all foul water and refuse discharged by waste-pipes, sinks, water-closets, and house-drains.

For the fulfilment of the objects of the Act, the Board, acting under it, have directed written notices* to be herewith sent on the report of their surveyor, directing you now to lay on a supply of water from the main, by a service pipe, and to put down a sink and a house drain, to fill up cesspools, and to provide a proper water-closet and dust-bin. When these requisites are provided, if they are provided at reasonable rates and the work is properly executed, they will be found conducive to the comfort, health, and respectability of the inmates, and they will be in reduction of the occupier's present charges. As the works prescribed will be additions to the premises, some addition of rent will be equitably due from the occupier for them. Should neither the owner nor the occupier be prepared to provide the required works, the Local Board will direct a proper and responsible contractor to execute them, at such time as will be the least inconvenient to the occupier; and in this case immediate payment for the outlay will not be required, but the works will be paid for by an improvement rate, distributed over a term of years, unless the owner should prefer paying the expense at once.

The cost of the work to be executed on your premises, if repaid by annual instalments of principal and interest, will not exceed a charge of per week, or quarterly.†

Owners or occupiers may get these works done themselves, on giving due notice, provided they are done to the satisfaction of the surveyor.

If a service-pipe, tap, sink, and return-pipe be fixed in each floor, the same expense will, of course, be incurred in each case.

The drains must be impermeable, and of the specified size and inclination; the water-closet apparatus and arrangements must be such as will detain and accumulate no deposit. The water-pipes must be of the specified diameter, and of sufficient strength, and the water taps or valves must be such as will not be liable to waste. Beyond such points as these, which must be attended to for the protection of the general service of the town, owners and occupiers may choose such descriptions of apparatus and sinks as they please. The Board have entered into contracts for the execution of such works, in order to protect the ratepayers from exorbitant charges for irregular and defective works.

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* These notices may be issued to any premises in the district as the works proceed, as soon as a public sewer has been brought to within 100 feet of such premises, without waiting until the whole of the public works have been carried out. Much time and trouble may thus often be saved in the execution of the private works.

† The charge for the public works and water supply and drainage will be in addition, and the whole expense will be less than the ordinary cost for mere cleansing.

surveyor, to the effect that it has been properly laid, that the adequate covers to the inlets have been fixed, and that no danger of stoppage or inconvenience is likely to arise from it.

The inclinations and sizes of the drains, and the depth beneath any fixed contiguous point, to which reference can be readily made, should be invariably recorded upon the plan: the name of the contractor or other party executing the work, with the date of its commencement and completion should be also noted thereon, and entered in an office register containing all the particulars of the work. A section of the work, exhibiting the nature of the ground which has been met with in the excavations, should be recorded at every fifty feet distance.

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He should next advise with the owners of the worst-conditioned houses as to the works required, and ascertain whether they would prefer to have the works executed by the public contractor or by tradesmen of their own, to whom he should forward instructions as to the particulars of works required by the Local Board.

Having thus ascertained the requisite particulars and made his estimate, he should make his report to the Local Board, obtain their orders thereon, and endeavour to complete, the notices and orders to occupiers for the required house works, so that the house-drains and water-services may, as far as possible, be completed with the mains when the trenches are yet open. The expenses of re-opening the trenches and making good the pavement may thus be saved.

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The surveyor, or his officer, should also sign a certificate attesting the fact of a due examination of the work having been made, and that it is sufficient, and stating the time when it was examined.

INSTRUCTION to SURVEYOR as to combined PRIVATE WORKS for the SUPPLY of HOUSES with WATER, the REMOVAL of WASTE WATER, and the general ABOLITION of CESSPOOLS.

"The general object of the Public Health Act is to ensure that a constant supply of pure water shall be carried into every house, and that means shall be provided, by return-pipes and house-drains, for carrying away all waste foul water from thence, and for preventing damp.

Other main objects of the Act which it is the duty of the Local Board to execute, are, to ensure that no ordure shall remain in or near premises, to abolish all cesspools, and to prevent the saturation of the soil and foundations of dwellings with foul matter, so as to avoid the creation of noxious vapours to the injury of the health of the inmates of the houses, or the deterioration of the air of the town.

The Local Board have now provided the main public works to facilitate the accomplishment of these objects for the service of the inhabitants. A proper supply of water has been obtained, and will be brought in mains, laid in a convenient direction for all the premises in the street where your house is situated, for the delivery of a constant supply into your house, by a service pipe and proper tap. This supply will serve for all domestic purposes, and for the use of a water-closet in the place of the cesspool, which is directed to be filled up. The Local Board have also completed the main drains and public sewers, for the removal of all foul water and refuse discharged by waste-pipes, sinks, water-closets, and house-drains.

For the fulfilment of the objects of the Act, the Board, acting under it, have directed written notices* to be herewith sent on the report of their surveyor, directing you now to lay on a supply of water from the main, by a service pipe, and to put down a sink and a house drain, to fill up cesspools, and to provide a proper water-closet and dust-bin. When these requisites are provided, if they are provided at reasonable rates and the work is properly executed, they will be found conducive to the comfort, health, and respectability of the inmates, and they will be in reduction of the occupier's present charges. As the works prescribed will be additions to the premises, some addition of rent will be equitably due from the occupier for them. Should neither the owner nor the occupier be prepared to provide the required works, the Local Board will direct a proper and responsible contractor to execute them, at such time as will be the least inconvenient to the occupier; and in this case immediate payment for the outlay will not be required, but the works will be paid for by an improvement rate, distributed over a term of years, unless the owner should prefer paying the expense at once.

The cost of the work to be executed on your premises, if repaid by annual instalments of principal and interest, will not exceed a charge of per week, or quarterly.†

Owners or occupiers may get these works done themselves, on giving due notice, provided they are done to the satisfaction of the surveyor.

If a service-pipe, tap, sink, and return-pipe be fixed in each floor, the same expense will, of course, be incurred in each case.

The drains must be impermeable, and of the specified size and inclination; the water-closet apparatus and arrangements must be such as will detain and accumulate no deposit. The water-pipes must be of the specified diameter, and of sufficient strength, and the water taps or valves must be such as will not be liable to waste. Beyond such points as these, which must be attended to for the protection of the general service of the town, owners and occupiers may choose such descriptions of apparatus and sinks as they please. The Board have entered into contracts for the execution of such works, in order to protect the ratepayers from exorbitant charges for irregular and defective works.

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* These notices may be issued to any premises in the district as the works proceed, as soon as a public sewer has been brought to within 100 feet of such premises, without waiting until the whole of the public works have been carried out. Much time and trouble may thus often be saved in the execution of the private works.

† The charge for the public works and water supply and drainage will be in addition, and the whole expense will be less than the ordinary cost for mere cleansing.

The surveyor is required to consult the convenience and the wishes of the occupiers as much as he can, and to give them full information.

The water mains and the main drains have been directed to be brought up to the back premises, wherever possible, and as near as practicable to the sink and water-closet, to prevent annoyance, and three or four fold expense of breaking up the floors of the house to carry the service-pipe and the drains to mains laid in the centre of the streets. Though this may require the occasional admittance of the surveyor or other responsible person to the back premises (at reasonable times) to remove stoppages or make repairs, the occupiers will be saved the necessity of admitting workmen to take up their floors, while they altogether escape danger and annoyance from the passage of offensive and noxious matter through the house itself.

FORMS of NOTICES for PRIVATE IMPROVEMENT WORKS for WATER SUPPLY; the ABOLITION of CESSPOOLS, and for HOUSE DRAINAGE and CLEANSING.

(NOTICE to construct DRAIN.)

*Local Board of Health for the District of*_____

To[1] the[2] of the house situated at[3]

Whereas our surveyor, hath by his report bearing date the day of , made it appear to us that the house situated at[4] within our district, of which you are the[2] is without any drain,[5] and that a sewer[6] is within one hundred feet of some part of such house:

And whereas by the said report it appears to us that[7] covered drain of[8] and at a level of[8] and with a fall of[8] is[9] necessary:

We do hereby require you, within the space of from the date hereof, to construct and lay down such covered drain[10] in connexion with such house, and[11] of the materials and size, at the level, and with the fall.

And if this notice be not complied with, we shall do the works referred to herein, and recover the expenses from the owner of the said house in a summary manner; or declare the same to be Private Improvement Expenses, as set forth in the Notification hereunto annexed.

Given this day of 185 .

[1] Insert, if known, name of owner or of occupier.
[2] Insert whether owner or occupier.
[3] Insert name of surveyor.
[4] Describe situation of the house.
[5] Or, without such a drain or drains communicating with the sea, or a sewer, as is or are sufficient for the proper and effectual drainage of the same and its appurtenances.
[6] Belonging to us, or which we are entitled to use, or the sea.
[7] State one or more, as the case may require.
[8] Insert the materials to be used, the size, the level, and the fall.
[9] Or, are.
[10] Or, drains.
[11] Here insert the means of drainage according to note 5, that is, our sewer, or the sewer which we are entitled to use, or the sea.

[In a non-corporate district, this notice must be under the seal of the Local Board, and hands of five of its members; in a corporate district, under the common seal only.]

(NOTICE of LOCAL BOARD to OCCUPIER when WATER can be supplied at a rate not exceeding 2*d.* a week.)

*Local Board of Health for the District of*_____

To occupier of a house, situate at within the district of the Local Board of Health.

Whereas surveyor to the Local Board for the district of has reported to the said Board that the house of which you are the occupier is without a proper supply of water, and that such a supply of water can be furnished thereto at a rate not exceeding twopence a week:

The said Local Board do hereby require you, within the space of from the date hereof, to obtain a proper supply of water for the said house, and to do all such works as may be necessary for that purpose (as described in the Notification hereunto annexed); and in your default the said Local Board will do such works and levy water rates upon your premises, not exceeding in the whole the rate of twopence per week, and the expenses of such works will be private improvement expenses, and be recoverable as such in the manner provided in the said Act.

Given this day of 185 .

[In a non-corporate district, this notice must be under the seal of the Local Board, and the hands of five of its members; in a corporate district, under the common seal only.]

The following forms are those in use when Improvement Rates are to be levied by the Local Board of St. Thomas, Exeter:—

ST. THOMAS, NEAR EXETER.

July 1852.

SIR,

I am instructed by the Local Board of Health to serve on you the accompanying notice , and at the same time to acquaint you that the Board are desirous of rendering you every assistance in carrying out the requirements of the Public Health Act in the most effectual manner, and at the least possible cost.

On application at the offices of Messrs. Robert Dymond and Sons, surveyors, No. 10, Bedford-circus, Exeter, a plan, showing the details of the proposed works in connexion with your premises, will be exhibited to you, and every information as to their cost, &c. will be readily afforded.

The great attention that has of late been paid to the subject of sewerage works in the Metropolis and elsewhere has shown that no system of drainage is so cheap or effectual as that by means of glazed stoneware pipes. The Local Board having resolved on the adoption of this system have contracted with manufacturers for the supply of a large quantity of pipes, junctions, closet pans, sinks, &c. of the best quality and forms. They are consequently enabled to supply such as may be required in your case at the wholesale price.

Two methods of complying with the requirements of the notice are open to your choice, namely, by having the works carried out to the satisfaction of the surveyor of the Board, by parties employed by yourself, or the Board will undertake the works at an economical rate through their contractor, and under the superintendence of their surveyor, levying the expense as a private improvement rate, of such amount as will be sufficient to discharge such expense, together with interest thereon at 5*l.* per cent., in such period not exceeding thirty years, as the Board may determine.

You will therefore be pleased to fill up, sign, and return to me one of the enclosed forms, stating which of these methods you prefer.

I am, Sir,
Your obedient servant,
W. M. Benison, *Clerk.*

St. Thomas.

185

Sir,

I beg to acknowledge the receipt of your notice, dated 185 , and to inform you, that I am willing to undertake the construction of the required works to the satisfaction of the surveyor of the Local Board, by parties employed by myself.

I am, Sir,
Your obedient servant,

To Mr. W. M. Benison,
Clerk to the St. Thomas Local Board of Health.

St. Thomas.

185

Sir,

I beg to acknowledge the receipt of your notice, dated 185 , and to inform you, that I am desirous that the Local Board should undertake the construction of the required works, levying the expense of the same in the manner directed by the Public Health Act, 1848.

I am, Sir,
Your obedient servant,

Mr. W. M. Benison,
Clerk to the St. Thomas Local Board of Health.

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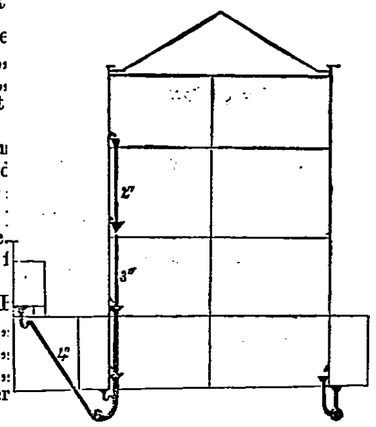
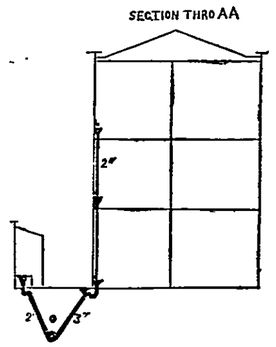
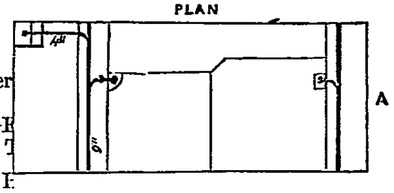
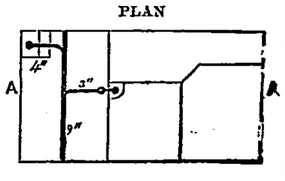
ief Classes.

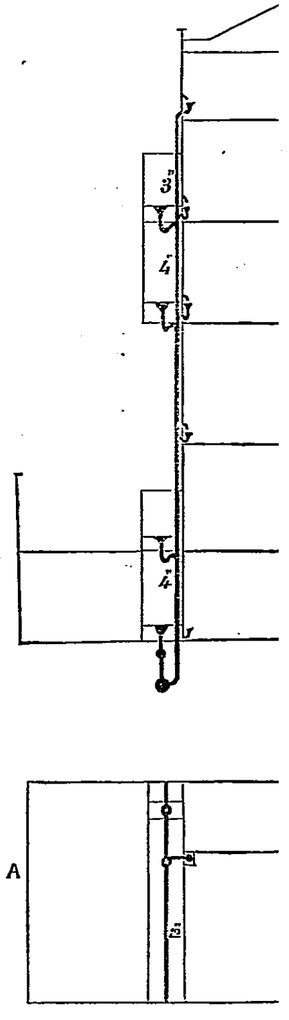
Descrip	THIRD RATE.	FOURTH RATE.
DR		
Drains, stone		
" "		
" "		
Water-closet		
"		
Sinks in hou		
" yard		
Syphons for		
Holdfasts to		
Digging, &c.		
Paving and 1		
1st-rate I		
2d "		
3d "		
4th "		
Labourer		
WAT		
Services, lea		
" "		
Cock, superi		
" comm		
" "		
Solder-joints		
"		
Putty-joints		
Wall-hooks		
1st-rate		
2d		
3d		
4th		
Labourer		
DRAINAGE		
1st-rate I		
2d "		
3d "		
4th "		
Labourer		

(No. 6.)

TABULAR VIEW of the QUANTITIES of MATERIALS and AVERAGE COST of improved Works for the Supply of Water (on the Constant System), for Water-closets

Description of Materials.	Unit of Measurement.	Rate of Cost.	1st-rate House. Sinks and water on one floor and water-closets on two floors.			2d-rate House. Sinks and water on one floor and water-closets on two floors.			3d-rate House. Sinks and water on one floor and water-closet in yard at back.			4th-rate House. Sink and water on one floor and water-closet in yard at back.			Labourer's Cottage. Sink and water in back room and water-closet in yard at back.			Average cost of drainage and water supply per floor additional.	Proportion of cost of sewer and water sub-mains on frontage of Houses.		
			Quantities.	Cost.	Per Week.	Quantities.	Cost.	Per Week.	Quantities.	Cost.	Per Week.	Quantities.	Cost.	Per Week.	Quantities.	Cost.	Per Week.	Cost.	Gross.	Per Week.	Per ft. run.
DRAINAGE.—		s. d.		£ s. d.			£ s. d.			£ s. d.			£ s. d.			£ s. d.		£ s. d.	£ s. d.	d.	s. d.
Drains, stoneware, 4 inch	Feet	0 7	34	0 19 10		30	0 17 6		14	0 8 2		6	0 3 6		6	0 3 6					
" " 3 "	"	0 5	12	0 5 0		8	0 3 4		8	0 3 4		7	0 2 11		7	0 2 11					
" " 2 "	"	0 4	8	0 2 8		5	0 1 8		5	0 1 8		4	0 1 4		4	0 1 4					
Water-closet pans complete, superior	No.	25 0	1	1 5 0		1	1 5 0		1	1 5 0											
" " common	"	12 0	1	0 12 0		1	0 12 0		- -	- -		1	0 12 0		1	0 12 0					
Sinks in houses	"	10 0	2	1 0 0		2	1 0 0		2	1 0 0		1	0 10 0		1	0 10 0					
" yards	"	2 3	2	0 4 6		2	0 4 6		2	0 4 6		1	0 2 3		1	0 2 3					
Syphons for sinks, 2 inch	"	1 3	4	0 5 0		4	0 5 0		4	0 5 0		2	0 2 6		2	0 2 6					
Holdfasts to pipes	,	0 4	12	0 4 0		10	0 3 4		1	0 0 4		2	0 0 8		2	0 0 8					
Digging, &c.	Yds.cube.	1 0	- -	- -		- -	- -		- -	- -		10½	0 10 6		10½	0 10 6					
Paving and flooring made good	Ft.super.	0 2	- -	- -		- -	- -		- -	- -		78	0 13 0		78	0 13 0					
					d.			d.			d.			d.			d.				
1st-rate House			- -	- -	1½	- -	- -	1⅜	- -	- -	1	- -	- -	0⅞	- -	- -	0⅞	1 17 3¼	6 1 6	1¾	4 6
2d "			- -	- -		- -	4 12 4		- -	- -		- -	- -		- -	- -		1 9 4	4 19 0	1½	4 6
3d "			- -	- -		- -	- -		- -	3 8 0		- -	- -		- -	- -		0 16 8	2 14 0	0¾	3 0
4th "			- -	- -		- -	- -		- -	- -		- -	2 18 8		- -	- -		0 16 6	0 17 6	0¼	1 2
Labourer's Cottage			- -	- -		- -	- -		- -	- -		- -	- -		- -	2 18 8		- -	0 17 6	0¼	1 2
WATER SUPPLY:—																					
Services, lead, ¾ inch	Feet	0 7	70	2 0 10		31	0 18 1														
" " ½ "	"	0 5	6	0 2 6		36	0 15 0		56	1 3 4		16	0 6 8		16	0 6 8					
Cock, superior, ¾ "	No.	6 0	1	0 6 0		1	0 6 0														
" common ¾	"	3 6	1	0 3 6		1	0 3 6														
" " ½	"	3 0	2	0 6 0		2	0 6 0		3	0 9 0		2	0 6 0		2	0 6 0					
Solder-joints	"	1 4	9	0 12 0		6	0 8 0														
"	"	1 0	1	0 1 0		1	0 1 0		10	0 10 0		4	0 4 0		4	0 4 0					
Putty-joints	"	0 6	2	0 1 0		1	0 0 6		1	0 0 6		1	0 0 6		1	0 0 6					
Wall-hooks	"	0 1	4	0 0 4		5	0 0 5		5	0 0 5		3	0 0 3		3	0 0 3					
					d.			d.			d.			d.			d.				
1st-rate			- -	3 13 2	1⅛	- -	- -	0⅞	- -	- -	0⅝	- -	- -	0¼	- -	- -	0¼	0 19 8	1 11 6	0⅞	1 2
2d			- -	- -		- -	2 18 6		- -	- -		- -	- -		- -	- -		0 16 7	1 2 0	0⅝	1 0
3d			- -	- -		- -	- -		- -	2 3 3		- -	- -		- -	- -		0 9 0	0 15 0	0⅜	0 10
4th			- -	- -		- -	- -		- -	- -		- -	0 17 5		- -	- -		0 9 3	0 10 0	0⅜	0 8
Labourer's Cottage			- -	- -		- -	- -		- -	- -		- -	- -		- -	0 17 5		- -	0 10 0	0⅜	0 8
DRAINAGE & WATER SUPPLY. TOTAL:—					d.			d.			d.			d.			d.				
1st-rate House			- -	8 11 2	2⅝	- -	- -	2⅛	- -	- -	1⅝	- -	- -	1⅛	- -	- -	1⅛	2 16 11¼	7 13 0	2¼	5 8
2d "			- -	- -		- -	7 10 10		- -	- -		- -	- -		- -	- -		2 5 11	6 1 0	1⅜	5 6
3d "			- -	- -		- -	- -		- -	5 11 3		- -	- -		- -	- -		1 5 8	3 9 0	1	3 10
4th "			- -	- -		- -	- -		- -	- -		- -	3 16 1		- -	- -		1 5 9	1 7 6	0⅜	1 10
Labourer's Cottage			- -	- -		- -	- -		- -	- -		- -	- -		- -	3 16 1		- -	1 7 6	0⅜	1 10

