10. If you are building a house, or if you can achieve it in an old one, let no drain be under any part of your house. *Disconnect* all waste pipes and overflow pipes from the drains and place the soil pipe of the w. c. *outside* the house and ventilate it.

11. If there is a smell of drains in your house, or a damp place in a wall near which a waste-pipe or a soil-pipe runs, or a damp place in the cellar or kitchen floor near a drain or a tank, let no time be lost in laying bare the pipes or drains until the cause is detected.

12. If a rat appears through the floor of your kitchen or cellar, and a strong current of air blows from the rat hole when chimneys are acting and the windows and doors of the house are shut, feel sure that something is wrong with a drain.

13. If you are tenants and your landlord refuses to remedy the evil, do it at your own cost rather than allow your family to be ill.

14. Many a man who would be aghast at the idea of putting small quantities of arsenic into every sack of flour and so by degrees killing himself and family, does not hesitate to allow sewer gas to poison the inmates of his house, even in the face of the strongest remonstrances of his medical adviser.

15. A landlord may reasonably look for interest on money which he spends for the benefit of his tenant; but he is committing little short of manslaughter if, by refusing to rectify sanitary defects in his property, *he saves his own pocket at the expense of the health and lives of his tenants.*

16. If you be a landlord don't intimidate your tenants or threaten to give them notice to quit if they complain of defective drainage or sewer-gas in the house.

SANITARY NOTES.

Sub-Soil, Drainage, &c.—Suitable sub-soil drainage should always be provided, and in all cases care should be taken to ensure its remaining efficient as far as practicable and free from contamination by sewage. All buildings should have a carefully constructed damp proof course, either of asphalt or pure Portland cement. A layer of Portland cement concrete, from four to six inches thick, should be laid on the ground under all wooden floors to prevent damp from rising and the growth of fungus. Ample through ventilation should be provided under all floors. When floors are relaid the space beneath should be disinfected.

Sites of Infectious Diseases to be recorded.—A plan should be

kept showing, in selected colors, the location and date of each reported case of infectious disease.

Periodical Examination of Drains.—The drains should be periodically examined from the manholes, and the clearing rods passed through them to ascertain that there is no obstruction.

Sanitary engineers consider that an unusual smell is generally the first evidence of something wrong, and that, traced to its source, the evil is half cured. They inspect first the drainage arrangements. If the basement generally smells offensively, they search for a leaking drain-pipe, *i. e.*, a pipe badly jointed or broken by settlement, and these will often show themselves by a dampness of the paving around. If, upon enquiry, it turns out that rats are often seen, they come to the conclusion that the house drain is in direct communication with the sewer or some old brick barrel drain, and therefore examined the traps and lead bends which join the drain pipes to see if they are gnawed or faulty. If the smell arises from any particular sink or trap, it is plain to them that there is no ventilation of the drain, and more especially no disconnection between the house and the sewer, or no flap-trap at the house drain delivery into the sewer.

If a suburban house be under examination, a smell at the sink will, in nearly every case, be traced to an unventilated cesspool, and, in opening up the drain under the sink, in such a state of things, they will take care that a candle is not brought near, so as to cause an explosion. If the trap is full of foul, black water, impregnated with sewer air, they partly account for the smell, by the neglect of flushing. If the sink, kitchen, and scullery wastes are in good order, and the smell is still observable, they search the other celler rooms, and frequently find an old floor-trap without water, broken, and open to the drain. If the smell be amoniacal in character, they trace the stable drains, and see if they lead into the same pit, and if so, argue a weak pipe on the route, especially if, as in some premises, the stable drains run from the mews at the back, through the house, to the front street sewer.

Should a bad persistent smell be complained of mostly in the bedroom floor, they seek for an untrapped or defective closet, a burst soil-pipe, a bad junction between the lead and the cast-iron portion of the soil-pipe, behind the casings, etc., or an improper connection with the drain below. They will examine how the soil-pipe is jointed there, and, if the joint be inside the house, will carefully attend to it. They will also remove the closet framing, and ascertain

if any filth has overflowed and saturated the flooring, or if the safe underneath the apparatus be full of any liquid. If the smell be only occasional, they conclude that it has arisen when the closet handle has been lifted in ordinary use, or to empty slops, and satisfy themselves that the soil-pipe is unventilated. They, moreover, examine the bath and lavatory waste-pipes, if they are untrapped, and, if trapped by a sigmoidal bend, whether the trapping water is not always withdrawn owing to the syphon action in a full-running pipe. They will trace all these waste-pipes down to the sewer, ascertain if they wrongly enter the soil-pipe, the closet trap, or a rain-water pipe in connection with the sewer.

If the smell be perceived, for the most part, in the attics, and, as they consider, scarcely attributable to any of the foregoing evils, they will see whether or not the rain-water pipes, which terminate in the gutters, are solely acting as drain ventilators, and blowing into the dormer windows. They will also examine the cisterns of rain-water, if there be any in the other portions of the attics, as very often they are full of putridity.

A slight escape of impure air from the drains may be difficult to detect, and the smell may be attributed to want of ventilation, or a complication of matters may arise from a slight escape of gas.

Neither are all dangerous smells of a foul nature, as there is a close sweet smell which is even worse. Should the drains and doubtful places have been previously treated by the inmates to strongly-smelling disinfectants, or the vermin killed by poison, the inspectors of nuisances will find it difficult to separate the smells. In such a case, however, they will examine the state of the ground under the basement flooring, and feel certain that there are no disused cesspools or any sewage saturation of any sort. They will also ascertain if there be any stoppage in the drain-pipes, by taking up a yard trap in the line of the drain, and noting the reappearance of the lime-water, which they had thrown down the sink. And invariably, after affecting a cure for any evil which has been discovered, they will have the traps cleaned out, and the drains well flushed.

A thoroughly drained house has always a disconnection chamber placed between the house drain and the sewer, or other outfall. This chamber is formed of a raking syphon and about two feet of open channel pipe built around by brick work, and covered by an iron manhole. Fresh air is taken into this chamber by an open grating in the manhole or by an underground pipe, and the air thus

constantly taken into the chamber courses along inside the drain, and is as continuously discharged at the ventilated continuations of soil pipes which are left untrapped at the foot, or at special ventilating pipes at each end of the drain. This air current in the drain prevents all stagnation and smell.

When a house is undergoing examination, it is wise to test for lighting-gas leakages, and there is only one scientific method of doing so, which is as follows :—Every burner is plugged up save one, and to that is attached a tube in connection with an air force pump and gauge—the meter having been previously disconnected. Air is then pumped into the whole system of pipes and the stop-cock turned, and if, after working the pump for some time and stopping it, the gauge shows no signs of sinking, the pipes may be taken as in safe condition; but if the mercury in the gauge falls owing to the escape of air from the gas tubes, there is a leak in them, which is discoverable by pouring a little ether into the pipe close by the gauge, and re-commencing pumping. Very minute holes can be detected by lathering the pipes with soap and water, and making use of the pump to create soap bubbles.

Besides the drainage, they will, especially if they detect a bad and dank smell, see if it arises from the want of a damp-proof course or of a dry area, see if there be a wet soil under the basement floor, a faulty pipe inside the wall, an unsound leaden gutter on the top of the wall, or an overflowing box-gutter in the roof, a leaky slatage, a porous wall, a wall too thin, and so on.

They will also keep an eye upon the condition of the ventilating arrangement, and whether the evils complained of are not mainly due to defects there. The immediate surroundings of the house will also be noted, and any nuisances estimated.

Sanitary Inspectors, whilst examining into the conditions of the drains, always examine the water cisterns at the same time, and discover whether the cistern which yields the drinking water supplies as well the flushing water of the closets. They will also ascertain if the overflow pipe of the cistern, or of a separate drinking-water cistern passes directly into the drain. If the overflow pipe be syphon-trapped, and the water rarely changed in the trap, or only when the ball cock is out of order, they will point out the fallacy of such trapping, and, speaking of traps generally, they will look suspiciously on every one of them, endeavor to render them supererogatory by a thorough ventilation and disconnection of the drains.

Smoke and Peppermint Tests.—If there is a suspicion that there

is anything defective in the traps, apparatus or joints of pipes, resulting in the emission of sewer-gas at improper places, the drains should be tested by either the peppermint or smoke tests.

Instructions for—1st. Carefully close all ventilating pipes from soil pipes or drains, ventilating shafts from drains, inlets for fresh air to drains, or soil pipes, etc.