FIR



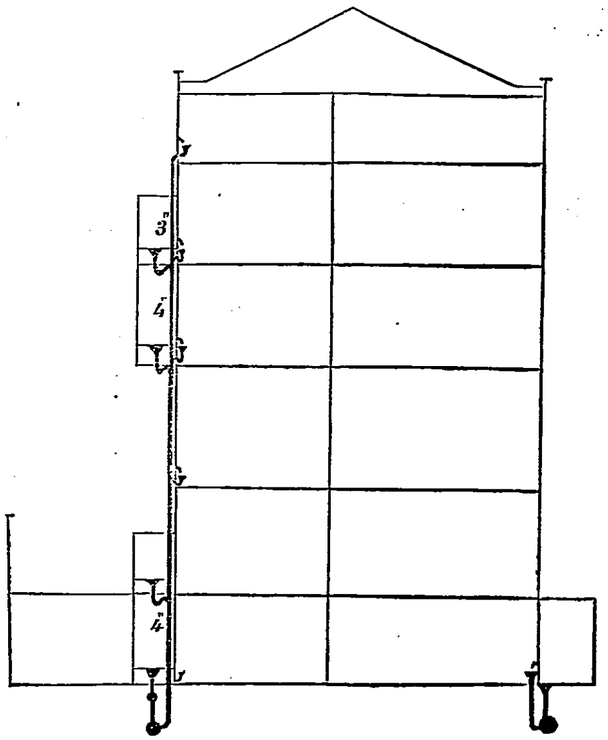
The figures indicating the rate per week show the payment per week by each class of house, supposing the repayment of principal and interest at 5 per

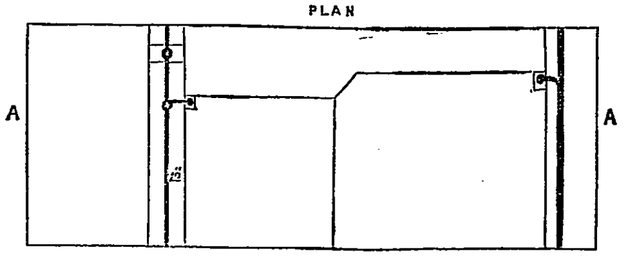
(No. 6.)

ply of Water (on the Constant System), for Water-closets, Sinks, and House-drains; for Habitations of the several under-mentioned Chief Classes.

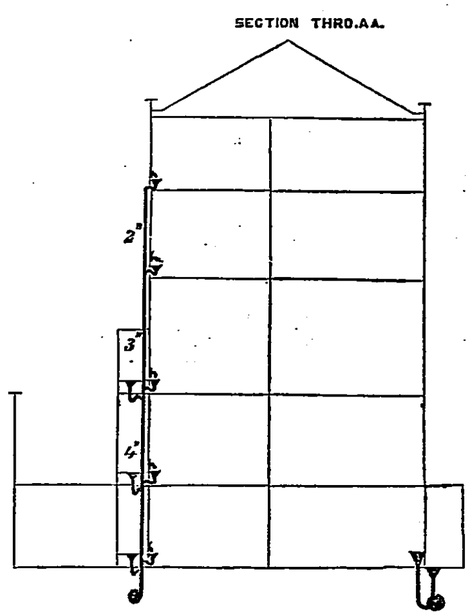
Average cost of drainage and water supply per floor additional.	Proportion of cost of sewer and water sub-mains on frontage of Houses.		
Cost.	Gross.	Per Week.	Per ft. run.
£ s. d.	£ s. d.	d.	s. d.
1 17 $3\frac{1}{4}$	6 1 6	$1\frac{3}{4}$	4 6
1 9 4	4 19 0	$1\frac{1}{2}$	4 6
0 16 8	2 14 0	$0\frac{3}{4}$	3 0
0 16 6	0 17 6	$0\frac{1}{4}$	1 2
- -	0 17 6	$0\frac{1}{4}$	1 2
0 19 8	1 11 6	$0\frac{7}{16}$	1 2
0 16 7	1 2 0	$0\frac{5}{16}$	1 0
0 9 0	0 15 0	$0\frac{3}{16}$	0 10
0 9 3	0 10 0	$0\frac{5}{32}$	0 8
- -	0 10 0	$0\frac{5}{32}$	0 8
2 16 $11\frac{1}{4}$	7 13 0	$2\frac{1}{4}$	5 8
2 5 11	6 1 0	$1\frac{3}{4}$	5 6
1 5 8	3 9 0	1	3 10
1 5 9	1 7 6	$0\frac{3}{4}$	1 10
- -	1 7 6	$0\frac{3}{8}$	1 10

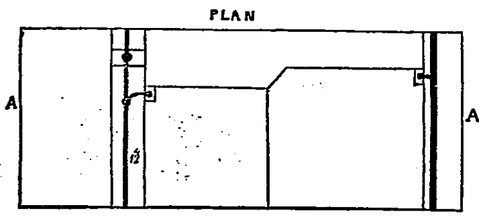
FIRST RATE.



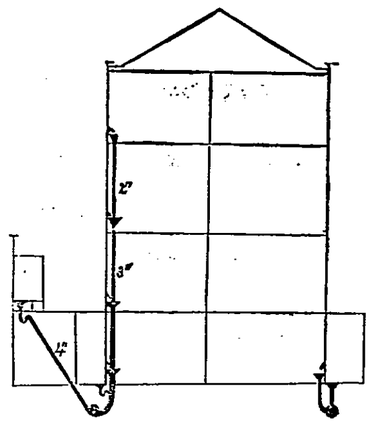


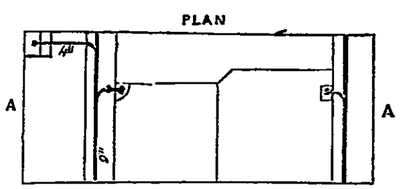
SECOND RATE.



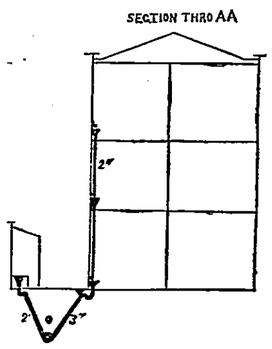


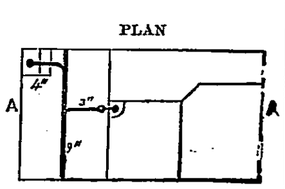
THIRD RATE.





FOURTH RATE.





ass of house, supposing the repayment of principal and interest at 5 per cent. per annum be distributed over a period of 30 years.

(No. 7.)

TABLE showing the QUANTITIES and the AVERAGE COST of OLD WORKS in BRICK HOUSE DRAINS of DEPOSIT, &c.

(No. 7.)

TABLE showing the QUANTITIES and the AVERAGE COST of OLD WORKS in BRICK HOUSE DRAINS of DEPOSIT, &c.

Description of Materials, &c.	Unit of Measurement.	Rate of Cost.	1st-rate House. Sinks and water on one floor and water-closets on two floors.			2d-rate House. Sinks and water and water-closets on two floors.			3d-rate House. Sinks and water on one floor and water-closet in yard at back.			4th-rate House and Labourer's Cottage. Sink and water on one floor and water-closet in yard at back.			Proportion of cost of sewer and water-mains on frontage of Houses.		
			Quantities.	Cost.	Per Week.	Quantities.	Cost.	Per Week.	Quantities.	Cost.	Per Week.	Quantities.	Cost.	Per Week.	Gross.	Per Week.	Per ft. run.
DRAINAGE:—		£ s. d.		£ s. d.			£ s. d.			£ s. d.					£ s. d.		s. d.
Sewers 5×3 and 5×2, 6 upright sides	Feet	- - -	27	- -		22	- -		18	- -		15					
,, bricks in - - -	No.	- - -	7,128	- -		5,808	- -		4,330	- -		3,608					
,, digging to - - -	Yds. cube	- - -	96	- -		73⅓	- -		58⅔	- -		30⅔					
Drains, of brick, 12 inch - -	Feet	0 3 0	105	15 15 0		70	4 13 4		80	5 6 8		43	2 17 4				
,, ,, 9 ,, - - -	,,	0 1 4	4	0 5 4		630	- -		720	- -		387					
,, bricks in - - -	No.	-	6,102	- -		31⅓	1 11 1½		44⅓	2 4 6		28¾	1 8 8				
,, digging to - - -	Yds. cube	0 1 0	48½	2 8 6		210	1 15 0		240	2 0 0		129	1 1 6				
,, paving and flooring made good	Ft. super.	0 0 2	327	2 14 6		1	5 0 0										
Water-closets, complete, superior -	No.	5 0 0	1	5 0 0		-	- - -		1	3 10 0							
,, ,, medium -	,,	3 10 0	-	- - -		1	1 10 0		-	- - -		1	1 10 0				
,, ,, common -	,,	1 10 0	1	1 10 0		14	2 9 0		2	0 7 0		2	0 7 0				
,, lead soil-pipe to, 4½ inch	Feet	0 3 6	14	2 9 0		3	4 10 0		2	2 0 0		1	1 0 0				
Sinks in houses - - -	No.	1 10 0 / 1 0 0	2	3 0 0		2	0 12 0		2	0 12 0		1	0 6 0				
,, in yards and areas - - -	,,	0 6 0	2	0 12 0		13	1 2 9		12	1 1 0		6	0 7 6				
,, lead pipe to, 2½ inch - -	Feet	0 1 9	7	0 12 3		-	- - -		-	- - -							
,, ,, 2 ,, - -	,,	0 1 3	-	- - -		3	0 19 6		2	0 9 0		1	0 3 0				
Bell-traps, brass - - -	No.	0 6 6 / 0 4 6 / 0 3 0	2	0 13 0													
,, iron - - -	,,	0 3 0 / 0 2 6 / 0 2 0	2	0 6 0	d.	2	0 6 0		2	0 5 0		1	0 2 0			d.	
1st-rate House - - -	- -	- - -	- -	35 5 7	10⅝	- -	- - -	d.	- -	- - -		- -	- - -		15 3 9	4 9/16	11 3
2d ,, - - -	- -	- - -	- -	- - -	- -	- -	24 8 8½	7¼	- -	- - -	d.	- -	- - -		12 7 6	3¾	11 3
3d ,, - - -	- -	- - -	- -	- - -	- -	- -	- - -	- -	- -	17 15 2	5¼	- -	- - -	d.	8 11 0	2 9/16	9 6
4th ,, and Labourer's Cottage	- -	- - -	- -	- - -	- -	- -	- - -	- -	- -	- - -		- -	9 3 0	2¾	7 2 6	2⅛	9 6
WATER SUPPLY:—																d.	
Mains, 5 inch - - -	Feet	- - -	27	- -		22											
,, 4 ,, - - -	,,	- - -	- -	- - -		- -	- - -		18								
,, 3 ,, - - -	,,	- - -	- -	- - -		- -	- - -		- -	- - -		15					
Cisterns, kitchen - - -	No.	15 0 0 / 12 0 0 / 8 0 0	1	15 0 0		1	12 0 0		1	8 0 0		1	3 0 0				
,, closet - - -	,,	6 0 0 / 5 0 0 / 4 0 0 / 3 0 0	1	6 0 0		1	5 0 0		1	4 0 0							
Services, wastes, &c. 1¼ inch -	Feet	0 1 2	10	0 11 8													
,, ,, 1 ,, - -	,,	0 0 11	145	6 12 11		23	1 1 1		15	0 13 9		6	0 5 6				
,, ,, ¾ ,, - -	,,	0 0 7	82	2 7 10		183	5 6 9		140	4 1 8		64	1 17 4				
Cocks and balls - 1 ,, - -	No.	0 12 6	1	0 12 6		2	0 18 0		2	0 18 0		1	0 9 0				
,, ,, ¾ ,, - -	,,	0 9 0	1	0 9 0		3	0 10 6		2	0 7 0		2	0 7 0				
,, bib - ¾ ,, - -	,,	0 3 6	2	0 7 0													
Ferrules - 1 ,, - -	,,	0 2 0	1	0 2 0		1	0 1 3		1	0 1 3		1	0 1 3				
,, - - ¾ ,, - -	,,	0 1 3	-	- - -													
Washers and wastes, 1¼ ,, - -	,,	0 3 6	1	0 3 6		2	0 4 0		2	0 4 0		1	0 2 0				
,, ,, 1 ,, - -	,,	0 2 0	1	0 2 0													
Solder-joints - 1½ ,, - -	,,	0 3 0	2	0 6 0		4	0 8 0		4	0 8 0		2	0 4 0				
,, - 1 ,, - -	,,	0 2 0	15	1 10 0		29	1 18 8		19	1 5 4		11	0 14 8				
,, ¾ ,, - -	,,	0 1 4	13	0 17 4	d.											d.	
1st-rate House - - -	- -	- - -	- -	35 1 9	10½	- -	- - -	d.	- -	- - -		- -	- - -		2 0 6	5 5/12	1 6
2d ,, - - -	- -	- - -	- -	- - -	- -	- -	27 8 3	8¼	- -	- - -	d.	- -	- - -		1 13 0	1 5/6	1 6
3d ,, - - -	- -	- - -	- -	- - -	- -	- -	- - -	- -	- -	19 19 0	6	- -	- - -	d.	1 2 6	1/4	1 3
4th ,, and Labourer's Cottage	- -	- - -	- -	- - -	- -	- -	- - -	- -	- -	- - -		- -	7 0 9	2⅛	0 15 0		1 0
DRAINAGE AND WATER SUPPLY. TOTAL.					s. d.											d.	
1st-rate House - - -	- -	- - -	- -	70 7 4	1 9½	- -	- - -	s. d.	- -	- - -		- -	- - -		17 4 3	5 3/16	12 9
2d ,, - - -	- -	- - -	- -	- - -	- -	- -	51 16 11½	1 3½	- -	- - -	d.	- -	- - -		14 0 6	4¼	12 9
3d ,, - - -	- -	- - -	- -	- - -	- -	- -	- - -	- -	- -	37 14 2	11¼	- -	- - -	d.	9 13 6	2 7/16	10 9
4th ,, and Labourer's Cottage	- -	- - -	- -	- - -	- -	- -	- - -	- -	- -	- - -		- -	16 3 9	4⅞	7 17 6	2 3/16	10 6

in Brick House Drains of Deposit, &c.

(No. 8.)

TABLES showing the actual COST of PRIVATE WORKS for the WATER SUPPLY and DRAINAGE of COTTAGES in RUGBY, CROYDON, BARNARD CASTLE, and TOTTENHAM.

I.—TABLE showing the actual COST of PRIVATE WORKS for the Water Supply and Drainage of Six Cottages in Little Pennington-street, RUGBY, the Property of James Atty, Esq., laid on from the Water Mains and to the Drainage Pipes of the Local Board of Health.

Work executed in January 1852.

Water Supply—	£	s.	d.		Per Cottage. £	s.	d.
95 lineal feet of 1-in. and ¾-in. iron pipe, with bends, &c.	1	15	5½	-	0	5	11
75 lineal feet of ¾-in., ½-in., and ⅜-in. block-tin pipe	1	8	9	-	0	4	9½
One 1-inch iron stop-cock on main-branch	0	5	0	-	0	0	10
Seven brass bib-cocks, 4 of ⅜-inch, and 3 of ½-inch diameter	1	10	0	-	0	5	0
Three water-closet pans, with traps, valves, and fans	2	14	0	-	0	9	0
Laying iron pipes, and making good surface of ground; fixing tin pipes and bib-cocks, and forming connexions with water-closet pans	2	4	4	-	0	7	4⅘
Total for water supply	9	17	6½				
or per house	-	-	-		1	12	11
Drainage—							
Sixty-three straight stoneware pipes (each 2 ft. long), 5, 4, and 3 inches diameter	1	18	0	-	0	6	4
Twenty-seven curved and junction pipes and syphon-traps, of 4 and 3 inches diameter	2	3	1	-	0	7	2⅙
113 lineal feet, laying pipes at an average depth of 5 ft., and making good surface	2	0	0	-	0	6	8
41 lineal feet, laying pipes at an average depth of 4 ft., and making good surface	0	11	11½	-	0	2	0
Emptying 3 old cesspools	0	9	0	-	0	1	6
Bricklayer, setting 3 water-closet pans, making good walls adjoining old cesspools, and setting iron gratings in yards	1	8	6	-	0	4	9
Three new iron gratings for yards	0	6	0	-	0	1	0
Total for drainage	8	16	6½				
or per house	-	-	-		1	9	5⅙
Total cost of both classes of private works	18	14	1	-	3	2	4⅙

[Each cottage has a separate water-tap carried within doors; there are 3 water-closets to the 6 cottages.*]

The cost of the public works of water supply and drainage will be defrayed by a special district rate of 10*d.* in the pound upon the rateable value of the house property in the town of Rugby.