2nd. Place about a tablespoonful of the crude oil of peppermint in the pan of the topmost w. c. and gradually pour in about a gallon of hot water. If the peppermint makes itself felt inside the house, or in the drain outside, it indicates a defect in the soil pipes or drains. Care must be taken to tightly close the door of the w. c., and the person putting the peppermint down must not emerge until the test has been finished, as he, of course, would taint the air in his vicinity, consequently two persons must be employed in applying the tests. (Petroleum, oil of rosemary, ether, or other strong smelling essential oil may also be used, but peppermint is considered the best for the purpose.)

3rd. This should be repeated in the topmost w. c. in each house and also, if considered necessary, in the lower w. c's. in each house; also in the sinks, baths, yard-gullies, or any other outlet for water connected with the drains.

4th. The smoke test should be applied by using one of the smoke testing machines used for this purpose.

This should be applied by opening the drains outside of each house that contains closets, baths, sinks, or other fittings directly connected with the drains, or where the drains run under any portion of a building and forcing the smoke up the drain towards the house or by forcing it down from the top of the house. If any smoke is visible in the house, or any smell of the same can be detected, it also indicates defects in the drains or pipes sufficient to admit sewer-gas into the house.

5th. The outside drains should also be tested in sections between the various traps and gullies; probably they are old brick or stone drains, and may leak and contaminate the earth, or there may be old disused drains from some buildings connected with them.

Hydraulic Test.—This is most conveniently done by stopping up the lowest end of the drain with a plug, and then filling with water. Any subsidence of the water after a few hours will indicate leakage.

If no such convenience as a disconnecting pit exists, the drain pipe would have to be opened and stopped.

Soil pipes should be similarly tested, as a small accumulation on

the inside of the pipe might be sufficient to prevent the passage of smoke or peppermint through a defect in the pipe, which, however, would give way under water pressure.

Flushing.—The drains may be flushed separately, noting the speed at which the water travels, and whether or not accompanied by a deposit.

Analysis of Sub-Soil Water.—In some cases it may be desirable to analyze the sub-soil water.

Old Culverts to be destroyed.—Old culverts, if discovered, should be destroyed, as they harbor rats, and may prove to be sources of contagion.

Water Supply Pipes disconnected from Sewer.—Direct communication between water mains and urinals, w. c.'s or latrines should be cut off, special cisterns being provided for their supply, and the water in them should never be used either for cooking or drinking purposes, but reserved entirely for flushing the apparatus.

Underground Tanks.—The overflow from such tanks should invariably deliver on the surface, and never into an underground drain, manhole, or inspection pit, as trapping under such circumstances is sure to fail, and sewer gas will be absorbed.

Water Mains Periodically Tested.—Water mains should be periodically tested, say once in six months, to ascertain that they do not leak, as leaky water mains may lead to insuction of sub-soil pollution, in addition to entailing a waste of water.

Disinfectants.—The term "disinfectant," which is now in general use, is employed in several senses. By some it is applied to every agent that can remove impurity from the air; by others to any substance which, besides acting as an air purifier, can also modify chemical action or restrain putrefaction in any substance, the effluvia from which may contaminate air; while by others again it is used to designate the substances which can prevent infectious diseases from spreading, by destroying their specific poisons.

Experiments have been recently conducted to determine the action of various disinfectants, in a greater or less state of concentration upon different microbes, and it has been found possible to define the degree of concentration necessary to constitute some of the chemical substances so employed as germicides. Many powerful deoderizers are not germicides, unless highly concentrated, although they may for a time render organisms inert by preventing their growth without actually destroying them.

The following list, it is thought, may be useful, and is therefore appended :—

Disinfectants, Powerful or Germicides.—Capable of destroying the most resistant microbes, under certain stated conditions of strength, temperature and time,—fire, boiling-water, steam, hot dry air, perchloride of mercury, carbolic acid, cressol, iodine, trichloride, osmic acid, permanganate of potash, iodine water, chlorine water and bromine water.

Disinfectants, Weak.—Capable of destroying microbes which are not in a state of spore. The powerful disinfectants more diluted, chloride of lime, hydrochloric acid, sulphorous acid, salicylic acid, chromic acid, creosote caustic lime, soda and potash.

Antiseptics—Capable of impeding or arresting the growth of microbes, but without necessarily destroying them.—Sulphate zinc, chloride lime, sulphate copper, sulphate iron, perchloride iron, boracic acid, borax, carbolic oil, thymol, oil of turpentine, eucalyptus oil.

Aerial Deoderants for fumigation.—Chlorine gas, sulphorous acid, nitrous fumes, ozone, euchlorine.

Powders for Disinfecting purposes.—Sanitary powder, sanitas, chloride lime, eucalyptol, surgical and tooth powder, carbolic acid, pine wood and eucalyptus.

Liquids for Disinfecting purposes.—Phenol, eucalyptol, camphorine, sulphenic acid, ozychlorogene, cresylic acid, carbolic acid, kresyline, pixine.

Use of Disinfectants.—In any district where an epidemic prevails or is threatening, disinfection of all water-closets, etc., should be carried on systematically, either with solutions of chloralum, cupralum, carbolic acid, or perchloride of mercury.

Any manure heaps or other accumulation of filth that might exist, which it is inexpedient to disturb or impossible to remove, should be covered with powdered vegetable charcoal, to the depth of two or three inches, or with a layer of fresh dry earth, or with freshly-burnt lime, if charcoal cannot be obtained.

Cesspits may be disinfected with solutions of copperas (3 lbs. to the gallon of water), or with cupralum or chloralum (1 lbs. to the gallon of water).

Condy's Fluid.—Condy's fluid, red and green, consists of a solution of potassium-permanganate. It is essentially an oxidizing agent. It is odourless, and very useful for pouring down drains and w.-c's. It arrests putrefaction for a short time, and prevents smell.

Chloride of Lime.—Chloride of lime is most powerful as a deoderant and also as a sterilizer, especially at a high temperature.

The application of disinfectants for purifying houses, rooms, etc., after cases of infectious disease have occurred therein, is not an engineering service; it is dealt with by the City Medical officer, so that the consideration of the methods of disinfection does not properly come within the scope of these notes.

It is, however, thought best to give some idea of the process recommended by experts.

"Recent investigations have shewn that gaseous substances such as sulphorous acid gas and chlorine gas, which have been often used for the purpose of disinfecting rooms and similar localities, cannot be relied on, and that the only disinfectant that can be depended upon to kill micro-organisms, particularly those capable of producing the infectious diseases, is a free application of a solution of perchloride of mercury. It is well to have this solution slightly acid, coloured also in such a way that it shall not readily be confused with drinks or medicines, and proper caution should be given to prevent accidents in its use.

The solution is made by dissolving half an ounce of corrosive sublimate and one fluid ounce of hydrochloric acid in three gallons of common water, with five grains of commercial aniline blue, or ordinary violet ink, to give the fluid a particularly distinguishing character. Proper caution should be given to avoid accidents, as the solution is a deadly poison.

The solution is easily made, keeps well, is very inexpensive, and should not be further diluted, and is easily applied. The use of non-metallic vessels (wooden or earthen house tubs or buckets) should be enjoined on those who use it.

The method of applying the disinfectant, will, no doubt, vary under different conditions, but the following may be taken as an outline of the procedure that should be usually adopted:

The walls should be thoroughly stripped of all paper, or other covering, and scraped. All skirting should be removed. The floor boards should be taken up, and all rubbish and dust found in the space under the joists should be removed, care being taken that the scrapings, rubbish and dust are not thrown away, but are burnt as they may contain infectious germs.

After a thorough clearance has been made, as described above, the whole of the ceilings, walls, joists, architraves and window linings, and any other fixed woodwork in the rooms, together with

the spaces below the floors, should be carefully washed with the solution of perchloride prepared as above directed. The solution should be applied with a whitewasher's brush.

A syringe should be used to squirt the solution into any nooks or interstices which the whitewasher's brush will not properly reach. Whenever used, the solution should be liberally applied, and should be allowed to remain over night.

Any dilapidated flooring or woodwork should be burnt, and only the thoroughly sound portions should be re-fixed, and these, before being fixed, should be thoroughly washed with the solution, allowed to remain overnight, and afterwards washed with warm water, in order to remove the mercury.

Ceilings and walls should be lime-washed, and all fixed woodwork should also be washed with warm water in order to remove the mercury.

In performing this operation the workmen should be provided with special clothing, *e. g.*, white duck to fit over their ordinary apparel, respirators, goggles and gloves, and further, they should be made to wash their faces before leaving work, at meal times, &c.

STREET RAILWAY REPORT.

HALIFAX, N. S., Nov. 15th, 1893.

Chairman Board of Works.

SIR,—In compliance with the resolution of your Board, I have visited a number of cities in the United States, and beg to submit the following report respecting the construction and operation of an Electric Street Railway in Halifax :—

The demand for improved street railway service in cities in recent years is the natural result and indication of progress. The rapid transit problem, although presented to us for the first time, is not a new one, and we are in a position to profit by the dearly-bought experience of other cities. Horse-power is too slow for any approach to rapid transit, and if we would keep pace with our neighbors, and encourage the growth of the city, better facilities must be provided for reaching the remote districts.