* This is deemed an objectionable arrangement for new cottages; the extra expense of a water-closet for each would have been about 15*s.* per cottage, involving an extra annual charge, calculated as above, of 10¼*d.* per cottage.

The present water rate charged by the Local Board is 4*d.* in the pound.

Deducting one fifth from the actual rental, the gross rateable value of the six cottages in question will amount to 33*l.* 4*s.*

The total account for public and private works of water supply and drainage will therefore stand thus:—

	£	s.	d.		Per Cottage. £	s.	d.
Special district rate for public works of water supply and drainage, at 10*d.* in the pound	1	7	8	-	0	4	7
Water rate, at 4*d.* in the pound	0	11	0¾	-	0	1	10⅙
Private improvement rate, at 7¾*d.* in the pound	1	1	5	-	0	3	7
Giving a total annual charge for the 6 cottages of	3	0	1¾	-	0	10	0⅙

or a weekly charge per cottage of 2⅓*d.*

14th June 1852. T. W. RAMMELL.

II.—TABLE showing the actual COST of PRIVATE WORKS for the Water Supply and Drainage of *One* Cottage, being the average of Ten Cottages numbered 48 to 51, and 56 to 61, Old Town CROYDON,* laid on from the Water Main and to the Sewers of the Local Board of Health.

Memorandum.—No private improvement rates have been mortgaged by the Croydon Board, but the following actual cost of carrying supplies of water into cottage tenements, and of carrying away the waste and soil-water has been ascertained. The works having been done by private contract for immediate payment.

The Works were executed in March 1852.

Water Supply—	£	s.	d.	£	s.	d.
Drilling and tapping main, and providing and fixing stop-cock, &c.	0	4	0			
Providing and fixing 28 feet of ½-inch iron service pipe, bends, &c.	0	14	0			
Providing and fixing one bib-cock	0	3	6			
Providing and fixing one gool-cock, with plumber's time, making the connexion to water-closet	0	7	6			
Providing and fixing stoneware water-closet pan and syphon-trap, set in brickwork	0	11	0			
				2	0	0
Drainage—						
Junction with sewer	0	2	3			
Providing and laying 22 feet of 4-inch drain-pipe, at 10*d.*	0	18	4			
Providing and fixing small kitchen sink of about 3 feet super., with brass grating and iron pipe to drain	0	10	0			
Providing and fixing one syphon-trap, and making connexion to sink	0	3	0			
Providing and fixing one syphon-trap, and 12-inch iron grating to yard sink, with small gully-hole	0	4	6			
Emptying and filling small cesspool or privy-pit	0	15	0			
Taking up and refixing water-closet seat and floor	0	5	0			
				2	18	1
Total cost				4	18	1

* In this situation the Board have a branch sewer and water-pipe at the back of the houses at about 23 feet from them.

The outlay for the public works of water supply and drainage has made a special district rate of 1*s.* in the pound upon the rateable value necessary, for the first two years.

The water rate charged by the Board on cottages not exceeding 5*l.* 10*s.* on the rateable value is 1*d.* per week.

The rateable value of the above cottage is about 4*l.*, for I find that 19 cottages are rated at 74*l.* 10*s.*

The total cost per cottage will therefore stand thus :—

	£	s.	d.
Special district rate for public works of water supply and drainage, at 1*s.* in the pound	0	4	0
Water rate, at 1*d.* per week	0	4	4
The present outlay of 4*l.* 18*s.* 1*d.* would require an equal annual payment of 4*s.* 8¼*d.* to pay off principal, and at 5 per cent., interest, in 22 years	0	4	8¼
Giving a total annual charge of	0	13	0

or 3*d.* per week per cottage.

Croydon, 24th June 1852. THOMAS COX, *Surveyor.*

III.—TABLE showing the actual COST of PRIVATE WORKS for the Water Supply and Drainage of Eleven Cottages in Baliol-street, BARNARD CASTLE, laid from the Water Mains and to the Drainage Pipes of the Local Board of Health.

Work executed in 1852.

Water Supply—	£	s.	d.
120 lineal feet of 1½-inch iron pipe, with bends, &c., including laying, fixing, stop-cocks, &c.	5	0	0
House service lead pipe, ½-inch, and ⅜, the half inch, water-closet supplied, and then ⅜ for supply of house-bib, and turning privies into water-closets, inclusive of pans, taps, valves, stop-cocks, bibs, and other fittings, and fixing	16	0	0
Total for water supply	21	0	0
or per house	1	18	2⅕
Drainage—			
Straight stoneware pipes (each 2 ft. 6 in. long), and 6 inches diameter, including curved and junction pipes	3	17	0
120 lineal feet, laying 6-inch pipes at an average depth of 4½ feet, and making good surface	1	8	5
216 lineal feet, laying 4-inch pipes at an average depth of 4½ feet, including cement and making good surface, and finding 4-inch pipes with junctions	6	18	0
11 syphon-traps for yard sinks and fixing	2	4	0
New iron gratings for yards and stone covers for sinks	1	2	0
Total for drainage	15	9	5
Or per house	1	8	1
Total cost of both classes of private works	36	9	5

[Each cottage has a separate water-tap carried within doors ; there are water closets erected or erecting for all the cottages.]

The cost of the public works of water supply and drainage will be defrayed by a special district rate of 1*s.* 6*d.* in the pound upon the rateable value of the house property, in the parts over which the works extend in the district.

The present water rate charged by the Local Board is 1*d.* in the pound ; deducting nearly one third from the actual rental, after the usual deductions are made, the gross rateable value of the 11 cottages in question will amount to 34*l.* 2*s.*, according to the poor rate assessment.

The total account for public and private works of water supply and drainage will therefore stand thus :—

	£	s.	d.
Special district rate for public works of water supply and drainage, at 1*s.* 6*d.* in the pound	2	18	1¾
Water rate, at 1*d.* in the pound	0	2	10
Private improvement rate	2	17	6¼
Giving a total annual charge for the cottages of	5	8	6
Annual charge per cottage	0	9	10½

or a weekly charge per cottage of about 2¼*d.*

CHARGES actually incurred for laying water into 7 cottages in King-street, which cottages are known by the name of Heckler's-row, and belong to Thomas Deighton and others.

	£	s.	d.
90 ft. 6 in. of ½-inch lead pipe	2	5	3
34 feet of ⅜-lead pipe	0	14	3
Seven ⅜-inch Lambert's taps	1	1	0
One ½-inch stop-tap	0	4	6
Wall-hooks	0	2	0
18 plumbers joints	0	9	0
Masonry	0	4	0
Smith's work, ferrule and insertion	0	1	6
	5	1	6

Or per cottage, 14*s.* 6*d.*

This includes all excavation and masonry ; a half-inch lead pipe passes through the back pantry of each house, from which a ⅜ service pipe was taken. Both the ½-inch lead pipe and the ⅜ was laid as private work, and are included in the above.

The cottages let for about 4*l.* 10*s.* each.

They are rated in the rate book at 2*l.* 1*s.* each ; water-closets remain yet to do and drainage.

CHARGES for PRIVATE WORKS in Barnard Castle District.

Drainage.

Excavating for and laying drainage pipes, &c., junctions with appendages, including joint-holes, filling, and restoration of surface to its original state, whether flagged, paved, or macadamized, and every other work relating thereto, exclusive of cement and pipes. Pipes laid to be any diameter not *exceeding* six inches :—

	£	s.	d.
Where depth averages not more than 5 feet - per yard	0	0	8½
„ „ „ 7 „ - „ -	0	1	0
„ „ „ 10 „ - „ -	0	1	6
„ „ „ 13 „ - „ -	0	2	7

Drainage—continued.		£	s.	d.
Pipes, vitrified, impermeable, 4 inches diameter	per yard	0	1	0
„ „ „ 6 „ -	„ -	0	1	6
Cement for 4-inch pipes - - - -	„ -	0	0	1¾
„ 6-inch „ - - - -	„ -	0	0	2
Turning existing privies into water-closets, including common pan, syphon trap, 1 yard of internal pipe, ½-inch or ⅝, tap, cleansing old place, fixing, walling up, and every other labour - - - - -	each	1	1	0
Yard sinks, and stone taps, including all labour in fixing and materials - - - - -	each	0	5	0

All disputes to be *decided solely and finally* by the Local Board.

Plumber's Work.

Lead Pipe.	Weight per yard.	Charge for laying, including Pipe. s. d.	
⅜-inch -	5 lbs. - -	1 2	per yard.
½ „ -	6 lbs. - - -	1 4	„
⅝ „ -	7 lbs. - -	1 6	„
¾ „ -	9 lbs. - - -	2 0	„
1 „ -	13 lbs. - -	2 9	„

Extra for every plumber's joint.

The parties to find excavator, and also to fill up ground, and restore after pipe laid. Plumber to do the rest.

IV.—Table showing the actual Cost of Private Works for the Water Supply and Drainage of Six Cottages in Tottenham, the Property of Thomas Tilley, laid on from the Water Mains and to the Drainage Pipes of the Local Board of Health.

Works executed in August 1852.

Water Supply (all as fixed)—	£	s.	d.	Per Cottage. £	s.	d.
95 lineal feet of ¾-in. galvanized wrought-iron pipe, with bends, &c. - - -	4	9	3¼	0	14	10½
93 lineal feet of ½-in. ditto ditto -	3	10	2¼	0	11	8½
Two ¾-inch brass stop-cocks on main branch -	0	7	0	0	1	2
Six brass bib-cocks (screw-down), of ⅜-inch diameter - - - -	0	12	6	0	2	1
Two self-closing cocks - - -	0	18	0	0	3	0½
Four common lever stop-cocks, ¾-inch way -	0	15	2	0	2	6
Six water-closet pans, with traps, &c. - -	1	7	0	0	4	6
Four water-waste preventers - - -	3	12	0	0	12	0
Total for water supply - -	15	11	1½			
or per house - - -		-		2	11	10½

Drainage—	£	s.	d.	Per Cottage. £	s.	d.
135 feet straight stoneware pipes (each 2 feet long), 4, 3, and 2 inches diameter, and curved and junction pipes and syphon-traps, of 2 and 4 inches diameter - - -	2	10	6	0	8	5
135 lineal feet, laying pipes at an average depth of 4 ft., and making good surface - -	4	9	9	0	14	11½
Emptying 6 old cesspools (and filling up) -	1	10	0	0	5	0
Bricklayer, setting 6 water-closet pans, making good walls adjoining old cesspools, &c. -	3	0	0	0	10	0
Six new sinks and traps for wash-houses and yards - - - -	0	15	0	0	2	6
Total for drainage - -	12	5	3			
or per house - -	-	-	-	2	0	10½
Total cost of both classes of private works -	27	16	4½	4	12	8½

[Each cottage has a separate water-closet; and also a separate tap for water, carried within doors.]

The cost of the public works of water supply and drainage will be defrayed by a special district rate of 4½*d.* in the pound upon the rateable value of the house property in the town of Tottenham.

The present water rate charged by the Local Board is as under :—

	In the Special District Rate Assessment. Above £ s. d.	And not exceeding £ s. d.	Water Rate, per Week. £ s. d.	Water Rate, per Annum. £ s. d.
On Premises assessed - -	- - -	10 0 0		0 2 6
„ „	10 0 0	15 0 0		0 3 9
„ „	15 0 0	20 0 0		0 5 0
„ „	20 0 0	25 0 0		0 6 3
„ „	25 0 0	30 0 0		0 8 0
„ „	30 0 0	40 0 0		0 11 0
„ „	40 0 0	50 0 0		0 14 0

And 3*s.* for every additional sum of 10*l.*

The gross rateable value of the six cottages in question is 60*l.*

The total account for public and private works of water supply and drainage will therefore stand thus :—

	£	s.	d.	Per Cottage. £	s.	d.
Special district rate for public works of water supply and drainage, at 4½*d.* in the pound -	1	2	6	0	3	9
Water rate, at 2½*d.* in the pound - - -	1	1	0	0	3	6
Private improvement rate, at 6*d.* in the pound -	1	10	0¾	0	5	0⅛
Giving a total annual charge for the 6 cottages of	3	13	6¾	0	12	3⅛

or a weekly charge of 2·83*d.*

The foregoing costs included the "water-waste preventer," laid to four cottages out of the six, which ensures the fullest possible flush of water to the closet, at the same time prevents either wilful or accidental waste, from leaving the cocks open, or injury to the same.

James Pilbrow, *Engineer.*

SUMMARY of foregoing Returns.

Name of Town.	Rateable Value of Cottage.	Annual payment per cottage for Public General Works and Mains.		*Annual* payment per cottage for combined Public General Works for Water Supply and Drainage.	*Weekly* payment per cottage for combined Public Works for Water Supply and Drainage.	Annual payment per cottage for Private Improvement Works, *i.e.* Service-water Pipes, Sinks, Water-closets, and House Drains.		Annual payment per cottage for combined Private Improvement Works of Water Supply and Drainage.	Weekly payment per cottage for combined Private Improvement Works of Water Supply and Drainage.
		Water Supply.	Drainage.			Water Supply.	Drainage.		
	£ s. d.	s. d.	s. d.	s. d.	d.	s. d.	s. d.	s. d.	d.
Rugby -	5 10 8	3 1	1 6½	4 7½	1 1/16	1 8½	1 6½	3 3	0 3/4
Croydon -	4 0 0	2 2	1 10	4 0	0 13/16	2 7½	3 9	6 4½	1½
Barnard Castle	3 2 0	- -	-	4 8	1 1/16	2 5¼	1 8¼	4 1½	0 13/16
Tottenham -	10 0 0	- -	-	3 9	0 9/16	3 0½	2 5	5 5½	1¼
Average -	5 13 2	2 7½	1 8½	4 3⅛	1	2 5½	2 4¼	4 9¾	1 1/16

(No. 9.)

SPECIFICATION for DRAINAGE PIPES.

Local Board of Health of

Contract No.

1. *Extent of contract. Power for alterations.*—The description and quantities of the drainage pipes required by the Local Board of Health to be furnished by the contractors are set forth in the schedule No. 1, annexed to the accompanying form of tender, the figures inserted being the nearest practicable approximations to the whole quantities that will be actually required. The engineer, however, shall have power to make, within reasonable limits, any additions to or deductions from these quantities that may appear to him to be expedient or proper; and the amount in value of all such additions and deductions shall be calculated upon the basis of the schedule of prices annexed to the contractor's tender.

2. *Description of pipes given in drawings and specification.*—The whole of the pipes shall be of the forms, dimensions, and thicknesses shown in the drawings deposited at the office of the Local Board, as described in this specification and accompanying schedules, but should any discrepancies exist between the wording of the specification and the dimensions written on the drawing, or between the dimensions written on the drawing and the diagrams they refer to, in all cases the contractor shall be regulated by the wording of the specification in preference to the written dimensions, and by the written dimensions in preference to the diagrams they refer to.

Samples to be submitted.—The samples submitted with the contractor's tender will be retained and regarded as fair average specimens with regard to material, quality, and workmanship, of the whole of the pipes to be furnished.

3. *Quality of pipes.*—They shall be sound, and well burnt throughout their thickness, impermeable to moisture, and of smooth interior surface, the joinings of the parts perfectly sound, and the pipes free from cracks, flaws, blisters, and all other imperfections; circular in the bore, of true form in length, whether straight or curved, internally of the full specified diameter, and of uniform thickness, not less than one twelfth of the diameter.

4. *Engineer at liberty to test pipes and reject those of defective quality.*—The engineer or surveyor shall have power at any time to examine and test the impermeability or the strength of any of the pipes, to the extent to which the contractor shall have stated in the particulars accompanying his tender, that they will resist moisture, or will bear external and internal pressure; and shall be at liberty to reject all pipes which in his opinion are of an inferior quality of material to the sample submitted, or defective in any other respect, or which in his opinion vary in too great a degree from the forms, dimensions, and thicknesses, shown in the drawings before referred to; and he may direct the immediate removal of any such rejected pipes at the contractor's expense.

5. *Places and periods of delivery of pipes.*—The whole of the pipes shall be delivered, at the contractor's expense, in sound condition, at such place or places within the district of the Local Board as the engineer or surveyor may from time to time determine, and at the several dates specified in the accompanying schedule No. 3; and in case the contractor shall fail or neglect to deliver any of the above-mentioned quantities of pipes within the respective times mentioned, he shall forfeit and pay for every week afterwards elapsing until such pipes are delivered, the sum of pounds, together with all losses and damage for which

the Local Board of Health may be liable for the non-fulfilment of contracts or works which may be dependent upon such deliveries. The Local Board of Health shall also in such case be at liberty to contract with any other maker for the whole on any portion of the pipes, and charge the excess of cost, if any, and all expenses arising therefrom, to the contractor.

6. *No extras allowed, unless upon certificate.*—No extra charges or additional claims of any kind will be allowed, unless upon the certificates in writing of the engineer or surveyor to this effect.

7. *Differences to be decided by engineer.*—Should there arise any misunderstanding as to the meaning of anything contained in this specification during the progress of the works, the decision of the engineer or surveyor to the Local Board of Health for the time being shall be conclusive and binding.

8. *Payments.*—The contractor shall be entitled to receive payment for the quantities of pipes actually delivered at the expiration of two months after the respective periods mentioned, such payments being made upon the certificate of the engineer or surveyor, subject to a deduction of twenty-five per cent. from the full ascertained value; which deduction will be retained by the Local Board until three months after the last time of payment. All payments will likewise be subject to deduction for any penalties that may accrue by reason of the improper or imperfect performance of the contract.

9. *Sureties.*—The contractor shall (when required) find two good and sufficient sureties, in a sum equal to one fourth the amount of his tender, for the full and complete performance of his contract.

Contract for Drainage Pipes.

Conditions to be observed by Contractors tendering.

1. The tender must be made upon a printed form annexed to the specification, and must be signed by a principal, or by a declared agent acting in his behalf.

2. The blank schedule of prices annexed to the form of tender must be filled up.

3. A sample of straight lengths of pipe and of curves or junctions, each of 4 inches, 9 inches, and the largest diameter comprised in the contract respectively, must be submitted with the tender.

4. Full particulars must accompany the tender as to the place where the pipes are intended to be manufactured, the description of clay to be used, and the processes of manufacture to be adopted; the weight in pounds per foot run of each size of pipe when dry, and after 48 hours saturation, and the pressure of pounds on the square inch which pipes of the various sizes are capable of resisting externally and internally.

5. Should the contractor have any doubt as to the meaning of any portion of the specification, he must set forth the particulars of such doubt in writing, and submit the same with his tender, in order that it may be formally settled before his tender is accepted.

6. Tenders must be delivered at the office of the Local Board on or before the day of , endorsed "Tender for Drainage Pipes," and addressed "To the Chairman of the Local Board of Health of ."

7. The Local Board do not bind themselves to accept the lowest or any other tender; and no tender will be entertained in which these conditions are not complied with.

Tender for Drainage Pipes.

185 .

To the Local Board of Health of

Gentlemen,

do hereby engage to make and supply you, the Local Board of Health of with the required drainage pipes, in the quantities and of the description set forth in the annexed schedule No. 1, in conformity with the terms and conditions contained in the foregoing specification, and with the drawings deposited in your office; and to deliver the same in the quantities and at the several dates named in the annexed schedule No. 2, for the sum of ; and also to supply any further quantities that may be required, at the prices marked in the annexed schedule No. 3; and do undertake to execute an agreement (to be prepared by and at the expense of the Local Board), for the due performance of the contract.

And propose , of and of , as the two parties who are each willing to become security for the due and proper performance of contract, in the penal sum of , being one fourth of the gross amount of tender.

, Gentlemen,

Your obedient servant,

Particulars.

Name of place where pipes are to be manufactured - - - -
Description of clay to be used - -
Processes of manufacture to be adopted -

Weight of each size of pipe when dry, and after 48 hours saturation.

Diameter of Pipe.	Lbs. per foot run.	
	When dry.	When saturated.

Pressure which each size of pipe is warranted to resist.

Diameter of Pipe.	Lbs. per square inch.	
	Externally.	Internally.

Remarks.

Local Board of Health of

Contract for Drainage Pipes.—Schedule No. 1.

Quantities.

Straight Pipes.		Curved Pipes.		Straight Junction Pipes.		Taper Junction Pipes.		
Internal Diameter.	Lengths when laid.	Internal Diameter.	No.	Internal Diameter.	No.	Internal Diameter of Taper.	Internal Diameter of Junction.	No.
Inches.	Feet.	Inches.		Inches on Inches.		Inches to Inches.	Inches.	

Local Board of Health of

Contract for Drainage Pipes.—Schedule No. 2.

Rates of Delivery.

Dates.	Straight Pipes.		———
	Sizes.	Lengths when laid.	
	Inches Diameter.	Feet.	The quantities of curved pipes, and straight and taper junction pipes of the various sizes accompanying each delivery, shall be in the same proportion to the whole.

Local Board of Health of

Contract for Drainage Pipes.—Schedule No. 3.

Prices.

Straight Pipes.		Curved Pipes.		Straight Junction Pipes.		Taper Junction Pipes.		
Internal Diameter.	Price per foot length when laid.	Internal Diameter.	Price per Pipe.	Internal Diameter.	Price per Pipe.	Internal Diameter of Taper.	Internal Diameter of Junction.	Price per Pipe.
Inches.	*s. d.*	Inches.	*s. d.*	Inches on Inches.	*s. d.*	Inches to Inches.	Inches on Inches.	*s. d.*

(No. 10.)

SPECIFICATION for EARTHWORK and for laying DRAINAGE PIPES.

Local Board of Health of

Contract No.

Extent of contract.—The contract comprises the excavation for and the laying of the several lines of drainage shown on the accompanying plans and sections, Nos. , and such others as may be deemed, from time to time, necessary during the progress of the works, and in accordance with the conditions contained in this specification. The drawings and specification are intended to be explanatory of each other, but should any discrepancies appear, or any misunderstanding arise as to the import of anything contained in either the drawings or specification, the explanation of the engineer or surveyor of the Local Board shall be considered final and binding upon the contractor. The dimensions written on the drawings shall be taken in all cases in preference to the scale; and the wording of the specification in preference to written dimensions. In the absence of the engineer or surveyor the instructions of the clerk of the works or other officer who may be appointed to superintend the works shall be followed with respect to them.

Dismissal of incompetent persons.—If any person employed by the contractor on the works should appear to the engineer to be incompetent or to act in an improper manner he shall be at full liberty to discharge him, and such person shall not be again allowed to be employed upon them without permission.

Contractor responsible for errors in plans, &c.—The levels of the plans and sections and the bench marks are believed to be accurate; and any others that may be required shall be given to the contractor, and every assistance in setting out the works; but as the contractor will be held responsible for the consequences of any error, it will be for him to verify all data with which he may be furnished, should he so think fit.

Notices.—The contractor shall not commence the works until due notice in writing has been given to him. He shall give all necessary notices in writing to all persons having authority over roads, pavements, pipes, or other property or works liable to be affected by the execution of his contract of the period of commencement of the works.

Power to vary works.—The works shall be carried on in such portions as the engineer shall direct, and he shall have power also to vary, extend, or diminish the quantities of work, within reasonable limits, during its progress, without vitiating the contract; but no part of the works shall be altered by the contractor from that shown on the drawings, or described in the specification, without the express sanction of the engineer.

Work not to be underlet.—The contractor shall not assign, underlet, or make a sub-contract for the execution of any portion of the work, unless with the consent of the engineer.

Pipes to be provided by Local Board.—The drainage pipes will be provided by the Local Board; but when given into the custody of the contractor, he shall be held responsible for their safety. They will be deposited at places as convenient as practicable for use; but all further cartage or removal that may be necessary shall be done at the contractor's expense.

Materials, implements, and labour provided by contractor.—All materials to be provided by the contractor shall be of the best description; and he shall furnish all efficient labour and implements necessary for the full

and complete performance of his contract; he shall provide and maintain all necessary hoarding, fences, and bridgeways for the traffic, and shall furnish lights and watchmen whenever required for the safety of the public, or for the protection of properties. If any materials or implements should be brought to the ground which the engineer may deem to be of inferior description, or improper to be used in the work, the same shall be removed forthwith; and if the directions of the engineer are not complied with in 24 hours after written notice, he shall be at liberty to remove the same at the expense of the contractor.

Mode of excavation.—The ground shall be excavated in open trenches to the necessary width and depth. The trenches shall be opened at least one foot wider than the diameter of the pipe intended to be laid, the bottom of the trench being hollowed out to the exact form and size of the lower half of the pipe, which will be embedded in it. No tunnelling will, on any account, be allowed, except under circumstances which render it unavoidable, and then only with the express sanction of the engineer in writing, in which case it shall be executed in accordance with his directions; and the drains shall be laid, and the work shall be backed in by a trusty person approved by the engineer.

Protection of buildings, &c. at contractor's expense.—The contractor shall, at his own expense, shore up, sling, protect, alter, divert, restore, and make good, as may be necessary, all water pipes, gas pipes, sewers, drains, buildings, walls, fences, or other properties, which may be disturbed or injured during the progress of the work.

Paving materials, &c. to be preserved.—In digging the trenches the contractor shall carefully take up and lay aside all paving materials, metalling, gravel, or other surface of roads and places, and all turf and vegetable mould of gardens or other grounds which may have to be disturbed.

Convenience of traffic, &c. to be considered.—The material excavated shall be laid compactly on the side of the trench, and kept neatly trimmed up so as to be as little inconvenience as possible to the public traffic or the adjoining tenants.

Bottom of trenches to suit the shape of pipes.—The bottoms of the trenches shall be neatly formed to the shape of the pipes to be laid down, so that the whole surface of the under half of the pipes shall have a full and even bearing throughout.

Pumping, &c.—The contractor shall, at his own expense, pump out or otherwise remove any water which may exist in the trenches, and shall form all dams or other works necessary for keeping the excavations clear of water during the progress of the works. In cases of running sand or other bad or treacherous ground, the works shall be proceeded with day and night without intermission, if the engineer shall so direct.

Shoring of excavations.—The sides of the excavation shall be supported with suitable timber whenever necessary. The contractor will be held responsible for all damage which may happen to neighbouring properties, or in any other way from neglect of this precaution. In any case in which the engineer shall direct that the timbering shall be left and buried in the trench, the cost of the timber will be allowed, unless the necessity for leaving it has arisen from carelessness or neglect in the work, in which case the timber will not be paid for.

Good foundation to be secured for pipes.—All irregularities in the trenches shall be filled up with gravel or clay, firmly rammed in; but where the ground would not present a sufficiently firm foundation for the pipes, the contractors shall excavate to such increased depth as may be necessary, and shall make good to the required form and level with concrete, or such

other course shall be taken for securing a good foundation as the engineer may see fit to direct under the circumstances, and all increased work arising therefrom will be paid for as an extra.

Pipes to be fitted before laid.—Previously to the pipes being lowered into the trenches, they shall be fitted together dry on the surface, and matched, so that when jointed in the trench, they may form the most accurate and truest possible line of tubes.

Mode of laying pipes.—The pipes shall be laid truly in line and gradient throughout, according to the plans or directions furnished from time to time; and all curves, tapering pipes, junctions, syphons, and other pieces required shall be properly excavated for and laid as directed. The ends of all junctions laid in for any future house-drain or other connexion shall be closed up with a flag, or slate, circular piece of wood, or other effectual covering to prevent the entrance of any dirt or material. An exact record shall be kept of the point where every such junction is made.

Defective pipes to be rejected.—No broken or damaged pipes shall be used in the works. It will be for the contractor to reject all defective pipes that may be delivered on the ground, as he will have to make good or to pay for all breakage which may subsequently occur.

Mode of joining pipes.—In joining the lengths the socket or rebate of the pipe shall be neatly filled round with clay well-tempered and worked to the proper consistency, and the end of the next pipe being then carefully placed in, the joint shall be bedded and surrounded externally with a band or layer of clay, extending three inches each way beyond the external line of joint, and tapering off from three inches thick in the middle. Especial care shall be taken that this band is made perfect and tight in the under part of the joint. To ensure this and to allow of the continuous bedding of the pipe, the bottom soil must be dished out at every joint.

Pipes to be freed from dirt, &c.—The interior of the pipes shall be carefully freed from all dirt and superfluous clay as the work proceeds, for which purpose a disc plate, mould, or other implement, sufficiently long to pass two joints from the end of the pipe last laid shall be continuously worked through.

Agricultural drain-pipes to be laid where directed.—In wet soils, or where the engineer may direct, agricultural drain-pipes shall be laid in the trenches previously to the bedding of the main drainage pipes, the bottom being re-formed and made good over them.

Pipes to be laid in puddle where directed.—Whenever directed also, the trench shall be excavated to a depth of six inches below the level at which the drainage pipes are intended to be laid, and nine inches wider than the pipes on each side. The space below the intended level of the pipes shall then be filled in with puddled or well-tempered clay, so as to form an impervious and uniform bed for the pipes. When the pipes shall have been laid they shall be carefully surrounded with the same description of puddled clay, the trench being wholly filled in therewith to a height of nine inches above the top of the pipe.

Examination of work.—No line of pipes shall be covered in until they have been examined by the engineer or clerk of the works, and directions given to that effect.

Filling in.—The soil on each side and six inches over the pipes shall be carefully laid in, so as not to disturb them, and solidly rammed down. The trench shall then be filled in with layers of earth twelve inches deep at a time, each layer being well rammed over the whole surface. The first layer shall be placed over the pipes with a shovel, and not teamed from barrows. The pipes shall not be walked upon until this is done.

Reinstatement of paving, &c.—The contractor shall replace all paving or other surface material which may have been disturbed, to the satisfaction of the engineer and of the persons having control over such several public and private places.

To make good sewers, fill up cesspools, &c.—The contractor shall provide for the flow of sewers, drains, or watercourses interrupted during the progress of the works, and shall restore or make good all connexions as may be directed. He shall empty and fill up all cesspools on the line of the excavations, and shall immediately cart away or remove all offensive matter with such precautions as may be directed.

House-drainage to be connected with consent.—Any house-drainage or private drainage works shall, with the consent of the engineer or surveyor, be connected with the works in progress, the contractor putting in the first pipe from the junction, for which he will be paid.

To cart away superfluous earth.—As the trenches are filled in he shall cart away also all superfluous earth and other materials from the spot, and leave al the roads and places free and clear, and in good order.

To give up any objects of value.—Any coins or objects of antiquity or value which may be met with, shall be at once deposited at the office of the Local Board.

General condition as to execution of works.—The contractor shall execute with the best materials and workmanship of their several kinds the whole of the works comprised in the drawings and this specification. They are intended to include whatever may be requisite to render the works complete, but should anything be accidentally omitted, which may fairly be implied, as included in the contract, the same shall be executed at the expense of the contractor.

Alteration of works; extra charges.—The difference of expense of any addition, diminution, or alteration of the works which may be directed, shall be added to or deducted from the amount of the contract agreeably to the rates specified in the schedule of prices annexed to the contractor's tender. If the items do not appear in the schedule, the charge for the same shall be settled by the engineer, but no extra charges whatever will be allowed, unless with the written orders of the engineer, and a claim is sent in weekly by the contractor for every such charge to which he may consider himself entitled.

Contractor to pay all fees, and compensate damage.—The contractor shall pay all fees, and shall compensate for or make good at his own expense whatever damage may occur to any person, or to public or private properties, by reason of the execution of the works, beyond the compensation for way-leave in going through private premises which may be agreed to be paid by the Local Board.

Contractor to be responsible for entire works.—The contractor shall have charge of and be responsible for the entire line of works until the completion, and whenever the engineer shall require it, openings shall be made for examination, and if the work should in any respect be found defective, all expenses of such examination and of making good shall be defrayed by the contractor, but if found to be in a satisfactory condition, such expenses will be allowed.

No allowance for necessary delay of works.—Should it be deemed necessary on account of the inclemency of the weather, delay in the delivery of the pipes, or any other cause, to suspend the execution of the works, or any portion of them, the engineer shall have power so to direct without any extra allowance to the contractor; but the period of time during

which the works may be so suspended shall be allowed to the contractor in computing the time of completion of his contract.

Notice to contractor for defective work, &c., and proceedings thereon if not remedied—If at any time it shall appear that the works, or any part thereof, are not being executed in conformity with the contract, or in a sound and workmanlike manner, and if satisfactory progress shall not be made therein, the engineer shall give written notice to the contractor, and if he shall refuse to amend the defective work, or comply with any order in relation thereto, or if in three days after notice he shall not have adopted ample means for the satisfactory prosecution of the work, the Local Board shall have full power to take the whole of works out of the hands of the contractor, and proceed with the execution thereof, and all extra costs and charges which may arise shall be paid for by the contractor.

Date of completion of contract, and penalty for delay.—The time fixed for the completion of the whole of the works of this contract is from the date of the engineer's order to commence them, and the contractor shall payas liquidated damages *l.* for every day that any part of the said work shall by his default remain unfinished after that time, whether the works shall be in course of completion by the contractor or by the Local Board or others on their behalf.

Contractor to keep works in good order.—The contractor shall be held liable for keeping in repair and good order the whole of the works for six months after the date of completion.

Payments.—Payments will be made to the contractor in monthly instalments, on the certificate of the engineer of the value of the works executed in the preceding month, subject to a deduction of 25 per cent. upon such value. Full payment of the balance will be made upon the certificate of the engineer that the contract has been fulfilled to his satisfaction, six months after the date of completion, subject to all legal and equitable deductions.

ADDITIONS to SPECIFICATION for EARTHWORK, &c. in Contracts which include brick sewers, gullies, and other works appertaining thereto.

All bricks employed in this contract shall be good, sound, well burnt stocks of uniform shape.*

The ground shall be excavated of the proper widths and depths indicated by the drawings, in such manner and of such lengths only at one time as shall be directed by the surveyor.

The invert of the brick sewer, as shown in drawing No. , is to be formed of blocks, each 18 inches long, and of such width as may be directed, to be prepared in proper boxes, and well grouted up with thick cement grout in the boxes, and also after being fixed in the work. These blocks are to be made at least ten days before they are used, and they are not to be used until the cement has become quite hard.

The brickwork shall be formed in the best manner, well bonded. The joints shall be struck flush with the face of the work, and shall not exceed, in any part of the interior of the work, one eighth of an inch in thickness.

All junctions and connexions of drains with the sewer shall be made in the manner shown in drawing No.

All sewers or drains met with, or cut through, shall be connected with the new sewer with approved junctions as indicated, and with such brick-

* Wherever it is possible to procure them, it should be specified that the bricks for sewers should be "radiating."

work in cement as may be directed; or, if so required, they shall be perfectly restored to the same condition as before the commencement of the works.

The ground shall be carefully filled in, and the work backed up in a proper manner as it proceeds, and the ground shall be properly rammed down, in the whole of the excavation, after the completion of such lengths of the sewer as may be directed.

Gullies shall be constructed, in the position shown on the plan No. , of the materials, forms, and dimensions shown in drawing No.

Side entrances and ventilating shafts shall also be constructed in such positions as may be directed, and of the materials, forms, and dimensions exhibited on the drawing No.

GENERAL SPECIFICATION of WORK to be executed for the DRAINAGE of, and SUPPLY OF WATER to Houses within the District of the Local Board of Health of

Provide and lay down in the several courses, and at the depths and inclinations indicated on the accompanying plan, No. , stoneware pipe sewers or drains, of the dimensions marked upon each line.*

For the quality of materials, mode of laying, and other stipulations, clauses Nos. of the "Specification for drainage pipes," and clauses Nos. of the "Specification for earthwork and for laying drainage pipes," shall be included in, and form part of this specification.†

Provide and securely fix water-closet pans, kitchen and yard sinks, syphons, bends, and junctions of a description and quality equal to the samples kept at the office of the Local Board, as may be required in each case, and as are marked in the accompanying list or table set forth in each case.‡

Provide and securely fix from the main to the several parts of the premises to be supplied, the requisite length of inch piping, with tops, and all necessary joints, ferules, &c. for the service of water to the water-closets, sinks, and other parts indicated on the plan, No. , and described in the accompanying list or table set forth in each case.

All damage to premises incidental to the works of drainage and water supply, shall be made good in a workmanlike manner, and with sound and suitable materials, and everything restored which may have been interfered with, and left in a complete and satisfactory state, and the whole of the works shall be so carried on as to be of the least inconvenience possible to the inhabitants.

The whole of the work must be done according to the directions and to the satisfaction of the engineer or surveyor, and 24 hours notice in writing shall be given at the office of the Local Board previously to the work being commenced.

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* This specification is made applicable to those cases in which the materials and apparatus will be provided by the contractors employed by owners and occupiers; but it will be desirable that the Local Board should keep a stock of the materials and apparatus required, which would be furnished to contractors for labour, &c. acting under the Local Board.

† The whole of the clauses of these specifications, as far as they will be applicable, should be embodied in this specification.

‡ A form of table should accompany the specification in each case, in which the quantity of materials required should be filled in, of the description most suitable for the property.