Of course, it is generally admitted, that an increase of casualties is the natural result of the increased speed of cars. In the city of Baltimore there were 18 killed and 65 injured by street railway

cars between the month of May, 1891, and the 21st September, 1893. Ten of the eighteen were killed since July 7th, 1893. The number of casualities probably would have been much smaller if strict municipal regulations had been enacted and enforced from the time the present rapid transit system was inaugurated. The City Council are waking up, and strict Ordinances were passed last month to prevent accidents in future. A street railway has a grade crossing at every block and in thickly built up portions of the city an approaching car cannot be seen by persons going along a cross street until they are within less than 100 feet of the crossing. On Lockman Street, where the roadway is so narrow there are often vehicles or pedestrians moving along the tracks in either direction, and the speed of cars between North Street and Cornwallis Street cannot be increased with safety.

There are many aguments for and against rapid transit, but it may be said with truth that the greater speed of modern systems over the horse lines is a benefit to the travelling public which more than offsets the increased danger to life and limb. Faster cars and extended lines enable persons of moderate means to find homes farther removed from the centre of the city, where they can live in better health and at less expense. Even more important than this is the benefit to the public health, due to the removal of the street-car horses and their stables, and the deposits in the streets, which when dry are ground up and blown into houses. This improvement alone probably saves more lives than those sacrificed in cable and electric railway accidents.

These and other valid arguments might be bronght up if there were need; but there is no need. It is beyond question that the modern systems of street railway traffic, giving a higher rate of speed than the old horse cars, are here to stay and to multiply, and that it is for the benefit of the people at large that they should do so.

But because this is the case it is more important that the increase in accidents which has accompanied the increase in speed of city transit lines should be carefully watched and kept down by every reasonable means. We are forced to acknowledge from our own experience that fatal accidents are not unknown to horse lines. The danger in increasing the speed of street cars (if we except casualties to persons who persist in jumping on and off cars in rapid motion) lies in the greater difficulty of stopping. It should be distinctly understood that an increase in speed on a street railway means inevitably an increase in the number of accidents, and that,

as the speed increases above a certain point the increase in the casualties becomes more pronounced. An increase in speed from 8 to 12 miles per hour, for instance, would be a far more serious matter than an increase from 4 to 8 miles. The matter of regulating the speed of the cars must be in the hands of the City Council. They must be sure that the increase of speed does not pass the point of reasonable safety. At the same time, as it is not to be expected that cars drawn by a mechanical motor will be kept down to the pace of horse cars, it is well to inquire what steps can be taken to lessen the number of accidents. The methods recommended by past experience will be referred to in connection with the rules and regulations for the operation of the system adopted.

If we decide in favor of rapid transit, the next point for consideration is the motor, and this part of the question is of great importance to the promoter of the scheme as well as to the city. We cannot expect a capitalist to invest in a road the construction of which is most expensive and where the cost of operation would be greater than the revenue. At the same time the city's interests must take precedence.

The present age seems to be particularly prolific in the invention of motors for street railways, and in new applications of old and recognized motor forces for propulsion of the cars used for urban and suburban transit. Some of these possess decided merits, and present claims for the support of capitalists and the public that are at least worthy of careful examination; others are advanced by persons who are evidently ignorant of the Thermo-Dynamic, Chemical and Mechanical Laws upon which some of the operations depend, and their schemes when tested are found to be impracticable.

Besides the horse railroads there are in existence steam motors, ammonia motors, oil motors, gas motors, compressed air motors, storage batteries, cable traction and electric roads. It is not necessary to give a full description of each system to show that most of them would not commend themselves to the public.

Horse power needs no explanation. Like all other lines operated by independent motors, a horse railway requires merely a surface track. It causes no obstruction to streets and is generally reliable, but as already remarked is too slow for any approach to rapid transit. The grades are restricted to that up which a pair of horses with a helper can haul a loaded car. It also creates nuisances by requiring stables and causing unhealthy deposits in streets. In addition to these objections the constant cutting of the horses' feet makes deep ruts in the track.

Ammonia motors were in use in New Orleans over twenty years ago, and have been revived by a New Jersey Company operating under new patents. They claim great economy as compared with horse, trolley or cable system both in plant and in operation. This motor was tested at Jackson Park, the scene of the World's Fair in April, 1892. The hot water motor was substituted for the ammonia motor on the streets of New Orleans on the ground that it was cheaper and less troublesome.

The hot water motor may be classed with the steam motor, but is decidedly inferior to steam, and presents no special claims for public consideration. It was abandoned in New Orleans in favor of mule power.

Carbonic acid is entirely too expensive to be used as a motive power on street railways.

At the World's Fair there were on exhibition working models of street railway cars suspended from overhead double and single tracks. The cost of construction would prevent their adoption in Halifax, and the unsightly structures required would be a greater nuisance than wires.

There also was exhibited an oil motor car for which the principal advantage claimed was economy in operation. It has not passed the experimental stage and is a small affair. The car would seat twelve persons, and it was claimed would run a mile in four minutes at a cost of two cents per hour. It was stated that the motor was two horse power. An ordinary street steam motor should develop from 15 to 20 horse power. Two cents for two horse power of the motor would be nearly as expensive as horse power.

Gas motors have been in process of development for eight or nine years, and give promise of being successful. They are run with gas or naptha vapor. They are independent motors, but possess the disadvantage of requiring continuous operation with constant consumption of gas or vapor when thrown out of gear and not running. Their speed cannot be varied, but they must run at a nearly uniform rate.

Gas motors are in use on the North Chicago Street Railway, and have given satisfaction to the company, but do not seem to be received so favorably by the public. A bill was filed in the Superior Court in October asking for an injunction restraining the company from extending the tracks of the Gas Motor Company. The complainant maintained that he was the owner of a corner property, and pronounced the whole gas motor system to be a nuisance on account

of the offensive odors and piercing noises which the engine gave forth daily.

The largely extended use of compressed air for engineering purposes has led to great improvements in air compressors and the importance of air as a motive power for city railroads demands a careful consideration of its claims. Air is probably the cheapest power that can be used for the operation of street railways, and it is one against which none of the objections which apply to other systems can be urged. Some of its advantages are: It can run on any track, and requires no trolleys, wires, poles or cables, no disturbance of streets or overhead construction. The motors are independent, and there is no necessity, as in gas motors, to keep the machinery in constant motion. There are no live feed wires, and no obstructions to the free use of fire apparatus. There are no dynamos to be disabled during electric storms. There is no passenger space occupied by air reservoirs or motor machinery. The reservoirs are under the seats and the machinery under the floor. The stored power remains intact until used, no matter how long the period of suspension. Compressed air motors were tested on the South Avenue Elevated Railroad in New York some years ago, and have been used in France; but unfortunately they have not yet passed the experimental stage, and the best that can be said at the present time is that they give great promise of success in the future.

American inventors have been concentrating their energies on making the storage battery available for street car propulsion, but so far it is not a success. Economy in first cost, efficiency and durability had all to be sacrificed in the endeavor to store the greatest power within the least space and weight. The authorities in Paris are experimenting with the storage battery and the statement has been made recently in the newspapers that the Thomson-Houston Electrical Company have purchased for a large sum, a patent covering the storage battery system. It may be that there is a future for this system that will in time enable it to supplant the trolley, and that means good news to the general public.

A cable road is adapted only to metropolitan lines with a very heavy business, and such lines only can prove remunerative under this system. More power is required for the movement of the cable than for the propulsion of the cars. The cable must move, even if there is only one car on the line. A break in the cable stops every car, and repairs are difficult and cause very serious delays. The system is liable to derangement and blockades from various causes. Strands

of the cable sometimes become loose and entangle the grip so that it cannot be detached, and serious collisions and damages have resulted from this cause. Snow blows into the cable conduit and clogs it, and the water running into the slot, forming ice about the cable and sheaves in winter, would make the operation of the system in this city impracticable.

The last to be considered, but by no means least in importance, is the Electric Trolley Road. During the past twenty years the street railroad companies of this country have tested every known power for street car propulsion, and to-day there are only two powers considered a commercial success, viz., the cable and the trolley. The cable has been installed on about seven hundred miles of track during the past fifteen years, while nearly half of this mileage has been abandoned and the trolley installed in its stead. The trolley system has been constructed during the past seven years on over five thousand miles of track, and must therefore be recognized as the best known motive power. Electric motors are much better adapted to suburban service than either cable or horse power, and are coming into almost universal use where the volume of travel is neither very small nor extremely large.