CONDITIONS of TENDERS.

Tenders must be made upon the printed form annexed, and must be signed by a principal, or by a declared agent acting in his behalf. Should there be any doubt as to the meaning of any portion of the specification which would affect the amount of any contractor's tender, he should set forth the particulars of such doubt in writing, and submit the same with his tender, in order that it may be removed before acceptance of his tender. Tenders must be sealed and indorsed "Tender for laying drainage pipes," and must be addressed "To the Chairman of the Local Board of Health of ," and be delivered at the office by o'clock, on the day of

No tenders will be entertained sent in after that time, or of which the form and schedule are not completely filled in, and in every respect in conformity with the conditions.

Should the contractor have any doubt as to the meaning of any portion of the specification, he must set forth the particulars of such doubt in writing, and submit the same with his tender, in order that it may be formally settled before his tender is accepted.

The Local Board do not bind themselves to accept the lowest or any tender.

TENDER for laying DRAINAGE PIPES.

Contract No.

To the Local Board of Health of

Gentlemen,

hereby undertake to excavate the ground and lay the drainage pipes, and to perform all the works, matters, and things in connexion therewith required to be done by the Local Board of Health of , in accordance with the drawings and specification examined by at your office, and with the conditions thereto attached for the sum of .

And further undertake to execute and perform all other additional works which may be required, at the several prices which have set forth, to the several items in the schedule annexed.

And further undertake to execute an agreement (at the expense of the Local Board of Health) for the due performance and fulfilment of the conditions; and do hereby propose of , and of , as responsible sureties, who are willing to be bound with , jointly and severally, in the sum of , for the due and satisfactory performance of the whole of the works comprised in the contract, as well as of such additional works as may be ordered, and for the maintenance thereof in complete repair for the space of six calendar months from the date of the completion thereof.

As witness hand this day of 185

Signature _____

Address _____

Local Board of Health of

Contract No.

SCHEDULE of PRICES referred to in the Specification and Tender for laying Drainage Pipes, applicable to any addition to or diminution of the work comprised in the contract.

The following prices for laying drainage pipes include excavation, shoring the ground and adjacent properties, fencing, lighting, and watching, freeing the trenches from water, laying and jointing the pipes, with the curves, junctions, and other parts, filling in and ramming the earth, restoring and making good the paving, flagging, or other surface material, and clearing away all superfluous earth and rubbish in conformity with the conditions of the specification; the pipes being supplied by the Local Board.

Diameter of Pipes.	Price per lineal yard, not exceeding in depth					
	3 feet.	6 feet.	9 feet.	12 feet.	15 feet.	18 feet.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
4 inches - -						
6 „ - - -						
9 „ - -						
12 „ - -						
15 „ - -						
18 „ - -						

Excavating additional depth for and laying agricultural drain-pies, and making good foundation for main pipe, as per specification - - - - - - } Per lineal yard.

Excavating additional depth for and puddling round 12-inch drainage pipes, at any depth, as per specification - - - - - - - } Per lineal yard.

Other sizes in proportion.

Timber shoring, ordered to be left in trenches - } Per cube foot.

Brickwork, in blue lias lime mortar, including all implements and labour - - - - - - } Per rod.

Brickwork, in cement, whole or half brick thick - } Per rod.

Concrete - - - - - - } Per cube yard laid.

(No. 11.)

EARTHENWARE PIPE DRAINAGE.—RELATIVE COST of supplying EARTHENWARE DRAIN PIPES and laying the same complete in the under-mentioned Towns, under the superintendence of—

Diameter of Pipes.	Mr. RAWLINSON.								Mr. RAMMELL.							
	HITCHIN. (Pipes laid 8 feet deep.)				ORMSKIRK. (Pipes laid 8 feet deep.)				RUGBY. (Pipes laid 8 feet deep.)				SANDGATE. (Pipes laid 6 feet deep.)			
	Cost of Pipes per yard delivered.	Cost of laying per yard.	Total cost of Pipes and laying same complete per yard.		Cost of Pipes per yard delivered.	Cost of laying per yard.	Total cost of Pipes and laying same complete per yard.		Cost of Pipes per yard delivered.	Cost of laying per yard.	Total cost of Pipes and laying same complete per yard.		Cost of Pipes per yard delivered.	Cost of laying per yard.	Total cost of Pipes and laying same complete per yard.	
inches.	*s. d.*	*s. d.*	*s. d.*		*s. d.*	*s. d.*	*s. d.*		*s. d.*	*s. d.*	*s. d.*		*s. d.*	*s. d.*	*s. d.*	
21	—	—	—		—	—	—		—	—	—		—	—	—	
20	8 0	*5 0	13 9		7 0	1 8	8 8		8 4½	2 9	11 1½		—	—	—	
18	7 3	2 9	10 0		6 0	1 7½	7 7½		7 1½	2 9	9 10½		—	—	—	
15	5 4½	2 6	7 10½		4 3	1 7	5 10		5 4½	2 6	7 10½		—	—	—	
12	3 3	2 4	5 7		2 6	1 6½	4 0½		3 3	2 6	5 9		3 10½	1 9	5 7½	
9	2 0	2 3	4 3		1 5½	1 6	2 11½		2 0	2 0	4 0		2 4½	1 9	4 1½	
6	1 3	2 2	3 5		0 10½	1 5½	2 3½		1 2½	2 0	3 2½		1 4½	1 6	2 10½	
4	0 11½	2 2	3 1½		0 7½	1 5½	2 0½		0 10½	1 9	2 7½		1 0½	1 6	2 0½	
3	- -	- -	- -		- -	- -	- -		0 9	1 9	2 6		0 10½	1 6	2 4½	

Diameter of Pipes.	Mr. RANGER.								Mr. RAWLINSON.							
	CROYDON. (Pipes laid 9 feet deep.)				BARNARD CASTLE. (Pipes laid 9 feet deep.)				SOUTHAMPTON. (Pipes laid 9 feet deep.)							
	Cost of Pipes per yard delivered.	Cost of laying per yard.	Total cost of Pipes and laying same complete per yard.		Cost of Pipes per yard delivered.	Cost of laying per yard.	Total cost of Pipes and laying same complete per yard.		Cost of Pipes per yard delivered.	Cost of laying per yard.	Total cost of Pipes and laying same complete per yard.					
inches.	*s. d.*	*s. d.*	*s. d.*		*s. d.*	*s. d.*	*s. d.*		*s. d.*	*s. d.*	*s. d.*					
21	16 0	3 3	19 3		—	—	—		—	—	—					
20	- -	- -	- -		- -	- -	- -		- -	- -	- -					
18	8 0	3 3	11 3		- -	- -	- -		- -	- -	- -					
15	6 0	3 2	9 2		4 11½	1 10½	6 0½		6 0	3 7	9 7					
12	3 6	3 1	6 7		3 2	1 10½	5 0½		3 6	3 5	6 11					
9	2 2	2 9	4 11		2 2	1 8½	3 10½		2 2½	3 0	5 2½					
6	1 3	2 6	3 9		1 2½	1 7½	2 10½		1 3½	2 8	3 11½					
4	0 10	2 2	3 0		0 11	1 7½	2 0½		- -	- -	- -					
3	- -	- -	- -		- -	- -	- -		- -	- -	- -					

* The apparently excessive charge for laying down 20-inch Pipes at Hitchin is to be accounted for by their position under the bed of the river. In some places the pipes are 8 feet below the water line.

Note.—At Hitchin and Ormskirk an average increase of 1-8th to the cost per yard on the Pipes may be allowed for junctions, &c., and at Rugby and Sandgate 1-10th.

(No. 11.)—*continued.*

Diameter of Pipes.	Mr. PILBROW. Tottenham. Cost of Pipes per yard delivered.	Average depth of Pipes laid.	Cost of laying Pipes per yard run.	Total cost of Pipes laid per yard.	Messrs. DYMOND and SONS, Exeter. St. Thomas. Cost of Pipes per yard delivered.	Average depth of Pipes laid.	Cost of laying Pipes per yard.	Total cost of laying Pipes per yard.	Mr. ARTHUR WHITEHEAD, Exeter. Ottery St. Mary. Cost of Pipes per yard delivered.	Cost of laying per yard. Average depth 6 feet.	Total cost of Pipes laid.
inches.	*s. d.*	ft. in.	*s. d.*	*s. d.*	*s. d.*	ft. in.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
24	- -	- -	- -	- -	- -	- -	3 6	—	—	—	—
21	- -	- -	- -	- -	10 0	- -	3 3	13 3	—	—	—
18	7 4·20	5 0 to 13 0	2 4·5	9 8·7	8 0	7 6	2 9	10 9	—	—	—
15	5 4·8	7 0	1 7·5	7 0·3	6 0	8 6	2 3	8 3	8 6	2 4½	8 10½
12	3 4·5	6 5	1 4·5	4 9	3 7½	6 0	2 0	5 7½	5 4½	2 1½	5 4½
9	2 0·75	6 0	1 0·0	3 0·75	2 3	5 0	1 3	3 6	3 3¾	1 3¾	3 3¾
7·5	1 7·5	5 0	0 10·5	2 6	—	—	—	—	—	—	—
6	1 2·25	4 5	0 8·5	1 10·75	1 3¾	4 6	1 3	2 6¾	1 2¼	1 2¼	2 4½
4	- -	- -	- -	- -	1 0	3 0	1 0	2 0	0 10¼	1 0¾	1 11¼
3	- -	- -	- -	- -	0 10	- -	1 0	1 10	—	—	—
2	- -	- -	- -	- -	0 8	- -	1 0	1 8	—	—	—

(No. 12.)

Results of Inquiries as to the Expenses of the Manufacture of Drain Pipes on a large Scale, and also of Hollow Bricks.

Memorandum as to the Manufacture and Prices of Tubular Drain and Water Pipes.

Great obstacles to the progress of sanitary works have been presented by the defective manufacture of articles required for new construction, as well as by the excessive charges for them by the makers; the whole art of earthenware tube manufacture being very rude, and generally the intelligence and economic condition of the traders engaged in it very low.

A poor brickmaker or potter, receiving an order for a new sort of pipes, charges the whole expenses of his new kiln, and his new machine, upon the single set of the new articles ordered. Hence the actual charges of production, which are very low, form but a small element in the prices to the public, which are excessively high; which prices are nevertheless maintained even after the plant has been paid for. When the demand has become extended, and new makers have been brought into the field, while their numbers are few, and they are of this class, they rather combine to keep up prices, and divide the business amongst them, than compete, either as to the price or the quality of the articles supplied.

It is true that generally excessive prices really restrict profits as well as limit consumption; but traders of this class prefer the smaller sales at the higher prices, even with less aggregate profit. Where competition does arise upon these high prices, it is competition by trade allowances and "discounts off" to intermediate dealers; and sometimes, a corrupting competition by per-centages and allowances, or, in the proper words, by bribes to engineers, surveyors, architects, and builders.

Upon the investigation of the older works of construction, the obstinate preferences of the local administrators, and of their officers for works, on an extravagant scale, and of evidently doubtful efficiency,—the manifest sympathy of the subordinate officers and clerks with contractors in the case of defects and failures, against the public,—the palpable remissness in the measurements and checks against bad or deficient work, were collectively so strong as to lead to the belief that similar influences acted upon the officers, and even upon the administrative bodies themselves. Amongst these bodies were found relations of contractors, or of professional persons, or tradesmen indirectly connected with them; in fact, such trading influences, often assuming the garb of party politics, had prevailed in the constitution of the administrative bodies having the direction of the works. Majorities were, however, often misled by interested minorities; and indeed, a whole Board of gentlemen, perfectly disinterested, were often misled from not scrutinizing the details of the business themselves.

It is highly probable, that if Mr. Law Hodges, and several other gentlemen of enterprise, had not examined the manufacture of agricultural drain-tiles, analyzed the labour and expenses of constructing kilns and manufacturing tiles themselves, and proved at what cost they might be produced, the prices of the ordinary pipes would,—under the circumstances of there being no inducements to investments of capital on a large scale, or in the improvements of the works in any one locality,—have remained four or five times as much as their present price, the excessive charge continuing a formidable obstruction to land drainage. It appeared to the

members of the Sanitary Commission that the most efficient, if not the only means of protecting the public, was to ascertain carefully at what cost the articles requisite for town drainage might be made; and, to promote their manufacture under contracts, on a large scale, at such a moderate rate of profit, as, whilst it ensured the production, would preclude the payments of per-centages or of allowances.

To verify the information obtained, it was proposed to erect kilns as trial works, to give data for the prices of production by contractors on a large scale for the new works; or, in case of the failure of this method, to let out the kilns, and allow them to be worked by contract. The whole of this proceeding was vehemently opposed by the tradesmen; and every indirect, as well as direct, effort made to thwart it. Nevertheless, it appeared, upon inquiry, that the prices at which the chief article used in the old constructions had been supplied, were 50 or 60 per cent. above the prime cost at which they might have been produced; whilst, upon a subterranean survey, it appeared that large extents of brick sewers, even those of comparatively recent construction, were falling to pieces, from the bricks used having been far inferior to the qualities contracted for, and paid for, at those very high rates of profit. At the time of the supersedeas of the district commissions in the metropolis, there were large brick sewers projected, which would have been sewers of deposit, at an expense for one single district of a quarter of a million, of which sum the greater proportion would have been expended in brick, probably at the previous prices, or what were called the market prices, but which was far above the fair cost, including a reasonable profit.

In respect to the earthenware drain-pipes, it appeared that there could be only an inconsiderable extra cost in the manufacture of the glazed stoneware pipes made for house-drains beyond that for the production of the red earthenware pipes used as land-drains, except for the clay. This was brought from Dorsetshire, and ground and otherwise prepared at an expense of 10*s.* per ton, but it is now found that an equally good clay might be wrought at 7*s.* per ton.

The prices charged by the small makers in the country, with all the advantages of fuel as well as of clay upon the spot, appeared to be much higher than the prices of the makers of pipes in town, which both were greatly above the cost of production. For example, it may be mentioned, that whilst a 2-inch socket-pipe could be made at 4-16ths of a penny per foot, the lowest sale price at which they were offered from Staffordshire was 4*d.*, and from London at $3\frac{1}{2}d.$; that whilst a 4-inch pipe could be manufactured at 5-8ths of a penny per foot, the lowest sale price in Staffordshire was 6*d.* per foot, in London 5*d.*; that pipes 1 foot in diameter might be made at $2\frac{1}{4}d.$ per foot, the sale prices in Staffordshire and in London were 1*s.* 8*d.*; and that socket-pipes of 16 inches in diameter made at $3\frac{1}{4}d.$ were charged at the rate of 3*s.* 6*d.* per foot.

These results show how the members of a Local Board might be unconsciously led to adopt even the lowest tender of goods, and yet pay some 200 or 300 per cent. beyond the cost prices of production. Where the competitors were few, the tenders themselves appeared to be so arranged as to leave little choice to the authorities in the selection of contracts, and almost to preclude competition in the improvement in the qualities of the goods produced. When such improvements were suggested to the makers of the pipes as the application of a second pressure, by which their exactitude of form, the smoothness of their interior surface, and their strength might be increased, at an additional expense, whether by hand labour or by a machine, of a halfpenny or a penny a yard, they almost invariably protested that their profits were so very low that they really could not afford to make the improvement unless they were paid extra for it.

As an example of the rate of charge to the public, it may be mentioned, that the charge of builders for the first soil-pans of a very rude and inferior description was 7*s.* each. When the makers were remonstrated with on the workmanship, they pleaded that they could not afford to improve it, inasmuch as they were only paid 2*s.* 6*d.* each for them by the builders. Yet it appeared that the prime cost of production to the potter, for the same article, was little more than half that sum.

Since the subject was first investigated, there has been much reduction in the prices of the pipes, but it is chiefly by per-centages to contractors and to tradesmen, amounting, it is understood, to 40 per cent. or more upon the trade or the list prices, in itself a very objectionable mode of proceeding, maintaining the old and corrupt influences at the public expense. There has been very little improvement, however, in the manufacture of pipes or the connected apparatus; except in syphon water-closets, which have been much improved, but the prices of the best of them appear still to be extravagantly high, as compared with the cost of production and any superadded fair profit for articles produced on a large scale.

The quantity of clay used in the manufacture of hollow bricks of the common sizes is less than in the solid bricks; in the larger sizes it is very much less; there is less digging, less working, less wheeling and moving, and less carriage. Nevertheless, common brickmakers have charged more for the hollow bricks than for the common bricks, and full two thirds more than they are actually manufactured for by gentlemen who make them in their own kilns. It is probable, however, that there will be few, if any, of the smaller towns where it would not be found worth while, if from other circumstances it were practicable, for the Local Board to do what individual owners might do, *i.e.* construct kilns for the manufacture of the drain-pipes required. The delay of efficient measures of sanitary improvement is in itself a source of great expense, and sacrifices may be required for speed. It is only for undertakings on a very large scale, and under peculiar circumstances, that it could be recommended as worth while for the Local Board of any town to erect works for the manufacture of pipes, as contemplated for the service of the metropolis. In general, more money would be lost by delay than would be saved upon the prices of the articles, even where the circumstances were more than usually favourable for such a course; but it will, nevertheless, be of use that members of Local Boards should, to protect the ratepayers and themselves from excessive charges, acquaint themselves with the real expenses of production, and of how much room there is for improvement in the quality of the goods supplied, without trenching upon a fair remuneration for their manufacture.

When the labour and expense of production has been analysed and ascertained beyond a doubt, a liberal profit should be allowed to the manufacturer, with a fair allowance for the irregular nature and risk of the demand.

In respect to the trial works, hereafter described, although as being the first known to have been made, they may be important and useful as far as they go, it is to be observed, that the nature of the clays was so various, and the burnings and manipulations of them so different, that it is recommended, that for any large or special works, new and varied trials will be made. It was intended that the trials should be renewed and varied by different observers.

Extracts from a Report of the Works Committee of the First Consolidated Metropolitan Sewers Commission.

"The manufacture of earthenware drain-pipes is, apparently, in a very primitive state. The machines now in use are only a few years old. It

is admitted, that by the use of steam-power and machinery great improvements might be effected in the manufacture; but the demand for such pipes has hitherto been only at distant places, scattered over the country, and not sufficiently large in any one place to make it worth while generally to resort to the use of steam-engines, at least for the manufacture of red earthenware pipes. There are very few manufacturers of those articles, and their average profits are known to be upwards of one hundred per cent., which is not too high, perhaps, to compensate for the uncertainty of the demand in that season in which pipes, as well as bricks, may be made in the common method. Private individuals, owners and occupiers, gentlemen who wish to drain their own lands, find it to their interest, contrary to the practice in other matters, to erect kilns and manufacture pipes for themselves. The Town Council of Liverpool, who contemplate carrying out a tubular system of drainage, have, it is understood, engaged with a potter to construct works on their behalf on a contract. The question which is now pressed for decision is, whether it be expedient that the Commissioners should to any and what extent manufacture pipes, by persons directly under their own control.