They can be run beyond the obstructed streets of the city at any rate of speed that may be desired, and in suburban localities have few objectionable features. There are two systems which use the trolley —the overhead and the underground conduit system. The latter has few disadvantages. With the underground system it is impossible for anyone to be injured by the electric current, and the cost of insurance is not affected along the line of the road. It has a metallic circuit, the feed and return wires being carried in the conduit and consequently does not give any trouble when there is ice or snow on the rails. There are two roads in operation, one in Chicago, the other in Washington, which I examined. In both these cities no overhead wires are allowed, and in Washington no horse traction for street railways will be permitted after January 1st, 1896. The electric road is run by the underground trolley system to the city limits, changing there to overhead. It has not been run in the winter, as the road was not opened till March, 1893. In Chicago the road was operated last winter and they had considerable difficulty with snow. To run a conduit system in Halifax the slot must be kept clear, necessitating three ruts in the snow and ice, two for rails and one for the slot. If the road were closed at the first heavy fall of snow, the conduit probably would be frozen up,

and could not be cleared except by the heat of the sun in March and April. For this reason I would not like to recommend its adoption until it has been tried in colder climates than Washington.

Every system has some objectionable features, and the overhead trolley system is by no means free from defects. The most serious objection arises from the impediment to the free use of apparatus for extinguishment of fires, and the obstructive and unsightly appearance of poles and trolley wires. Numerous accidents from contact with live feed wires have occurred, and contact with telephone and telegraph wires has been the supposed cause of fires. In addition to this, there is liability to delay in transit in winter from ice or sleet on rails, and feed wires, which break the electrical connection. In spite of these and other disadvantages, the use of the overhead trolley is increasing, and no doubt will continue to increase unless a better system shall be substituted and give such evidence of superior efficiency as to inspire universal confidence. If we are to have rapid transit, the overhead trolley, although not the ideal system, seems to be the nearest approach to a satisfactory solution of the problem. Any disposition on the part of the company to make a change should be taken advantage of by the Council. The present condition of the street railway could not be more unsatisfactory. The rails are worn out and cars cannot be kept on them. The roadway between the rails and immediately outside is never up to the level of the rails, causing water to stand on the track. The stringers and sleepers require renewal and the whole track is dangerous to traffic. Our fire apparatus is liable to be completely disabled on the way to a fire, the route to which lies along or across the tracks. The consequence of such an accident can be imagined only. I would recommend that permission be granted to the Company to construct and operate an ovehead trolley line, and further, that unless the change is made within a reasonable time, or the present track thoroughly renewed and put in good order, the track be torn up and application made to the Legislature to transfer the franchise to some company that will construct and operate a first class road.

It has become a custom in the United States to put those franchises up to the highest bidder. In New Orleans, where a change is proposed from mule power to electric traction, the franchise sold for the equivalent of $1,246,000. In Toronto the franchise was sold in 1891, and the city received 8 per cent. on all gross receipts up to $1,000,000 per annum, and as the gross receipts increase the percentage increases. In Nova Scotia the franchise is a free gift to the

first applicant. The City Council has an opportunity now, however, to consider the rights of the whole community, and although they cannot be considered as taxpayers, they can be protected as travellers. It is a law recognized by progressive transportation companies that the more attractive and comfortable the conditions of travel are made within certain commercial limits the greater will be traffic. Rough, badly-kept tracks, and irregular or inefficient service, neither invite traffic nor insure big profits, and while the city might perhaps benefit by obtaining a share of the receipts for the street privileges granted, the city authorities should pay more attention to the character of the service afforded to the travelling public. In other words, it is better that the company should be made to spend a part of their profits in improving the conditions of the traffic and the comfort of the traveller, than to give up even an equal sum to the city with the public convenience ignored.

I would recommend that a contract be made with the company, binding them to comply with all city ordinances now in force, and as hereafter passed or amended, and containing such conditions as His Honor the Recorder may think necessary to protect the interests of the city. It should provide:—

That the company shall at any time, when required by the City Council, substitute for the "overhead trolley system" such other motor system as may be approved by the said City Council.

That the gauge of the system (4 ft. 8½ in.) shall be maintained on main lines and extensions thereof; and the location of the railway on any streets shall not be made by the company, or confirmed by the City Council, until plans thereof showing the proposed position of the rails, the style of rail to be used, the location of all poles, and the other works in each such street have been submitted to, and approved in writing by the City Engineer.

That if the City Engineer shall at any time order any of the poles or fixtures removed, the company shall remove the same within a reasonable time, and restore the streets to a proper condition, satisfactory to the City Engineer.

That the company shall maintain the ties, stringers, rails, turnouts, curves, etc., in a state of thorough efficiency, and to the satisfaction of the City Engineer, and shall remove, renew, or replace the same as circumstances may require, and as the City Engineer may direct. The whole road, and all work in connection, shall be constructed according to the specification, to be approved by the Board of Works, on the recommendation of the City Engineer. When a

street upon which a track or tracks are laid, or to be laid, is to be paved in a permanent manner, on concrete or other like foundation, the company shall remove the track and substructure, and replace the same, according to the best modern practice, with pavement, improved rails, points, and substructures of such description as may be determined upon by the City Engineer, as most suitable for the purpose, and for the comfortable and safe use of the highway for vehicles; and all changes in the rails, tracks, and roadbed, construction of new lines or addition to present ones, shall be done under the supervision of the City Engineer, and to his satisfaction.

That the company shall conform to all the provisions of the Act of Incorporation of the Halifax Street Railway Company and Acts in amendment thereof, (except such as have been repealed).

That all extensions and new lines shall be regulated by the same terms and conditions as relate to the system to be established.

That no new line or extension shall be opened for traffic until the company has obtained a certificate in writing from the City Engineer that the same has been constructed to his satisfaction.

That the company will lay its tracks in conformity to the grade or grades of the street, as laid down by the City Engineer, and thereafter at its own expense re-locate and lay its tracks so as to conform to any change of grade adopted by the City Engineer on any and all streets in which said tracks may be, when instructed by said engineer to make such change or alteration.

That the city shall have the right to take up and replace the streets traversed by the railway lines for the purpose of altering the grades thereof, constructing or repairing pavements, sewers, drains or conduits, or for laying down or repairing water pipes, and for all other purposes within the powers of the corporation without being liable for any compensation or damage that may be occasioned to the working of the railway or the works connected therewith.

That the company will permit, and the City Council is hereby granted authority at the expense of the said company to enter upon and remove its track or tracks, or any part thereof, or anything in connection therewith, from any and all streets of the city of Halifax in which the same are located, whenever the use of the same or any part thereof shall at any time be discontinued.

That the company shall make such disposition of the earth and other material removed from the streets of the city in the construction and maintenance of the railway, as shall be directed by the city engineer.

That in all cases in which any work is required to be done or expense incurred in the repair of any streets, or removal of snow or ice under the agreements, or any Act of the Legislature or which the company is in any way bound to do, the same may, at the option of the City Council, be done and incurred at the expense of the said company by the said city, and said company shall forthwith reimburse said city for the same.

That police constables in uniform and (while a fire is in progress) members of the City Fire Department showing badges shall be carried free.

That the payment of a fare shall entitle a passenger to a continuous ride from any point on the railway to any other point on a main line or branch of said railway within the city limits, and to enable this service to be carried out transfer arrangements must be made by the company to meet with the approval of the city engineer and the endorsation of the Council.

That the company shall be liable to, and shall indemnify the city against all damages arising out of the construction or operation of the said railway system.

That should the city engineer deem it advisable that any work provided for in this agreement or mentioned in the specification be done by the city, the company shall deposit with the City Treasurer a sum sufficient in the opinion of the said engineer to perform the said work and the said work shall be done by the said engineer, who shall certify the cost of said work to the City Treasurer, and the balance remaining, if any, shall be returned to the said company.

That the said company shall pave and keep in good repair all the spaces between the tracks and rails and two feet outside of each rail with such material and in such manner as the City Engineer shall approve, and whenever, in the opinion of the City Engineer, it shall be necessary to renew the said pavement, it shall be renewed by the company with the same materials, or with such other materials, and in such manner, as the engineer shall direct or approve.

The latter section, one of the most important, is in force in nearly every city of any consequence in which a street railway is operated. We have very little paving in Halifax, but we are behind the times in that respect. Those streets through which the street railway runs should be placed and kept in good order so that they will be a credit instead of a disgrace to the city. It may be claimed that after the horses are removed the street will be kept in repair much more easily and at less expense. At the same time, the traffic will

always follow the rail, and ruts will be made on each side, making it difficult and dangerous for vehicles. There is very little level track, and where it is level the water lies on it, a condition of things which no macadam pavement will stand. Where the track is laid with a grade the water is bound to follow the rail, destroying the best macadamized surface. I would strongly recommend the adoption of this section.

I would also recommend the passing of an Ordinance providing that:—

All street railway cars are to be of the most approved design for service and comfort, including heating, lighting, signal appliance, numbers and route boards. They must be carefully and thoroughly washed and cleansed, so that all filth and dirt are removed from the inside of the car on each and every day on which they may be used. Smoking will only be allowed on the front platform of closed cars and rear seat and platform of open cars.

No car shall be run without a conductor, as well as a driver or motor man. The conductor shall announce distinctly the name of cross streets as the car reaches them.

No person shall drive any car unless he be of the full age of twenty-one years, or shall have obtained written permission from the Mayor for such purpose. All drivers or motor men shall wear a badge bearing their number, and the railway company shall, whenever required to do so by the Mayor, furnish a list of all the conductors and drivers, and of any one of them conducting or driving a carat any specified time, and shall keep such register, books or records as shall enable them to furnish such information.

The cars shall have the right to the tracks as against any person, carriage, vehicle or incumbrance, put, driven or being thereon, with a view to delay or embarass the progress of the cars; and no person shall obstruct the said tracks, or obstruct or prevent the cars from running or progressing thereon, or remain or keep any vehicle on said tracks in the way of any cars, if there shall be an opportunity to turn off.

The front platform of all cars shall be provided with gates, and one gate shall be provided for the rear platform and placed on the left side of it. All switches and turnouts shall be arranged so that cars shall pass to the right, and conductors shall not permit ladies or children to enter or leave a car while the cars are in motion, and shall only receive and discharge passengers on the right side of cars. Open cars must be provided with straps, chains or bars on the left side.

The front end of each car shall be provided with a fender of such design as the city engineer shall approve, to prevent possible accidents to persons or animals.

Each car shall be provided with a loud, clear sounding gong. The motorman shall keep vigilant watch, and shall sound the gong when approaching and passing another car, cross-street, teams or persons, whether the latter are on the track or moving in the direction thereof, and on the first appearance of danger shall stop the car at once, and take the best means of avoiding the peril.

Cars propelled in the same direction, unless coupled together, shall be kept at least one hundred feet apart, except at stations and turnouts.

No person having control of the speed of a car shall allow the same to go in any street at a rate of speed greater than eight miles an hour; nor shall he allow such car in turning a corner or passing a cross-street to go faster than four miles an hour. He shall not allow any car to run faster than six miles an hour on Lockman street, between North street and Cornwallis street.

No person having the control or ordering of a street car shall allow such car to stop on a crossing or intersecting street, except to avoid collisions or accidents.

When the driver, motorman, conductor or other person having the care or ordering of a street railway car is required to stop his car at the intersection of two streets to receive or land passengers, the car shall be stopped so as to leave the rear platform of the car or train slightly over the farther crossing.

The street railway company shall be subject to a penalty of fifty dollars for any violation on their part of any provision of this article, and any conductor, driver, motorman or other person violating any provision of this ordinance shall be liable to a penalty of ten dollars, and it shall be the duty of the police to enforce the provisions of this ordinance.

An efficient fender on electric cars is a public necessity, but the device of greatest importance to safe operation is the brake. It must be remembered that the danger is not in the change of motive power, but in the increased speed. It may be supposed that all that is necessary to stop a car quickly is to reverse the motor, but an attempt to stop by reversing the motor as at present constructed is almost certain to burn out a fuse wire or an armature and leave the motor useless. The old horse car hand brakes are not suitable for electric cars, and it is probable that air brakes or some other im-

provement will displace hand brakes. There should be a clause in the contract or ordinance providing for a change in brakes whenever the City Engineer deems it advisable. We will then be in a position to take advantage of any new invention.

Under the Act of Incorporation the plans and specification must be approved by the Board of Works before the work is commenced. The specification covers ten miles of track, but as there is only miles of track now in operation, I presume it is a mistake. The specification will be considered as providing for relaying the track now laid with single track. It requires considerable modification and some additions before it can be recommended for approval.

The section of rail must be submitted to the City Engineer before it can be approved.

The grade of rails must be as provided for in the contract.

The streets should be opened only in such places and at such lengths as the City Engineer shall approve in writing.

Provisions should be made for proper protection of work day and night.

Provision should also be made for relaying all city work torn up, like sidewalks, crossings, etc., and for placing materials so that the street will not be obstructed.

All material shall be inspected by the City Engineer before being used.

The pavement I have already referred to, and I trust the Council will have the clause in reference to street surface altered as recommended.

No length of turnout should be fixed. The location and length are placed in the hands of the City Engineer by law and must vary according to circumstances.

The clause in reference to poles requires amendments. The concrete specified, 11 to 1, would not stick together and would be useless. The poles must not be set pressing against the curb stone. I would recommend that iron poles be used between Buckingham Street and Bishop Street, and that wherever concrete sidewalks are about to be laid wooden poles shall be removed and iron poles substituted.

I would recommend that brackets be used instead of cross suspension where the City Engineer thinks it advisable.

The clause in reference to size, etc., of wires cannot be recommended for approval. This is one of the most important clauses to

to be considered. I hope the day will come, and very soon, when poles on the street will be a thing of the past and all wires will be laid underground. In the recent conference with city authorities respecting wires, the representatives of one company claimed that electric light and telephone wires could not be laid in the same conduit. Such, however, is not the case, as in New York, Philadelphia, Washington, Chicago, and other large cities it is being done successfully every day. A large extension of overhead wires must be regarded with apprehension and I would recommend that an ordinance relating to wiring be passed. I have not had time to prepare one for submission with this report, but will have one framed at an early date.

I made careful enquiries respecting the system of wiring, more particularly regarding returns. It was frankly admitted by every electrical superintendent that they had not yet decided which was the best system. Each expert, including the superintendent of the largest electric road on the continent, stated that he was experimenting every day in order to determine the best method of carrying return currents. It is not surprising therefore that any man should be ignorant of what has not yet been discovered. Frequent changes are being made in this department of science, and machinery used two or three years ago for developing power, &c., is now obsolete. Provision should be made in the contract obliging the company to adopt improvements when directed to do so.

Electrolysis is working mischief not only in America but in Europe as well. In Paris several accidents have already occurred as a consequence of the melting of the gas mains and the subsequent escape and explosion of leaking gas. In the trolley system the current of electricity leaves the positive poles of the dynamos, flows through the feeders to the trolley wires, through the trolley down the pole to the car, through a concealed wire to a motor under the car. The current leaves the motor and passes into the rails, and should have an easy path upon which it can return to the negative pole of the dynamo. If the rails are not well bonded, or if the supplementary wire laid between the rails becomes broken or destroyed, or if it is too small, the current seeks an easier path. It follows water and gas pipe or any conductor in its way till it reaches the nearest point to the generating station. No apparent danger is done by the current of electricity traversing the pipes. It is only when it attempts to leave the pipe and meets with resistance that the trouble begins and the metal is eaten away.

The specification provides for the best insulation, but the size of wires is entirely too small, and there is no provision for a main return. It is unnecessary to give a full specification here, and I would suggest that the wiring be done to the entire satisfaction of the City Engineer.

The specification must be re-written, and I would respectfully recommend that further consideration of it be postponed until it is amended and again submitted for approval.

In the meantime the consideration of the petition need not be delayed.

Respectfully submitted,

F. W. W. DOANE,
City Engineer.

WATER DEPARTMENT OFFICE.

F. W. W. DOANE, ESQ., *August 28th, 1894.*
City Engineer.

I have, according to your instructions, prepared a schedule of stock on hand, number of feet of main pipe; also number of feet of service pipe laid and renewed, with length of main pipes recleaned, in 1893 and spring of 1894; also all tools and machinery belonging to the Water Department.

All of which is respectfully submitted,

E. MORRISON,
Forman Water Department.

List of Pipes Cleaned and Recleaned by Mechanical Scrapers during the Season of 1893.

No.	LOCATION.	Diameter of Pipe, inches.	Length cleaned, ft.	Total cost.	Remarks.
1	Low Service Main	24	13400	12.23	Recleaned.
2	High Service "	20	6000	12.00	"
3	" "	15	29500	12.89	"

List of Streets where Pipes have been Laid during the Season of 1893 and Spring of 1894.