"It appears that various new forms of pipes and apparatus will require to be tried, involving expense on the part of the manufacturers.

"Several potters have offered to the Commission their kilns for trial works.

"But the acceptance of any of these offers would apparently be attended with the inconvenience of connecting the Commission with an individual manufacturer or tradesman, who will expect compensation for his trouble, and whose wares may not eventually prove to be suitable; nor could trial works be carried on in such premises with perfect freedom, nor would the arrangement be so satisfactory to competing manufacturers, from several of whom it may be found eligible to take supplies of earthenware pipes.

"On the other hand it is objected, that governments and public bodies never manufacture so well or so cheaply as private individuals.

"In the mode in which governments and public bodies have usually proceeded, of not making it the strong interest of any individual manager of works to manufacture so well or so cheaply as private individuals, this must no doubt continue to be so; but it does not appear to be absolutely impossible or hopeless to give to a manager of works an interest as strong and facilities as great as those of any private individual.

"The question for immediate consideration is, however, not of permanent manufacture, but of trial works, to ascertain what descriptions of articles will best serve, and what prices may be fairly given to private manufacturers, who will not erect the trial works without some assurance of obtaining large orders.

"In consequence of a resolution adopted by the Court, invitations were issued to manufacturers in all parts of the country to send in prices and specimens of their wares. Lists of prices have been received from a considerable number of manufacturers and specimens from . Mr. Donaldson has made up a comparative table of the lists sent in, an abstract of which is hereto appended. (Page .) From this it will be seen that the prices of goods offered, from Staffordshire and Newcastle for instance, are as high as the goods manufactured at Lambeth and Vauxhall, notwithstanding the comparative cheapness of coal, and that clay for pipes is found on the spot at several places from which lists of prices have been sent; it appears, moreover, the quality of specimens, not on the average better, if so good as those already obtained in London. Most of the specimens are exceedingly rude. The pipes delivered from the manufacturers in London, not as specimens, but for actual use, are however frequently inexact in

form, rough in the interior, and greatly below the qualities which there is reason to believe may be obtained without any additional expense.

"The drainage of the Dean's Yard was much delayed by the necessity of returning the pipes first sent, which were of a very inferior quality; and at last the surveyors, to avoid further delay, found it expedient to use pipes of four inches in diameter where they would have preferred pipes of three inches diameter had the construction been more exact. It is to be feared that the private house builders, judging from the common construction of house-drains, will no be so particular, and that there will, on this account, be many instances of the failure of tubular house-drainage. Whilst there is a rising demand for such articles, of whatsoever quality can be obtained, great care or expense for the improvement and perfect finish of the manufacture cannot be reasonably expected.

"The inquiries into the means of improving the manufacture, commenced, from convenience, with the kilns. The chief results obtained on this topic are set forth in Mr. Roe's Report. The most decided improvement in these constructions is the Ainslie Tile-kiln, the use of which is strongly advocated by Mr. Smith of Deanston. By this kiln, it is stated, that five parts out of seven of the coal ordinarily consumed may be saved. The royalty asked for the use of the patent, is one fourth of the fuel saved; which does not appear to be an unfair compensation. The Company have, however, at the instance of Mr. Smith, offered the use of the patent for one set of kilns gratis to the Commissioners, being desirous of its trial.

"An analysis of the labour, quantity of clay, and expense of making pipes, has been made out, in part, from the information furnished by the manager of the Ainslie tile-works, and reduced to a tabular form by the Court's assistant-surveyor, Mr. Gotto. The Committee are assured that, if kilns and works be provided under the Commission, the production of goods at the prices therein stated may be obtained by contract for management with a manager, who will, for a rate of per-centage on the quantity manufactured, produce good pipes according to a specimen at the prices therein set forth. Apart from any peculiar advantages derivable from the Ainslie tile-kilns, and supposing that the prices there set forth were varied to the extent of fifty per cent., the results furnished by the system of piece-work or contract work proposed, appears to be such as there is no prospect of obtaining in any other method.

"The analysis of the prices of labour and material in making tubular drain-pipes, shows grounds for the expectation of the production, at immensely reduced prices, of articles of at least equal construction to the pipe-drains at present commonly sold. The stoneware material of the pipes commonly sold in London is of very high quality, vitreous, impermeable, and strong. Its chief use was for the manufacture of bottles for holding spirituous liquors, ginger beer, soda water, &c. The vitreous qualities in the higher degree adapt the stoneware more for water pipes at high pressure than for drain-pipes, or at least for the larger sizes, which, it appears, may be made as exact in *form*, and smooth in surface, of well-selected red clay as of the stoneware material. The experiments made on the flow of sewer-water through glass pipes tend to show that smoothness of surface is a very inferior quality to rectitude of form. The burning for the glazing of earthenware pipes is very apt to injure their quality. The red earthenware pipes admit of a glaze, but it does not at present appear for the pipes of the larger sizes to be worth the expense.

"The durability of earthenware pipes, especially of those which are alternately wet and dry, and are exposed to frost, is to a great extent as their permeability. If they be lightly baked, and of a sandy clay, they may be expected to chip and fall away, and be as perishable as badly-constructed garden-pots. Red earthenware drain and water pipes have, how-

ever, been taken out of the ground several centuries old. The red earthenware Roman tiles, made of the clay in this country, their bricks and flues, are found in good preservation at this time. If red earthenware pipes be made only of the same clay of which the bricks are made which are used in the construction of sewers, from the process used, from the thickness of the clay being less, the earthenware pipes will be better burnt, harder, and more durable than the brickwork. Mr. Roe has expressed a confident opinion that pipes properly made of the London clay will be as good and useful pipes for the construction of drains as those commonly made of stoneware in London.*

"Specimens of red earthenware pipes, of a close impermeable texture and smooth surface, have been presented, which appear to be of a superior quality. Amidst the various qualities of clay, some appear to be peculiarly adapted to the purpose. Clays, it is stated, may be obtained at an expense of 6*s.* per ton. In calculating the prime cost of the manufacture of earthenware pipes, a selected description of clay is estimated for. It is recommended, that specimens should be sought and tried. It will be seen that the estimates will admit of considerable additions, not only for select clays, but for extra care in its preparation, and in the whole process of the manufacture, for omissions, errors, and contingencies, even if the ultimate cost were more than doubled; important reductions may, there is fair reason to expect, be made, as compared with all the lists at present sent in.

"The contrast at present stands thus, in respect to the larger sized pipes, which are of first-rate importance, as superseding, for all perhaps except valley lines, expensive lines of sewer, such as cost from 15*s.* to 25*s.* per foot, or from 3,960*l.* to 6,600*l.* per mile.

	Present price offered according to tenders sent in from private tradesmen.	Estimated expense of production by contract, by works and machinery found by the Commission.
	£ s. d.	£ s. d.
Per 1,000 feet of 16-inch earthenware pipe, 1 inch thick - -	125 0 0	16 2 6
Per mile - - - -	660 0 0	85 2 9

"The expense of stoneware glazed pipes, 16 inches diameter, at the price at which they are at present furnished to the Commission, would be 135*l.* per 1 000 feet, or 712*l.* per mile; so that, as compared even with the price of executing such work, it appears to be practicable to save, by the system proposed, at the rate of 600*l.* per mile,—or allowing for extra expense in the selection of clays, and the manufacture and contingencies, say from 500*l.* or 400*l.* per mile. Any such saving, if realized in any proportion to the extent estimated, would admit of extension of improved sewerage works and means of relief at a rate never hitherto contemplated. Thus an example was given in a report by Mr. Hale of the drainage of upwards of 900 houses of the first class with one 12-inch drain-pipe. A 16-inch pipe would apparently have carried away extraordinary floods of storm-water from such an area. Mr. Gotto was requested to estimate what would be the expense of similarly laying down a mile of 16-inch pipe in an old sewer, with junctions of 4-inch branch pipes to every house-drain made good.

* All this is dependent on making them as impermeable as the stoneware pipes, either by glazing or burning.

"He estimates that the expense would be 254*l.* 14*s.* 5*d.* per mile. (*Vide* Appendix.) In many situations such a line of pipe would keep the sewer entirely clear of deposit, and, so far as the sewer itself was concerned, clear of smell, and greatly diminish, if not prevent, the circulation of foul gases from the house-drains through the sewers. According to the report of Mr. Lovick, the present expense of flushing in some districts is 2*l.* 10*s.* per mile per week, and the average expense throughout the new district is 29*l.* per annum per mile. This rate is, however, deemed to be owing to old accumulations now in course of removal. Even in the Holborn and Finsbury division, where the flushing is regular, the expense of keeping the sewers clean by flushing, averages, even with piece-work, 12*l.* 5*s.* per mile per annum. Now the annual expense of a mile of earthenware tubular sewer, constructed as above, and to keep itself clear, as in the example given by Mr. Hale, but allowing for a 16-inch pipe instead of a 12-inch, at 20 years payment, would not be more than 19*l.* 8*s.* 5½*d.* per mile per annum. Under the flushing system, in the least uncleanly sewers district, the expense of flushing represents, at 8*d.* per load, the present expense of removal of 517 loads of detritus and decomposing refuse, spread in portions over a mile of surface three feet wide on the average, until it is removed at weekly and fortnightly intervals. At an extra expense of 2*l.* 3*s.* in the best-conditioned district, the retention and spreading of the 517 loads may be prevented in streets where there happens to be a sufficient fall.

"Mr. Gotto has been requested to examine what, on the same data, would be the saving practicable in the construction of the connected works of gully-shoots, made with materials obtained on the contract system by the Commissioners, as contrasted with the recent and present expense of such works in the Metropolis. From this table it appears that the price of gully-shoots was:—

	Price each. £ s. d.
As constructed in the city - - - - - - -	12 16 10
As constructed in the Westminster district in 1839 -	7 17 6
Ditto in 1845 - - - - - - - - -	4 4 11
Of 9-inch stoneware pipe at the present time in the Westminster district - - - - - - - -	3 17 0½
Of 6-inch stoneware pipe at the present time in ditto -	3 5 4
As they may be constructed of red earthenware pipe, 6 inches in diameter - - - - - - -	1 10 3
As they may be constructed of 4-inch earthenware pipe, by contract, under the Commissioners - - -	1 7 5

"The proposed reduction of the price of gully-shoots will be of great importance for suburban road drainage and road construction.

"In addition to the earthenware pipes required for house and general drainage, it appears that there will be need for large quantities of bricks for arching over large watercourses, also for side entrances, and for other connected works. The Commission is entitled to an exemption of duty for bricks used for such purposes, and which are marked with the word 'drain.' This economy the previous Commissions do not appear in any one instance, in any one district, to have thought worth the trouble of effecting by getting bricks made expressly for the purpose. There is reason to believe that, apart from the exemption from duty, bricks may be made hollow for the purposes of the Commission with great advantage.* The attention of the General Purposes Committee was some months ago directed to the subject, and Mr. Roe was ordered to get specimens made

* The duty is now repealed.

and tried. He states that the larger brickmakers have expressed their belief that hollow bricks may be made about one third cheaper than the common bricks. He has had samples made of various shapes for arch-work, and some of them are made in preparation for trials. Such trials as have been made show that the hollow brick constructions will be superior to the common brick in strength. If made by contract under the Commissioners on the same principle as the earthenware tubes, the prospect of economy to the ratepayers is very large indeed. Mr. Gotto has been directed to make estimates of the comparative prices, and he gives the following, of a mile of watercourse sewers six feet wide, to be arched over, supposing the bricks to be in both cases free of duty :—

One mile of 6-feet arch, of 9-inch stock brick - -	£384 10 0
The same might be constructed of hollow brick for -	220 10 0
Gain per mile by the use of hollow brick - -	£164 0 0

"Mr. R. Rawlinson, one of the Superintending Inspectors of the General Board of Health, has built of hollow bricks one of the largest roofs recently constructed in Europe, 196 feet long by 64 feet wide. He states that by the substitution of hollow bricks he gained in strength, and he saved upwards of 300 tons in weight. Some apprehensions having been expressed as to the strength of these bricks made hollow, of common clay, and of the common size, he tested them with 15 tons of weight.

"He has made a highly important table, given in the Appendix, of the relative cost of the hollow brick and the solid brick construction. From this table it will be seen that in some of the forms, the advantages of the hollow brick construction are very great for walls and partitions.

The present expense of constructing side entrances on the plan of those made by Mr. Roe, including iron work, is - - - - - -	£16 6 0
The same, with hollow brickwork, would be, as estimated by Mr. Gotto - - - - - -	10 18 0½
Gain by the use of hollow bricks - - -	£5 8 0

"As from the unanimous opinions of the consulting engineer and the surveyors, and from the lists sent in from tradesmen, it appears that there is no reasonable probability of obtaining early in the market the articles in question so cheaply as they appear to be obtainable by contract under the Commission, it is recommended to the Court—

"That a sum of 300*l.* be placed at the disposal of the Works Committee for the construction of one set of the Ainslie kilns, machines, and a drying shed.

"That the Works Committee be authorized to engage a manager of the works, to be paid by a commission not exceeding 5 per cent. on the quantity of good wares he produces, according to a specimen to be agreed upon, at the scale of prices estimated in Mr. Gotto's table.

"That to give the manager a further interest in carrying out further improvements, an arrangement be made with him that his rate of percentage shall increase with any improvements he may make in the qualities of the articles in comparison with the specimens, or with any reduction in their prices."

Cost at which Tubular Drain-pipes were manufactured in these Experiments.

Size of pipes, inches in diameter.	Materials. Clay.	Materials. Coals, 1 cwt. to a ton of clay.	Cost of materials, labour, and burning, per 1,000 feet. Cost of clay, say at 7*s.* per ton, including royalty, digging, &c.	Labour in pugging, &c., at 2*s.* per ton.	Labour in moulding, carrying to drying shed, and attendance during drying.	Cost of coals, at 20*s.* per ton.	Extra for management, kiln-rent, waste, labour, packing, and drawing kiln.	Total prime cost per 1,000 feet in the field.
	ton. cwt. lbs.	cwt.	£ *s.* *d.*	*s.* *d.*	£ *s.* *d.*	*s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
5	4 0 20	4	1 8 0	8 0	1 0 0	4 0	1 10 0	4 10 0
6	5 15 0	5¾	2 3 0	11 6	1 8 9	5 9	2 3 1	6 9 4
7½	6 16 70	6¾	2 9 9	13 7	1 14 2	6 9	2 12 0	7 16 1
8½	8 18 50	9	3 2 5	17 10	2 4 8	9 0	3 7 0	10 0 11

Table contrasting the Prices of Tubular Drain-pipes. Fifty per cent. is here added to the prices in the foregoing table, for profit, carriage, &c.

Size of pipes, inches in diameter.	Lengths.	Red earthenware pipes, if made by contract.	Red earthenware pipes, at the present sale prices.	Stoneware glazed, at the present sale prices.	Average gain: On red earthenware pipes, if made by contract, over the present prices.	Average gain: On red earthenware pipes, if made by contract, over glazed stoneware pipes.
		£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
5	Per foot -	0 0 1½	0 0 5	0 0 6	0 0 3½	0 0 4½
	Per 1,000 feet	6 15 0	20 16 8	25 0 0	14 1 8	18 5 0
	Per mile -	35 12 9	110 0 0	132 0 0	74 7 3	96 7 3
6	Per foot -	0 0 2¼	0 0 6	0 0 7	0 0 3¾	0 0 4¾
	Per 1,000 feet	9 14 0	25 0 0	29 3 4	15 6 0	19 9 4
	Per mile -	51 4 4	132 0 0	154 0 0	80 15 8	102 15 8
9	Per foot -	0 0 3¾	0 0 9	0 1 0	0 0 5¼	0 0 8¼
	Per 1,000 feet	15 1 6	37 10 0	50 0 0	22 8 6	34 18 6
	Per mile -	79 11 10	198 0 0	264 0 0	118 8 2	164 8 2

Prices at which Hollow Bricks could be made under the Commissioners, by the use of improved machinery and kiln.

Size.	Quantity of material used per 1,000 feet. Clay.	Coals at 1 cwt. per ton.	Cost of materials, labour, and burning, per 1,000 feet. Cost of clay and digging, at 2*s.* per ton.	Labour in working, at 2*s.* 6*d.* per ton.	Labour in making at 1*s.* per ton.	Cost of coals, at 20*s.* per ton.	Double duty.	Extra for management, kiln-rent, waste, labour, packing, and taking out of the kiln, and contingencies.	Total cost per 1,000 feet in the kiln.
	tons cwt. lbs.	cwt. lbs.	£ *s.* *d.*	£ *s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	£ *s.* *d.*
4 by 4	6 13 0	6 73	0 13 4	0 16 7½	6 8	6 8	10 6	9 4¾	3 3 2¼
5 „ 5	7 15 2	7 85	0 15 6¼	0 19 5	7 9¼	7 9¼	10 6	10 11	3 11 10¾
6 „ 6	8 18 6	8 104	0 17 10	1 2 4	8 10½	8 10½	10 6	12 6	4 0 11
8 „ 8	12 19 3	12 54	1 4 11	1 11 2	12 5¾	12 5¾	10 6	17 4¾	5 8 11¼

TABLE contrasting the PRICES of SOLID BRICKWORK at the contract price under the Commission, namely, 11*l.* per rod, with Brickwork of Hollow Bricks, if made by contract under the Commission, including the duty in both cases.

Description of labour, materials, &c.	Quantities.	9-inch solid brickwork, laid in mortar.	8-inch hollow brickwork, laid in mortar.	Gain by using 8-inch hollow, instead of 9-inch solid brickwork.
		s. d.	*s. d.*	*s. d.*
Bricks	Per sq. yard	2 10¼	—	—
Labour, carriage, &c.	„	1 2	0 8	—
Mortar	„	0 10	0 6	—
Cost of hollow bricks, if made by contract under the Commission	„	—	1 5½	—
Total	„	4 10¼	2 7½	2 2¾

TABLE showing the STRENGTH of PIPES made by MACHINE, March 2, 1849.