Name of Street.	From.	To.	Diameter of Pipe, in.	Length of Pipe, ft.	Total Length.
Robie	Garrick	South 106 ft	6	106	
"	"	North 209 ft	6	209	
Garrick	E. Side Robie	To connect Robie St. Pipe	6	48	
Gottingen	Ontario	To connect opposite Black	6	590	
Brunswick	Jacob	George	9	1204	
North	Brunswick	Lockman	9	455	
Woodill	End of Pipe	East 54 ft	4	54	
Cedar	Walnut	East 112 ft	6	112	
Edward	Manhole S. of Coburg Road	South 279 ft	6	279	
Bell Air Ter'ce.	End of Pipe	North 117 ft	4	117	
Barrington	Prince	North 132 ft	6	132	
"	Main	G. M. Smith's bldg.	4	14	
Kempt Road	MacCara	North 18 ft	6	18	
"	Main	Hayward Brewery.	3	42	
Uniacke	End of Pipe	East 36 ft	4	36	
Young	Bilby	South 100 ft	4	100	
Kaye	Gottingen	N. Star	12	810	
Sackville	Main Pipe	Woodbury Bros.	1½	17	
Service Pipes	(Put into Houses Lead)		1	55	
"	" "		¾	182	
"	" "		½	4043	8623 ft.

101 houses supplied with water in 1893, and Spring of 1894.
55 service pipes renewed.

Old Fire Hydrants replaced with Improved Frost Jacket Hydrants.

Name of Street.	Location.
Morris Street	Corner South Park Street
Lower Water Street	Between Sackville and Salter Streets
Duke Street	Corner Water Street
Water Street	South Side Ordnance
Cornwallis Street	Corner Lockman Street
Brunswick Lane	Corner Maitland Street
Cogswell Street	Opposite Hospital
South Park Street	Corner Brenton Place

Pipe Stock on hand April 30th, 1894.

No. of Pieces.	Diameter.	Weight of one.	Weight in lbs.	Total Weight.	Cost per lb.	Total Value.	Remarks.
11	27	2651	29,161	29,161	2¼	666.12	.....
2	24	2555	5,110	5,110	1¾	89.42	T and B 12 ft.
4	24	....	9,698	9,698	1¾	169.71	T and B 11 ft.
8	24	3192	25,536	.....	....	.....	.....
6	20	1263	7,578	.....	....	.....	.....
10	15	1200	12,000	.....	....	.....	.....
124	12	680	84,320	.....	....	.....	.....
12	10	550	6,600	.....	....	.....	.....
50	9	538	26,900	.....	....	.....	.....
95	8	386	36,970	.....	....	.....	.....
352	6	280	97,560	.....	....	.....	.....
20	5	222	4,440	.....	....	.....	.....
354	4	156	55,224	.....	....	.....	.....
39	3	130	5,070	.....	....	.....	.....
80	2½	26	2,080	.....	....	.....	Stand Pipes.
70	.....	12	840	.....	....	.....	Plates.
160	.....	6	960	366,078	2¼	8236.75	Caps.

Wood Wedges.

Diameter of Pipe.	No. of Pieces.	Total Number.	Cost of Each.	Total Value.
24″	1000	.....	.....	.....
20	2300	.....	.....	.....
15	3500	.....	.....	.....
12	1400	.....	.....	.....
9	1700	.....	.....	.....
6	5000	14500	1¼	$181.25
Keys	6000	6000	¼	15.00

Branch Pipes and Irregular Pieces.

No. of Pieces.	Diameter.	Description.	Weight of one in lbs.	Weight of Whole.	Total Weight.	Cost.	Total cost.
3	27	Bell Mouth	831	2493			
1	24	Cap	290	290			
4	24	Thimbles	396	1584			
3	20	"	230	690			
3	15	Double B. 15" outlet	896	2688			
3	15	" 6" "	660	1980			
1	15	Single B. 15" "	812	812			
2	15	Y B.	1012	2024			
9	15	Thimbles	234	2106			
1	15	Reducing to 6"	400	400			
1	15	Saddles, 9" outlet	150	150			
1	15	" 6" "	122	122			
1	15	" 3" "	115	115			
6	12	Double Branches, 12" outlet	615	3690			
2	12	" 9" "	500	1000			
3	12	" 6" "	475	1425			
3	12	Single " 12" "	524	1572			
3	12	" 9" "	494	1482			
3	12	" 6" "	469	1488			
4	12	Reducing to 6", no Faucet	200	800			
5	12	Thimbles	160	800			
12	12	Caps	45	540			
2	12	Reducing to 6", with Faucet	200	400			
5	12	" to 9"	240	1200			
4	9	Double Branches	411	1644			
4	9	Single "	355	1420			
1	9	Double 9" and 3" outlet	450	450			
3	9	Single 6" outlet	306	918			
3	9	" 4" "	250	750			
3	9	Reducing to 6"	121	363			
6	9	Thimbles	116	696			
5	9	Offsets	156	780			
12	9	Caps	34	408			
1	9	Saddle, 4" outlet	45	45			
1	9	" 3" "	40	40			
7	6	Double Branches	255	1785			
6	6	Single "	209	1254			
3	6	" 4" outlet	200	600			
1	6	Double Branch, 3" outlet	180	180			
3	6	Y Branches	250	750			
3	6	Reducing to 4"	124	372			
3	6	" 4", without Faucet	114	342			
3	6	" 3", "	105	315			
5	6	" 3", with Faucet	114	570			

Branch Pipes and Irregular Pieces.—(Continued).

No. of Pieces.	Diameter.	Description.	Weight of one in lbs.	Weight of Whole.	Total Weight.	Cost per lb.	Total cost.
7	6	Offsets	140	980			
6	6	Thimbles	67	402			
9	6	Bends	136	1224			
16	6	Caps	19	304			
25	4	Double Branches	123	3075			
5	4	Single "	114	570			
2	4	Y "	96	192			
2	4	Reducing to 3 in. with Faucet	95	190			
3	4	" 3 in. without Faucet.	84	252			
5	4	Offsets	66	330			
14	4	Thimbles	29	406			
6	4	Caps	11	66			
18	4	Caps for Main Stopcocks	15	270			
3	3	Single Branches	81	243			
5	3	C osses	90	450			
12	3	Thimbles	35	420			
12	3	Caps	6	72			
6	2	Double Branches	30	180			
4	2	Angle "	23	92	54445	2¼	1225 01
6	24	Split Thimbles	620	3720			
1	20	"	453	453			
9	15	"	260	2340			
13	12	"	222	2886			
25	9	"	139	3475			
24	6	"	92	2208			
7	4	"	64	448			
16	3	"	48	192			
16	....	Split Thimbles for Fire Plugs	61	976			
3	....	Plain " " "	81	243			
11	....	Extension Pieces for Fire Plugs	124	1464	18991	2½	474 77
1	20	Stopcocks				115 00	117 00
4	15	"				100 00	400 00
5	12	"				79 00	395 00
7	9	"				55 00	385 00
42	6	"				30 00	1260 00
12	4	"				20 00	240 00
2	3	"				14 00	28 00
4	15	Gun Metal Screws	28	112			
2	12	" "	19	38			
6	9	" "	14	84			
13	6	" "	9	117			
2	4	" "	6	12			
3	3	" "	5	15	378	60	226 80

Branch Pipes and Irregular Pieces.—(Continued).

No of Pieces.	Diameter.	Description.	Cost of one.	Total cost.
10	6	Siemen's Meters in stock	143 43	1434 30
1	4	" "	86 75	86 75
11	3	" "	65 67	722 37
1	2	" "	44 65	44 65
..	1½	" "	34 42	.....
6	1	" "	21 50	129 00
25	¾	" "	15 50	384 50
25	½	" "	14 50	362 50
1	1	Crown " "	49 25	49 25
1	¾	" " "	37 92	37 92
2	½	" " "	26 25	52 50
1	¾	Frost " "	31 42	31 42
2	½	" " "	.....	21 47
1	6	Siemen's Meters in use	143 43	143 43
10	4	" "	86 75	867 50
15	3	" "	65 67	328 35
4	2	" "	44 65	178 60
1	1½	" "	34 42	34 42
3	1	" "	21 50	86 00
22	¾	" "	15 50	341 00
85	½	" "	14 50	1232 50
1	1	Crown " "	49 25	49 25
5	¾	" " "	37 92	189 60
2	½	" " "	26 25	52 50
1	¾	Frost " "	31 42	31 42

Branch Pipes and Irregular Pieces.—(Continued).

No. of Pieces.	Diameter.	Description.	Weight of Whole.	Total Weight.	Cost.	Total cost.
1	12	Regulating Valves				206 66
1	6	" "				103 33
5		Pressure Gauges			10 00	50 00
10		Fire Plugs, with Jackets			66 50	665 00
10		" without Jackets			50 00	500 00
4	2½	Old Fire Plugs			13 00	52 00
9		Spare Castings for Fire Plugs	360	3240	03	97 20
5		Spare Jackets for "	345	1725	2¼	39 06
		Brass Castings, all sorts		196	35	68 60
4	1	Service Stopcocks			2 50	10 00
9	¾	" "			2 00	18 00
99	½	" "			1 50	148 50
1		Pipe Tapping Machine				127 60
1		4 H.-P. Gas Engine				475 50
1		5 H.-P. Steam Engine and Pump				625 00
22		Brass Nozzles for Fire Plugs	2½	55	60	33 00
6		" for Suction Hose	7	42	60	25 20
16		Cast Iron Caps for Fire Plugs	10	160	03	4 80
		Refined Iron, different sizes		1500	02	30 00
		Tin Tubing		516	33	170 28
	1	Lead Pipe	40			
	¾	"	256			
	½	"	484	780	04¾	99 45

Tools and Stock on Hand.

No.	Size.	Description.	Cost of One.	Cost of Whole.
1	....	Horizontal Boring Machine	75 00	75 00
1	....	Large Grinding Stone	.....	12 00
4	....	Screw Vices	7 00	28 00
1	....	Swedge Anvils	4 00	4 00
3	....	Anvils	12 00	36 00
2	....	Hand Boring Machines	20 00	40 00
1	....	Circular Saw, with Table	25 00	25 00
114	....	Pick Handles	1 25	142 50
94	....	Shovel Handles	40	36 00
73	....	Striking Hammers	88	64 24
27	....	Crow Bars	84	22 68
70	....	Blasting Drills, from 2 to 8 feet long	60	42 00
12	....	Sledge Hammers	2 00	24 00
16	....	Chisel Pointed Drill, 1 to 2 feet long	30	4 80
2	....	Forge Sledges	2 00	4 00
12	....	Iron Pounders	45	5 40
28	....	Diamond Points	15	4 20
5	....	Chisels	15	75
5	....	Case Monkey Wrenches	1 00	5 00
18	....	Key Wrenches	60	10 80
3	....	Set of Stock and Dies	12 00	36 00
1	....	Set of Pipe do. do.	12 00	12 00
15	....	Pipe Tongs, from 2 in. to ⅛ in.	2 00	30 00
14	....	Grubbing Axes	60	8 40
2	....	Felling Axes	75	1 50
2	....	Hand Carts	10 00	20 00
2	....	Iron Tool Carts	30 00	60 00
15	....	Wheelbarrows	5 00	75 00
4	....	Fire Plug Wrenches	75	3 00
20	....	Boring Drills for Shop	12	2 40
3	....	Iron Boring Braces	1 50	4 50
12	....	Wood Wedging Drivers	1 00	12 00
1	....	Patent Hoisting Gear and Chains	15 00	15 00
4	....	Blocks and Tackle complete	5 00	20 00
2	....	Socket Wrenches for Hatch Boxes.	2 00	4 00
10	....	Main Stopcock Keys	3 00	30 00
12	....	Service do. do.	1 00	12 00
10	....	Hand Hammers	75	7 50
25	....	Raising Irons	20	5 40
5	....	Wedging do.	10	50
12	....	Staving do.	12	1 44
8	....	Gasket do.	12	96
6	....	Cutting Out Irons	10	60
4	....	Eye Bolts for Lifting Pipes	5 00	20 00
1	....	Windlass with Gearing for Pipes	15 00	15 00
2	....	Do. without do.	10 00	10 00

Stock of Tools on Hand—(Continued).

No.	Size.	Description.	Cost of One.	Cost of Whole.
3	....	Hand Windlass	10 00	30 00
3	....	Windlass for Derricks	10 00	30 00
1	....	Broad Axe	1 00	1 00
3	....	Round Pointed Bars	1 00	3 00
3	....	Ratchets	5 00	15 00
6	....	Drills for Ratchets	15	90
3	¾	Taps for Service	1 00	3 00
2	3	Boring Clamps	2 00	4 00
1	4	Do.	2 50	2 50
2	6	Do.	3 50	7 00
2	9	Do.	4 50	9 00
1	12	Do.	4 75	4 75
1	15	Do.	5 50	5 50
2	....	Legs for Clamps	3 00	6 00
3	....	Choppers	5 00	15 00
1	....	Lead Pot	80	80
9	....	Tramways or Trolleys	3 00	27 00
7	....	Chain Slings	1 00	7 00
30	....	Hand Drills	25	7 50
12	....	Lanterns	75	9 00
1	....	Edison Pump	25 00	25 00
1	....	Suction Hose for Pump	10 00	10 00
1	....	Hand Cart do.	10 00	10 00
2	....	Iron Pumps	15 00	30 00
1	....	Large Testing Pump	30 00	30 00
2	....	Force Pumps for Service Pipes	6 00	12 00
2	....	Platform Scales	25 00	50 00
4	....	Torches, copper	2 00	8 00
1	....	Stone Cart	10 00	10 00
2	....	Stoves and Pipe	8 00	16 00
3	....	Spirit Levels	1 00	3 00
2	....	Sets of Shearpoles	4 00	8 00
4	27	Wrought Iron Straps	1 00	4 00
8	24	Do. do.	90	7 20
9	15	Do. do.	75	6 75
13	12	Do. do.	70	9 10
6	9	Do. do.	65	3 90
12	6	Do. do.	60	7 20
9	4	Do. do.	50	4 50
11	3	Do. do.	50	5 50
2	2	Portable Forges	10 00	20 00
		Blacksmiths' Tools, including Bellows	.....	100 00

Recapitulation.

Lbs.	Description.	Cost per lb.	Value.	Total Value.
14,804	Pipes	1¾	259 13	
395,239	"	2¼	8,892 87	
14,500	Wood Wedges	1¼	181 25	
6,000	Key Wedges	¼	15 00	
54,445	Branch Pipes	2¼	1,225 01	
18,991	Split Thimbles	2½	474 77	
	Stopcocks, from 20 in. to 3 in	....	2,825 00	
378	Gun Metal Screws	60	226 80	
	Fire Hydrants	....	1,217 00	
	Castings for Fire Hydrants	....	126 26	
	2 in. Old Fire Plugs	....	52 00	
	Brass Castings	35	68 60	
	Meters, from 6 to ½ in	....	6,891 20	
	Pressure Gauges	...	50 00	
	Service Stopcocks	.. .	176 50	
	Regulating Valves	. .	309 99	
	4-H. P. Gas Engine	....	475 50	
	5-H. P. Steam Engine and Pump	. ..	625 00	
	1 Pipe Tapping Machine	....	127 60	
97	Brass Nozzles for Fire Plugs	60	58 20	
160	Iron Caps for "	3	4 80	
516	Tin Tubing	33	170 28	
	Lead Pipe	...	99 45	
1,500	Refined Iron	....	30 00	
	2 Platform Scales	....	50 00	
	Tools of all sorts	....	1,561 67	26,293 88

Precipitation for the Year 1893.

1893.	Chain Lakes.				Spruce Hill Lakes.				City of Halifax.			
	Snow.	Melted Snow.	Rain.	Total.	Snow.	Melted Snow.	Rain.	Total.	Snow.	Melted Snow.	Rain.	Total.
January	20.75	2.81	2.66	5.47	19.50	2.31	2.09	4.40	.....	1.68	3.10	4.78
February	38.00	4.51	2.43	6.94	38.25	4.23	2.56	6.79	.....	3.76	2.21	5.97
March	5.25	0.50	1.53	2.03	4.75	0.58	1.52	2.10	....	0.56	1.73	2.29
April	5.50	1.13	2.86	3.99	6.50	0.83	3.19	4.02	.....	0.58	3.63	4.21
May	.....	.....	4.15	4.15	.....	.....	4.33	4.33	.....	.....	5.05	5.05
June	.....	.....	1.21	1.21	.....	.....	1.21	1.21	.....	.....	1.75	1.75
July	.....	.....	4.49	4.49	.....	.....	4.45	4.45	.....	.....	4.75	4.75
August	.....	.....	6.16	6.16	.....	.....	5.78	5.78	.....	.....	5.95	5.95
September	.....	.....	5.14	5.14	.....	.....	5.08	5.08	.....	.....	4.39	4.39
October	.....	.....	5.20	5.20	.....	.....	5.81	5.81	.....	.....	5.64	5.64
November	0.75	0.10	3.55	3.65	1.25	0.12	3.36	3.48	.....	0.15	3.60	3.75
December	15.25	1.25	7.58	8.83	19.25	2.36	8.17	10.53	.....	2.01	8.15	10.16
Total	85.5	10.30	46.96	57.26	90.05	10.43	47.55	57.98	.....	8.76	49.98	58.74

City returns kindly furnished by Augustus Allison, Esq., Dominion Government Meteorological Agent.

No. of gallons discharged over Long Lake Waste Weir in years 1892 & 1893.