Number of Experiments.	Marks.	Bore of pipe, in inches.	Thickness of pipe, in inches.	Length of pipe, in inches.	Weight of pipe, in pounds.	Bursting pressure: in lbs. per inch.	Bursting pressure: in feet of altitude.	Rolled or not.	Glazed or not.	Remarks.
1	H.	2·812	·469	20·68	8·75	420	970·2	Rolled	Unglazed	Smith's fine clay.
2	H.	2·87	·471	22·37	9·25	380	877·8	„	„	
3	H.	2·87	·471	22·37	9·25	280	646·8	„	Glazed	
4	N.	2·68	·472	21·0	7·75	180	415·8	Unrolled	Unglazed	Smith's fine clay.
5	N.	2·7	·473	21·5	7·89	170	392·7	„	„	
6	N.	2·69	·471	21·3	7·9	200	462·0	„	„	
7	A.	2·75	·468	21·5	8·12	140	323·4	Rolled	„	Smith's coarse clay.
8	A.	2·75	·468	22·31	8·25	270	623·7	„	„	
9	B.	2·75	·468	22·37	8·25	260	600·6	„	„	
10	M.	2·75	·5	21·37	8·25	160	369·6	Unrolled	Glazed	Smith's coarse clay.
11	M.	2·75	·468	21·37	8·5	120	277·2	„	Unglazed	
12	M.	2·73	·475	21·47	8·36	110	254·1	„	„	
13	—	2·375	·656	23·12	12·25	660	1,524·6	Rolled	Glazed	Smith's fine clay.
14	—	2·375	·656	22·75	12·25	360	831·6	„	„	
15	—	2·375	·630	24·12	12·75	500	1,155·0	„	„	

Averages of the above.

								Difference per cent.	
1 to 3	2·8506	·470	21·806	9·083	360	831·6	Rolled	96·36	Fine clay.
4 to 6	2·69	·472	21·26	7·846	183·3	423·5	Unrolled		
7 to 9	2·75	·468	22·06	8·206	223·3	515·9	Rolled	71·79	Coarse clay.
10 to 12	2·743	·481	21·403	8·37	130	300·3	Unrolled		
13 to 15	2·375	·6473	23·33	12·416	506·6	1,170·4	Rolled	—	Fine clay.

ANALYSIS of the CUBIC CONTENTS, AREA, HEIGHT, and COST PRICE of HOLLOW TILE and SOLID BRICK.

No.	Description of Materials.	Thickness of Tile in section.	Dimensions of Common and Hollow Bricks. Inches. Length.	Breadth.	Thickness.	Relative cost per 1,000. £ s.	Number of Bricks in one square yard.	Number of square yards in 1,000.	Thickness of Wall in inches.	Net cost of Bricks in one square yard. s. d.	Cost of Labour to set one square yard. d.	Cost of Mortar to set one square yard. d.	Cost of one square yard set complete. s. d.	Remarks.	Extra cost per yard if set in cement. d.	Cost of one square yard set complete in cement. s. d.	Cube inches of space in one square yard.	Cube inches of solid in one square yard.	Weight in lbs. of one Brick.	Weight of 1,000 solid and hollow bricks. T. c. q. lb.	Weight in lbs. of one square yard.
1	Common brick	—	9	4½	3	1 10	96	10½	9	2 10½	9	9	4 4½	Wall one brick or 9 in. thick.	9	5 1½	—	11,664	8½	3 15 3 16	816
2	Common brick for partitions.	—	9	4½	3	1 10	48	21	4½	1 5	5	5	2 3	Wall one brick or 9 in. thick.	5	2 8	—	5,832	8½	3 15 3 16	408
3	Hollow brick, square on section.	1	12	9	9	5 15	12	83⅓	9	1 4½	8	6	2 6¼	Wall half-brick, or 4½ in. thick.	6	2 8	7,056	4,608	27¼	12 3 1 6	327
4	Hollow ditto	1	12	8	8	4 15	13½	74	8	1 3½	8	6	2 5½	Wall one hollow brick, or 9 in. thick.	6	2 6½	5,832	4,536	23	10 5 1 12	310½
5	Ditto	¾	12	6	6	3 10	18	55¾	6	1 3¾	8	6	2 5	Wall one hollow brick, or 8 in. thick.	7	2 11½	4,320	3,456	14	6 5 0 0	252
6	Ditto	¾	12	5	5	3 0	21¾	47½	5	1 3	8	6	2 5	Wall one hollow brick, or 6 in. thick.	8	2 5	3,132	3,348	10¾	4 15 3 26	233¾
7	Ditto	¾	12	4	4	2 5	27	37	4	1 2½	8	6	2 4½	Wall one hollow brick, or 5 in. thick.	9	2 10	1,944	3,240	7½	3 6 3 24	202
8	Hollow ditto partition tile set on edge.	½	12	6	2	1 10	18	55¾	2	0 6½	4		1 0½	Wall one hollow brick, or 4 in. thick.	4	1 4½	864	1,728	7	3 2 2 0	126

N.B. One square foot of tile one inch thick is taken at 10 lbs. weight.

TABLE showing the COMPARATIVE STRENGTH of PIPES.

Bore of Pipe, in inches.	Thickness of Pipe, in inches.	Sectional Area of Pipes.	Bursting pressure		Rolled or not.	Remarks.
			in lbs. per inch.	in feet of altitude.		
2·8506	·470	4·903	73·41	169·6	Rolled	Fine clay.
2·69	·472	4·688	39·2	90·41	Unrolled	Fine clay.
2·75	·468	4·732	47·2	109·07	Rolled	Coarse clay.
2·743	·481	4·872	26·7	61·61	Unrolled	Coarse clay.
2·375	·6473	6·146	82·5	190·6	Rolled	Fine clay.

TABLE showing the STRENGTH of RED EARTHENWARE PIPES made by the PIPE MACHINE, July 18, 1849.

Number of Experiments.	Mark.	Bore of Pipe, in inches.	Thickness of Pipe, in inches.	Length of Pipe, in inches.	Weight of Pipe, in pounds.	Bursting pressure		Rolled or not.	Remarks.
						in lbs. per inch.	in feet of altitude.		
1	A.	2·75	·5	23·125	7·437	175	404·25	Rolled	Sound to 120 lbs., then the water came through in several places
2	„	2·75	·5	22·312	6·875	135	311·85	„	
3	„	2·625	·5	20·375	6·25	110	254·10	Unrolled	Sound to 100 lbs., and then same as No. 1
4	„	2·687	·5	20·5	6·25	Unsound	—	„	
5	B.	2·687	·5	23·5	7·5	105	242·55	Rolled	
6	„	2·687	·5	22·25	7·25	Unsound	—	„	
7	„	2·625	·5	21·187	6·624	95	219·45	Unrolled	
8	„	2·625	·5	17·562	5·5	50	115·50	„	
9	C.	2·812	·5	23·25	6·562	185	427·35	Rolled	
10	„	2·625	·5	21·5	6·062	155	358·05	Unrolled	
11	D.	2·75	·5	23·875	7·624	125	288·75	Rolled	
12	„	2·687	·5	23·687	7·624	120	277·20	„	
13	„	2·687	·5	21·625	6·875	95	219·45	Unrolled	
14	„	2·562	·5	21·25	6·562	100	231	„	

Averages of the above Pipes, &c.

A.	2·75	·5	22·719	7·156	155	358·05	Rolled	40·9 difference per cent.
„	2·656	·5	20·437	6·25	110	254·10	Unrolled	
B.	2·687	·5	22·87	7·375	105	242·55	Rolled	38·9 „
„	2·625	·5	19·37	6·062	77·5	167·47	Unrolled	
C.	2·812	·5	23·25	6·562	185	427·35	Rolled	19·3 „
„	2 625	·5	21·5	6·062	155	358·05	Unrolled	
D.	2·718	·5	23·78	7·624	122·5	282·97	Rolled	25·6 „
„	2·624	·5	21·5	6·718	97·5	225·22	Unrolled	

TABLE showing the COMPARATIVE STRENGTH of PIPES, July 18, 1849.

Bore of Pipe, in inches.	Thickness of Pipe, in inches.	Sectional Area of Pipes.	Bursting pressure		Rolled or not.
			in lbs. per inch.	in feet of altitude.	
2·75	·5	5·105	30·3	70·1	Rolled.
2·656	·5	5·	22·	50·82	Unrolled.
2·687	·5	5·007	20·9	48·4	Rolled.
2·625	·5	4·9	15·8	34·2	Unrolled.
2·812	·5	5·203	35·5	82·1	Rolled.
2·625	·5	4·9	31·6	73·	Unrolled.
2·718	·5	5·1	24·	55·4	Rolled.
2·624	·5	4·8	20·3	46·9	Unrolled.

TABLE showing the Delivery of Water through Red unglazed Pipes, compared with glazed Stoneware.

Description of Pipe.	Inclination.	Time to discharge 25 Cubic Feet.	Height of Water above Top of Pipe.	Diameter of Pipe.	Cubic Feet per hour.	Velocity per second.	Stoneware compared with the Red Pipe.
		m. s.	Inches.	Ft. In.		Feet.	
Glazed stoneware	1 in 60	2 0	3	0·24	750·	4·9	–
Red-ware rolled, B.	„	2 18	3	0·23	652·17	3·72	5 to 4·34
Red-ware, B. -	„	2 48	3	0·23	535·71	3·06	5 to 3·57
Red-ware rolled, D.	„	2 28	3	0·23	608·1	3·47	5 to 4·
Red-ware, D. -	„	2 46	3	0·23	542·1	–	5 to 3·61

The Pipe in the above experiment was fully charged.

EXPERIMENTS with the same Pipe running half full.

Glazed pipe -	1 in 60	4 16	Water level with head of pipe	–	351		
Red-ware rolled, B.	„	5 58	„	–	251	–	5 to 3·52
Red-ware, B. -	„	6 34	„	–	228	–	5 to 3·24
Red-ware rolled, D.	„	6 15	„	–	238	–	5 to 3·39
Red-ware, D. -	„	7 15	„	–	206	–	5 to 2·93

TABLE showing the STRENGTH of PIPES gained by a Second Pressure with Machine, when partially dried.

Number of Experiments.	Mark.	Bore of Pipe, in inches.	Thickness of Pipe, in inches.	Length of Pipe, in inches.	Weight of Pipe, in pounds.	Bursting pressure		Rolled or not.	Remarks.
						in lbs. per inch.	in feet of altitude.		
1	S	2·718	·5	21·56	7·	37·5	86·62	Unrolled	Smith's Red Clay.
2	S	2·687	·468	21·68	7·09	40·	92·40	„	
3	S	2·765	·49	21·5	7·	35·	80·85	„	
4	C	2·75	·5	21·55	7·33	45·	103·95	Rolled	Smith's Red Clay.
5	C	2·609	·487	21·36	7·26	90·	207·90	„	
6	C	2·718	·496	21·68	7·31	75·	173·25	„	
7	D	2·812	·531	21·5	7·75	30·	69·30	Unrolled	Reading Red Clay.
8	D	2·95	·531	21·68	7·8	Unsound	—	„	
9	D	2·875	·535	21·7	7·79	Unsound	—	„	
10	D	2·875	·531	21·7	7·76	40·	92·40	„	
11	D 1	2·87	·521	21·75	7·89	45·	103·95	Rolled	Reading Red Clay.
12	D 3	2·86	·523	21·73	7·9	80·	184·80	„	
13	D 4	2·89	·53	21·75	7·85	65·	150·15	„	

Averages of the above Pipes, &c.

								Difference per cent.	
1 to 3	2·723	·486	21·58	7·03	37·5	86·62	Unrolled	86·6	Smith's Red Clay.
4 to 6	2·692	·494	21·53	7·30	70·	161·70	Rolled		
7 and 10	2·843	·531	21·6	7·75	85·	80·85	Unrolled	80·9	Reading Red Clay.
11 to 13	2·873	·524	21·74	7·88	63·3	146·30	Rolled		

TABLE showing the COMPARATIVE STRENGTH of PIPES.

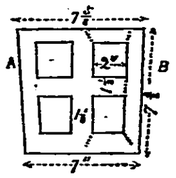
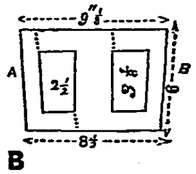
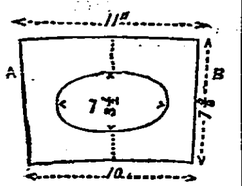
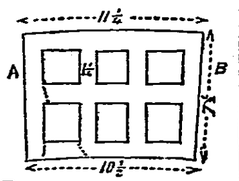
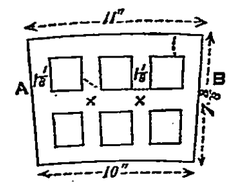
Bore of Pipes, in inches.	Thickness of Pipes, in inches.	Sectional Area of Pipes.	Bursting pressure		Rolled or not.	Remarks.
			in lbs. per inch.	in feet of altitude.		
2·723	·486	4·900	7·65	17·7	Unrolled	Smith's Red Clay.
2·692	·494	4·944	14·2	32·78	Rolled	
2·843	·531	5·628	6·23	14·39	Unrolled	Reading Red Clay.
2·873	·524	5·592	11·3	26·2	Rolled	

(No. 13.)

RESULTS of EXPERIMENTS made by Messrs. Burton, at the request of Mr. Roe, to try the Strength of Blocks of various Materials and Forms.

(No. 13.)

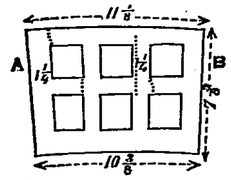
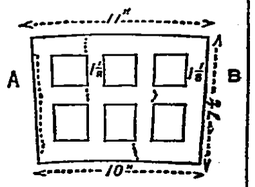
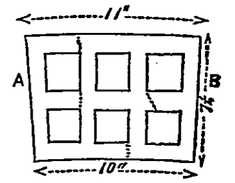
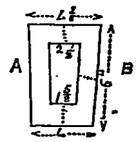
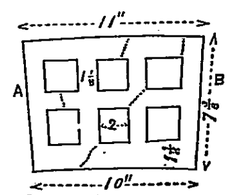
RESULTS of EXPERIMENTS made by Messrs. Burton, at the request of

SIZE AND FORM OF BLOCK.	Number of Experiments.	Length of Block, in inches.	Weight of Block, in pounds.	Total Area.	Area through A B.	First Crack, in tons.	Total Weight to crush. Tons.	Weight per inch for total area, in pounds.	Weight per inch at A B. in pounds.	Remarks.
	No. 1.	13¼	38½	105·5	44·7	5·6	9·7	214	486	Staffordshire Clay, or Terro Metallic. Direct weight on this Block for 48 hours. Not quite crushed. *See Note.*
 B	No. 1.	14	40	127·7	53·3	6·15	183·6	3,220	7,716	Staffordshire Clay, or Terro Metallic.
 C	No. 1.	15	58	165	52·5	2·0	4·4	59	187	Concrete. Stones in ditto large.
	No. 2.	15	56½	165	52·5	1·74	3·76	51	160	
 D	No. 1.	15⅛	68	170·1	75·6	3·7	9·85	129	291	Concrete. Stones in ditto large.
 E	No. 1.	14⅞	54½	163·6	66·9	6·1	85·9	1,176	2,876	Where marked thus (×), cracked at starting. Light-coloured Fire Brick.

Note.— From the very great difference in the weight required to crush the two Blocks, **A** and **F**, it is to be inferred that the Block **A** was imperfect, although no defect was observable.

(No. 13.)

Mr. Roe, to try the Strength of Blocks of various Materials and Forms.

SIZE AND FORM OF BLOCK.	Number of Experiments.	Length of Block, in inches.	Weight of Block, in pounds.	Total Area.	Area through A B.	First Crack, in tons.	Total Weight to crush. Tons.	Weight per inch for total area, in pounds.	Weight per inch at A B, in pounds.	Remarks.
 F	No. 1.	13¼	58	147·4	66·2	73·4	150·3	2,284	5,085	Flew to pieces. Light coloured Fire Brick, but not the same make as **E**.
 G	No. 1.	17½	65	192·5	78·7	24·2	159·3	1,853	4,534	Flew to pieces. Hard Stone-ware.
 H	No. 1.	17½	69	192·5	78·7	18·6	104·1	1,211	2,962	Hard Stone-ware, of a lighter colour than the last.
	No. 1.	9	15	37·1	19·1	5·7	42·6	2,569	4,496	Staffordshire Clay, or Terro-Metallic.
 J	No. 1.	9	36½	99	40·5	11·3	45·7	1,034	2,527	Stoneware. Very open.

The small dotted lines on the Sketches in the margin are to show where the Blocks first cracked.

The letters in the margin refer to the pieces of material accompanying this report.

(No. 14.)

TRIAL WORKS in respect to STREET CLEANSING by the use of the FLEXIBLE HOSE and the WATER JET.

Extract from a Communication by Mr. Lee, Superintendent Inspector, describing Trial Works for Improved Street Cleansing, conducted by him at Sheffield:—

"Messrs. Guest and Chrimes, of Rotherham, are patentees of a tap for the discharge of water at high pressures. They called upon me in February last, with an adaptation of their invention to the purpose of a fire-plug and stand-pipe, and expressed a wish to make an experiment with it.

"As their object was to show its powers to extinguish fires, we selected Church-street, one of the most public thoroughfares in the town, and containing the hall of the Corporation of Cutlers, a rather lofty building. At my request, the apparatus was applied with the most perfect success to the cleansing of the street; the Mayor, the Town Regent, and many other influential persons were present. The hose was of leather, 3 inches diameter, and about 60 yards long, with a discharge-pipe $1\frac{1}{4}$ inch diameter. The carriageway is from 20 to 24 feet wide, and about 150 yards long. It was washed almost as clean as a house-floor in five minutes. The surface of the reservoir is 350 feet higher than the point of discharge, and 2,557 yards distant from it. The time occupied, and the efficacy of the cleansing experiment, depended, of course, upon the quantity and force of the water, and not, to any material extent, upon the use of Messrs. Guest and Chrimes's stand-pipe. The apparatus will, however, be very useful where a constant supply of water at high pressure is given, and deserves a brief description.

"It consists of two parts; one of which, containing a female screw and closed valve, is to replace the common fire-plug, to be fast to the main pipe, and to be covered, when not in use, by a metal cap. The other part is the stand-pipe—a copper cylinder about 2 feet long, which screws on to the fire-plug. On the sides of the cylinder, about 6 inches from the top, are two arms at *right angles*, and each about 4 inches long, with screws to attach the hose. A screw piston about half an inch in diameter, with crutch handle, working in a stuffing-box, passes through the centre of the upright cylinder, and opens or shuts the valve of the fire-plug. Its advantages are, that it can be applied to the mains, and used with great readiness, without the assistance of the turncock, at any amount of vertical pressure. With the ordinary plug it is necessary, on the discovery of a fire, to seek the turncock, who is obliged, if the mains are full and a constant supply given, to seek the nearest main-tap, and turn of the water until the fire plug is opened and the hose attached, and then to go back and turn it on again. In the midst of the confusion much valuable time is thus added to that already lost in procuring the engines, and the jet is at last directed, as a matter of prudence, to the preservation of adjoining buildings, leaving that in which the fire originated to certain destruction. If this apparatus were at hand, two men could have it in full operation in less than two minutes. By a slight increase in the diameter of the stand-pipe, four arms might be connected with it, and four jets, managed by as many men, would throw into any building torrents of water sufficient to extinguish speedily any fire that had not been long raging.

"It will be obvious that this saving of time and labour would also be of great importance as affecting the cost of any system of public cleansing by the agency of water. In consequence of the gradual opening and closing of the valve there is much less danger of bursting the hose by a sudden

rush of water, or of damage to the pipes by its recoil, than with any other apparatus I have seen. The wear and tear of hose under great pressure must be a considerable item in *any* system of public cleansing. In extinguishing fires the hose is frequently burst, and before other hose can be attached, irreparable mischief is done by the raging element.

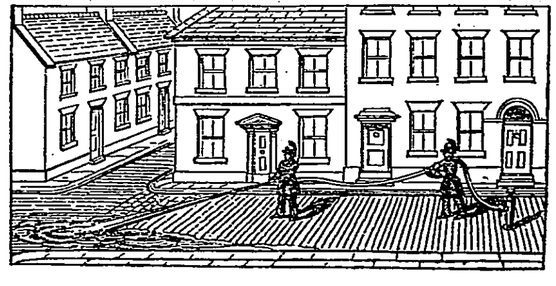
"This, therefore, is a great advantage possessed by the apparatus in question.

"A serious defect in Messrs. Guest and Chrimes's invention is, that the water has to pass one right angle at the fire plug, and another at the insertion of the arm in the stand-pipe. The time necessary for the discharge of a given quantity of water through a straight pipe being 1, the time for an equal quantity through a pipe of the same length and diameter, having a curve of 90°, would be 1·11, and with a right angle, 1·57. Two right angles would therefore increase the time to 2·464. As the *quantities* of water discharged in equal times by the same orifice, with the same length and form of pipes, under different pressures, are nearly as the square roots of the corresponding pressures; so, the *times* during which equal quantities of water are discharged, under the same circumstances, are nearly in the inverse ratio of the square roots of the corresponding pressures. Consequently, with the same discharge, from the same orifice *under the same vertical head*, and with a pipe of equal length and form, *a given increase of time* will indicate the amount of retardation due to any flexures, curves, or angles of the pipe. And, the retardation caused by any such flexures, curves, or angles in the pipe, *will be equivalent to a certain diminution of the vertical pressure*, easily ascertained. In the experiment in question, the jet from a $1\frac{1}{4}$ inch discharge-pipe with 350 feet pressure rose only to about 60 feet vertical height, in consequence of the two right angles in the apparatus.

"The time for a straight pipe being, as already stated, 1, two curved junctions would have only increased it to 1·23, while the right angle prolonged it to 2·464. The form of the pipe therefore becomes most important in any system of street-cleansing, not only as to the direct economy of time and labour, but also in reference to the power of the water in effectually removing the refuse.

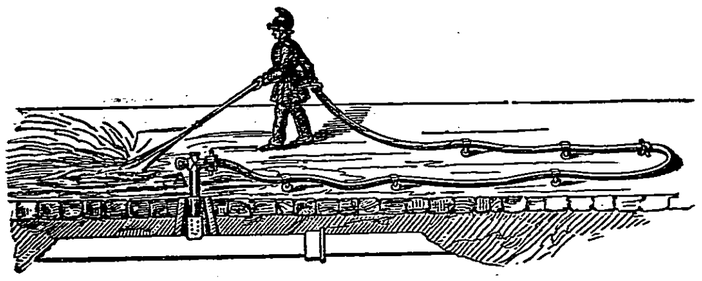
"The form of the pipe is no less important when applied to the extinguishing of fires, because with curved junctions, not only will the jet rise to nearly twice the height, under the same pressure, but the hose and stand-pipe will be available without fire-engines, under about half the vertical pressure necessary with right angles; and, not the least consideration is, that with an equal pressure, nearly double the quantity of water would be impelled to the same height in a given time. I suggested to Messrs. Guest and Chrimes the substitution of curved junctions, and pointed out these advantages, and am glad to hear they are about to adopt my recommendation.

Fig. 1.



"Sketch No. 1 shows the manner in which the experiment was performed, which was clumsy enough, but the best that could be adopted under the circumstances. The hose was stretched from the stand-pipe up the street, and the foreman having placed the end of the hose upon his shoulder with the discharge-pipe pointing to the pavement, at a distance of abont nine feet before him, the plug was opened, and he commenced walking down the street, moving the jet slightly from side to side. The weight and rush of the water through the hose was, however, too much for one man, and he was therefore assisted by a second, taking up the hose in a similar manner, and walking at a distance of two or three yards behind him. The work was laborious, but I have no doubt that with the substitution of curved junctions to the stand-pipe, giving a greater force to the water, and the adoption of some contrivance similar to what I have figured in the sketch No. 2, the work would be done as effectually, even in less time, and with perhaps half the expenditure of physical strength.

Fig. 2.



"The sketch shows a series of saddles, to be attached to the hose at regular distances, and moving on small wheels, so as to take off a great portion of the friction which has to be overcome in dragging the full hose along the pavement. The sketch will, I think, explain itself without further remarks, and if it is not the best thing that can be, may lead to something better from a wiser head. This sketch also shows the curved junctions for the fire-plug and stand-pipe.

Plan and sections of saddles.

"The third sketch shows a light carriage which would enable a man to run at great speed with the hose and all the necessary apparatus for extinguishing fires.

Fig. 3.

"It is little more than a wooden drum from 18 to 24 inches in diameter, which can be made either to revolve with the wheels or to remain stationary; it would be further useful in unfolding and folding the hose without loss of time.

"There would be a peg or button upon the drum, to which a loop at the end of the hose nearest the stand-pipe would be attached, and the movement of the carriage, however rapid, along the line of the hose, would wind it upon the drum. The drum would now be thrown out of gear with the wheels, and the carriage and apparatus removed to another place. On reaching its destination, it will be evident that if the drum be again put into gear with the wheels, and the carriage drawn in a contrary direction to the former, the hose will be unwound and ready to be attached to the stand-pipe without delay.

"We now come to consider the quantity of water necessary for public cleansing with the hose and jet. The line of pipes leading to Church-street, used for the experiment, is 12 inches in diameter, with an area of 113·097 square inches when it leaves the reservoir. It is afterwards reduced to 9 inches, area 63·617. The hose is 3 inches, area 12·566; and the discharge-pipe $1\frac{1}{4}$ inches, area 1·2271. There are branches from the main in its course, and also curves and flexures, both vertical and horizontal, the sines of all which have to be accounted for, as reducing the velocity of the stream. These circumstances added to the loss caused by the right angles in the fire-plug and stand-pipe, already alluded to, very much impede the discharge. The quantity of water actually used during the five minutes was 27·19 cubic feet, or about 170 gallons. I am disposed to add half as much more for waste in emptying the hose, &c., making 255 gallons for the 150 yards of street, this is equal to 2,992 gallons per mile.

"I have stated that the jet was in operation for five minutes in cleansing this street. In order to make a safe estimate I allow five minutes more for unfolding and *fixing* the apparatus; five minutes for *unfixing*, &c., and five minutes for removing to the next plug, or point of operation, making altogether 20 minutes for 150 yards in length: equal to rather more than $2\frac{1}{2}$ miles in length per day of 10 working hours. With improvement in the hose and means of transit, such as I have suggested, two men would by sufficient for one set of stand-pipe, hose, and jet, and would probable execute a greater length of work.

"I will now endeavour to apply the data obtained to the cleansing of a town like Sheffield. No one will doubt if two men can with ease cleanse $2\frac{1}{2}$ miles of road per day, *including the carrying away of the refuse*, that this is the most *economical* mode of street cleansing that can be adopted, even if we leave out of consideration, entirely, the fact that the work is done more perfectly by the agency of water than by any other means. All public highways, therefore, in all large towns, ought to be cleansed with the hose and jet as a matter of economy, exclusive of sanitary considerations. Unfortunately it will be long before this is practicable in Sheffield. The roads outside the dense population are numerous, and without either pipes to convey the water, or sewers to remove the refuse. I have been compelled, therefore, to consider the question as a sanitary regulation only, and to confine my estimate to the densely populated part of the borough. The following table shows the comparative extent to which this method of public cleansing could be readily applied in the six townships which constitute the borough of Sheffield:—

Township.	Total length of Public Carriage-ways.	Length to be cleansed with water three times per week.	Length to be cleansed with water twice per week.	Length to be cleansed with water once per week.	Total length of Public Highways to be cleansed with water.
	Miles.	Miles.	Miles.	Miles.	Miles.
Sheffield - - -	31½	6	10	9	25
Ecclesall Bierlow -	26¾	2	6	4	12
Brightside Bierlow -	20	1	1½	1½	4
Nether Hallam - -	Suppose 10	1	1	1	3
Attercliff-cum-Darnall -	„ 3½	- -	2½	½	3
Upper Hallam - -	„ 12	—	—	—	—
Total in the Borough	103¾	10	21	16	47

"Thus, it appears that 47 miles, or nearly half of the public highways in the whole borough might, without difficulty, be effectually cleansed in this manner. Ten miles three times a week, equal 30 miles; 21 miles twice per week, equal 42 miles; and 16 miles once per week; making a total of 88 miles per week, or 4,576 miles per annum. This at 3,000 gallons of water per mile would require 13,728,000 gallons of water per annum. At *one penny* per thousand gallons, the price at which I have shown in the Report on the sanitary condition of Sheffield, an abundant supply of water could be obtained, the quantity necessary for the purpose would cost 57*l.* 4*s.* per annum.

"At 6½*d.* per thousand gallons, the price obtained by the Waterworks Company, the same quantity would amount to 371*l.* 16*s.* per annum.

"I now proceed to the cost of labour:—4,576 miles per annum is equal to 14⅔ miles for each working day, or to six sets of two men cleansing 2½ miles per day each set. To these must be added three horses and carts, and three carters, for the removal of such debris as cannot be washed away, and for such parts of the town as cannot be cleansed by this system, making a total of 15 men. Their wages I would fix at 50*l.* per annum each. Taking into account, in addition, the cost and repair of hose, horses and carts, &c., the estimate given at page 110 of the report already alluded to is correct. It is as follows:—

	£	*s.*	*d.*
Annual interest upon the first cost of hose and pipes, three horses and carts, &c. - - - - -	30	0	0
Fifteen men's wages - - - - -	750	0	0
Three horses' provender - - - -	150	0	0
Wear, tear, and depreciation of hose, &c. - - -	250	0	0
Management and incidentals, say - - -	120	0	0
	£1,300	0	0

"It is there stated that the estimate is made on the supposition that the water supply was at the public cost. I have no doubt that with the use of canvas hose, the amount allowed in the estimate for wear and tear would more than cover the 57*l.* 4*s.* required for water;—but even with this sum added, the statement in the report would not be affected, namely, that *this would be about an average of one shilling per annum for each house in the borough.*

"The principal thoroughfares could be thus made perfectly clean, three times every week, before business hours, and the minor streets and lanes twice, or once per week, at later hours in the day; by the agency of an abundant supply of water, *at less than half the sum necessary for the cartage alone of an equal quantity of refuse in a solid or semi-fluid condition.*"

Extract from an Examination of Mr. Lovich, Surveyor to the Metropolitan Commission of Sewers.—(Report on the Supply of Water to the Metropolis, 1850.)

"You were directed to make experiments in cleansing by water by means of the hose and jet; will you state at what place you first carried them on?—Yes; the experiments were first carried on in Charles-street, Old and New Compton-streets, Church-passage, Dean-street, and Greek-street, Soho; subsequently in Church-lane, and four courts in Saint Giles's.

"Were you not able not only to cleanse the pavements by this means, but also to cleanse the walls from urine stains and other filth?—Yes.

"You were directed to prepare a sketch to show how the same plan can be carried out in courts and alleys. Give it in?—The sketches which I now hand in show the jet in operation. No. 1 is an illustration of the mode of surface-cleansing; No. 2, of the method of using the jet as a shower in close courts and alleys.

No. 1.

No. 2.

"State the quantity of water used each time, and the expense?—The quantity of water used was nearly one gallon per square yard; the cost was at the rate of 9*d.* per 1,000 yards, taking the cost of water on Mr. Wicksteed's estimate.

"Then it is clear from your reports that, in respect to the economy of time and of money, it is superior and is more efficacious in removing surface-evaporating matter or filth than any other method?—In a report to the Commissioners of Sewers I have estimated that the cost of the ordinary scavengering would be nearly double the cost of cleansing by the jet, and the jet has been shown to be far more efficacious in removing evaporating matter and filth.

"You were directed to prepare an estimate of street-cleansing by these modes, as applicable to two large thoroughfares?—Yes; I prepared estimates of the cost of cleansing by the jet in the Strand and High-street, Borough.

"Within what time and at what expense did you estimate this could be performed, apart from the cost of the water used?—The estimates were framed on the supposition that the work should be performed in one hour. In the Strand the daily cleansing of the carriageway would have cost 3*d.* per house per week; in the Borough, 2¾*d.* per house per week. But this rate is for wide streets with a large amount of traffic, on data from experiments with very low pressures, and is greatly in excess of the ordinary description of works, and would by no means, therefore, be a criterion of the average expense.

"What is the quantity of water required per square yard of pavement?—The quantity of water required I have found to be rather less than one gallon per square yard; but this was with extremely low pressures.

"Were not the experiments often made under what were considered other disadvantages besides those of low pressures?—They were; the pressures being very low, and the water having to pass through a great length of hose, decreasing the already limited power.

"With a higher pressure may we not safely estimate that they might be performed with a less amount of water and in a shorter time?—Yes; I had occasion to compare some experiments in cleansing by the jet made by Mr. Lee, of Sheffield, with very high pressures, with my own experiments with low pressures, and I found that he could perform the work in less than one third the time, at one third the cost, and with less than one third the expenditure of water. From this it would appear that the economy of high pressures must be very great.

"What is the quantity that would have been used for the Strand for each complete cleansing?—By the latest experiments 18¼ thousand gallons.

"In a day of partial rain, when the streets are sloppy and muddy, would not the cleansing by jet be the most eligible mode of cleansing?—The cleansing by jet on those days I consider would be by far the most eligible mode.

"What was the effect in hot weather and at other periods of this new mode of cleansing as compared with the mode of cleansing by scavengering? What was your general conclusion from these experiments as to the effect of this mode of cleansing?—The cleansing by water produced a most perfect state of cleanliness by the removal of *all* decomposing refuse, and the jet, when directed upward in the form of spray, appeared to have the effect of a shower, the air being made much cooler and fresher by it. The ordinary mode of cleansing by scavengering would have failed in removing much of the refuse, all of which the jet removed, and of course could not in any other way have improved the salubrity of the atmosphere. In hot weather these effects were more marked, the jet performing, but in a far more efficient manner, the office of the watering-cart. The ordinary mode of scavengering, without possessing any of the advantages of the jet, performed the work in a most imperfect manner. The system of cleansing by water eminently combined completeness with efficiency of action.

"Even where it might be desirable to use a street-cleansing machine to prevent accumulations of solid dung and the like, would it not be of importance to use the jet also?—In a report upon this subject I have stated the general conditions wherein the combination of the two would be of advantage for this purpose, but that the machine should be auxiliary to the jet, than conversely, as implied in the following passage: 'The frequency of application of this system (cleansing by jet) to the cleansing of the streets would be determined by their specific requirements, some, as the main thoroughfares, requiring daily cleansing, others cleansing at longer intervals. Thoroughfares having a large amount of traffic would require cleansing at an early period of the day; from this period to the cleansing on the following day the accumulations will have been going on, and the exhalations from them discharging into the atmosphere. It may be necessary to employ measures for the prevention of this condition in conjunction with the systematic operations of cleansing by water. To effect this there are two methods, by sweeping with hand labour, and cartage of the refuse; by the cleansing machine; hand labour, when compared with the cleansing machine, would appear to be the least economical in the proportion, as stated in Mr. Whitworth's evidence, of about three to one. The machine therefore, would appear to be the best adapted for this purpose, and with the least interference with the traffic of the street.'

"What is the total quantity of water, according to your estimate, that would be required for the purpose of street washing by means of the jet?—Assuming that there are 300,000 houses in the metropolis, with an average to each house of paved carriageway 28 square yards, of paved footway 16 square yards (on data afforded by an average district, in the absence of other certain data), the area of carriageway would be, in round numbers, $8\frac{1}{2}$ millions, of footway $4\frac{3}{4}$ million square yards. With one gallon of water for each square yard of carriageway (a proportion somewhat greater than I have found in practice with low pressures, and far greater than I believe would be the case with high pressures), and half a gallon for each square yard of footway, the quantity of water required for the *daily* cleansing of these areas would be nearly 11 million gallons, or $65\frac{1}{2}$ million gallons per week, or a rate per house of 218 gallons weekly, or $36\frac{1}{2}$ gallons daily. With a population of 7 to each house the rate would be nearly $5\frac{1}{4}$ gallons per diem for each inhabitant. Taking the cleansing of the streets in a ratio approximating to their specific requirements, about *one third* daily, *one half* twice, and the remainder *three* times per week, the quantity of water *per diem* would be 6·2 million gallons, or 20 gallons per house, or nearly 3 gallons per diem for each inhabitant. The following tables show the particulars more in detail:—

No. 1.—Of the Carriageway.

Period of Cleansing per Week.	Quantities to be cleansed at each Period.	Total Quantities cleansed per Week.	Water required, in Gallons.			
			Per Week.		Per Diem.	
			For Quantities cleansed.	Per House.	Per House.	Per Individual.
No.	Square yards.	Square yards.				
6	2,750,000	16,500,000	16,500,000			
3	1,000,000	3,000,000	3,000,000			
2	4,750,000	9,500,000	9,500,000			
	8,500,000	29,000,000	29,000,000	96·7	16·1	2·3

No. 2.—Of the Footway.

Period of Cleansing per Week.	Quantities to be cleansed at each Period.	Total Quantities cleansed per Week.	Water required, in Gallons.			
			Per Week.		Per Diem.	
			For Quantities cleansed.	Per House.	Per House.	Per Individual.
No.	Square yards.	Square yards.				
6	1,536,000	9,216,000	4,608,000			
3	576,000	1,728,000	864,000			
2	2,688,000	5,376,000	2,688,000			
	4,800,000	16,320,000	8,160,000	27·2	4·53	0·65 (nearly.)

No. 3.—Of the Carriage and Foot Ways.

Period of Cleansing per Week.	Quantities to be cleansed at each Period.	Total Quantities cleansed per Week.	Water required, in Gallons.			
			Per Week.		Per Diem.	
			For Quantities cleansed.	Per House.	Per House.	Per Individual.
No.	Square yards.	Square yards.				
6	4,286,000	25,716,300	21,108,000			
3	1,576,000	4,728,000	3,864,000			
2	7,438,000	14,876,000	12,188,000			
	13,300,000	45,320,000	37,160,000	123·9	20·63	2·95 (nearly.)

"It is stated that the quantity of water pumped into the metropolis is 50 million gallons per diem, or at the rate of 200 gallons per house?—It has been so stated."

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