	1892.	1893.
January	211,226,360	982,576
February		60,758,585
March	241,903,243	
April	57,186,763	332,062,217
May	84,085,451	173,923,963
June	17,123,963	
July	12,381,389	
August	55,196,703	
September	5,831,022	
October		
November	229,960,879	
December	95,307,034	521,481,538
Total	1,010,202,807	1,089,208,879

Plumbing Inspector's Report.

HALIFAX, N. S., May 25th, 1894.

MR. F. W. W. DOANE,
City Engineer.

SIR,—I beg leave to submit, for your information, the following report of work performed by me during the past year, commencing May 1st, 1893.

Yours respectfully,
CLAUD DONOVAN,
Plumbing Inspector.

No. of houses inspected or tested for defective plumbing, nearly all of which were put in good order	55
" new houses inspected and Collector's orders issued	77
" houses inspected for sewer connections	386
" drains inspected and passed	272
" times visited drains before passing	612
" houses inspected for waste of water	748
" waste notices served	260
" sanitary inspections	349
" sanitary notices served	157
Reinspections and inspections for other purposes	253

Meter Inspector's Report.

HALIFAX, N. S., May 1st, 1894.

MR. F. W. W. DOANE,
City Engineer.

SIR,—Appended please find my report of work done during the year ending April 30th, 1894, in the Water Department, and also a list of meters in use, and the sizes thereof.

Respectfully submitted,
JOHN E. BURNS,
Water Inspector.

May, 1893, to April 30th, 1894.

Month.	Number of Inspections.	Found in good order.	Leaks and waste.	Notices served.	Leaks shut off.	Leaks report'd by Police & others.	New houses inspected.
1893, May	119	116	3	3	1	1	.....
" Jnne	127	122	5	5	.....	2	.....
" July	110	110	.....	.....	.....	.....	12
" August	125	123	2	2	.....	2	10
" September	165	159	6	6	2	4	.....
" October	125	115	10	10	3	9	.....
" November	65	65	.....	.....	.....	.....	65
" December	149	137	7	7	1	2	20
1894, January	75	72	3	3	.....	1	.....
" February	150	147	3	3	2	3	.....
" March	122	116	7	7	1	3	.....
" April	132	130	2	2	.....	2	.....
	1465	1412	48	48	10	29	107

WATER METERS.

It has been deemed expedient for some years past to apply water meters to all service pipes where large quantities of water are used, and latterly the use of meters has been considerably extended, so as to embrace not only all complicated cases, but also many institutions. The total number of meters and stroke indicators now set in the city is one hundred and fifty (150).

STATEMENT 1.

New Meters set during fiscal year ending April 30th, 1894.

Kind.	Indicators.	½	¾	1	1½	2	3	4	6	Totals.
Siemen's	.....	46	18	4	....	....	3	1	....	72
Crown	.....	....	....	....	....	....	....	....	....	....
Starr	.....	....	1	....	....	....	....	....	....	1
Totals	.....	46	19	4	....	....	3	1	....	73

General summary of all Meters and Indicators set and in use.

Kind.	Indicators.	½	¾	1	1½	2	3	4	6	Totals.
Siemen's	1	80	22	8	1	3	16	11	1	143
Crown		1	4	1						6
Starr			1							1
Totals		81	27	9	1	3	16	11	1	150

The first of the foregoing tables shows the number of meters set in premises where the water consumption has not previously been measured. The greater portion of these were entirely new ones, the small remainder consists of such as had been permanently removed from other premises, and which were found to be in good condition.

The total number of meters removed for various reasons and replaced in premises was twenty three (23). The causes for removal are classified, as follows :—12 injured by frost ; 3 broken or defective dial gearing ; 4 broken or defective intermediate gearing and piston rods ; 4 change of size or capacity of meter.

Two sizes and kinds of meters are represented in this list, and of the whole number removed 4 of this number were placed in other premises.

JOHN E. BURNS,
Meter Inspector.

PERMANENT PAVEMENT.

FOREMAN'S REPORT.

Halifax, Dec. 14th, 1893.

F. W. W. DOANE, ESQ.,
City Engineer.

Dear Sir,—I beg to submit a statement of the various works carried out by me under your direction this season, comprising 37 different jobs.

Although late in beginning, (10th July) a considerable amount of work has been done.

The statements show, 1st, the cost of altering and resetting hatches on the line of concrete laid down this season. In such case the nett cost is shown and no allowance has been made for the sharpening or repairs of tools.

2nd, the cost of constructing 7 catchpits in different parts of the city. The cost of labor and carting should be charged to sewerage account, and the permanent paving credited with this amount, $155.18.

3rd, the cost of laying 10 new crossings, etc., which required 827 feet of new crossing stones, and 192 feet was reset. Over 200 yds. superfical paving stones were used. The cost of some of these crossings was charged to the different ward allotments.

4th, cost of resetting curb and gutter stones and setting and laying new curbs and gutters. This work comprises: Curbing reset, 1180 feet; new curbing, 1533 feet; gutters reset, 297 feet; new gutters, 3273 feet; resetting curbs and gutters cost from 53c. to 80c. per foot new. The average for old work per foot was 68c., which includes altering and resetting a part of crossings. The cost for South Park Street this year per foot lineal is 68c. for labor, carting and superintending, and includes the cost of laying part of two crossings on corner of Spring Garden Road; grading and macadamizing the half width of street from south corner of Morris Street to catchpit near Brenton Place; thence north to Spring Garden Road for the whole width of street; also for grading and covering with ashes the whole of sidewalks. Gottingen Street costs per foot lineal 66c., which includes macdamizing part of street, grading sidewalk and resetting part of two crossings. There was also a considerable amount of blasting for trench of curb.

5th, cost of concrete sidewalks, showing price per square yard.

6th, miscellaneous, building wall at Ordnance, private drains, ward work, etc.

7th, tabulated forms showing the total cost of work done and materials used on each street or block.

You will see from the above that a considerable reduction has been made compared with last year's work. On South Park Street last season the setting of curb and gutter stones cost 84c. per foot new, and I understand from you it was the cheapest work of the kind done last year. This year the same kind of work cost on South Park Street 68c., and on Gottingen Street 66c. per lineal foot. The most noticeable difference, however, is in the concrete sidewalks, the average cost of which has been reduced from $2.26 to $1.93 per square yard. The cheapest work cost $1.78, and only in one case has the cost exceeded $2.00 per yard. This occurred in the small piece at corner of Blowers and Barrington Streets, and shows that laying concrete sidewalks in small pieces should be avoided

where practicable. Considerable expense is always incurred in moving plant, etc., and runs the cost away up.

At the commencement of this year's work you gave me valuable suggestions which would probably reduce the cost, and I have endeavored to the best of my ability to carry them out without injury to the stability of the work, with the result that a great saving of the public money has been effected.

While looking over some old newspapers the other day, I came across a report of a meeting of the Board of Works at which Mr. Forsythe of Montreal was present. In answer to a question from Alderman Mosher, Mr. Forsythe replied that granolithic sidewalks would cost for a large contract about $3.00 per square yard, 1,000 yards would be $3.15 to $3.20 per yard. At a subsequent meeting of the Board you objected to the high price and said that it could be done cheaper by local tradesmen.

To prove that you were right, I have compared the average cost of this season's work with Mr. Forsythe's price:—

1479 yds. at $.318, (Mr. Forsythe's average)	4703 22
" " 1.93	2854 47
Saving to the City	$1848 75

I have also compared this season's work with last year's work:—

1479 yds. at $2.26 per yard	3342 54
" " 1.93 "	2854 47
Saving	$ 468 07

All prices quoted in this report include my own superintending.

So much for the price of concrete. As to the workmanship and general appearance of the work, I beg to quote the opinion of a Halifax gentleman who is a high authority on concrete. I refer to Dr. Murphy, Provincial Engineer. In conversation with him a few weeks ago, Dr. Murphy said that he had just returned from the World's Fair, and had also visited some of the largest cities in the United States and Canada, and had seen miles of concrete sidewalks, but had not seen any better than those laid by the corporation of Halifax.

Trusting these statements and this report will be satisfactory to you, the Board of Works, and Council generally, I am,

Your obedient servant,

GEORGE LOW,
Foreman.

Statement of Cost of Permanent Pavement Work Done in 1893.

GRANVILLE STREET, BETWEEN DUKE STREET AND GEORGE STREET.

Cost of Resetting and Building Hatches.

J. Rhuland, Agent.

No. 116 and 118. Re-setting, narrowing and building up hatches :—
1893.

Aug. 16.	3 bbls. Cement at $2.50 per bbl			7 50	
	9 bush. Sand at 7 cents per bush			63	
	One Granite Coal-hole, $9 ; Metal Cover for same, 84 cts.			9 84	
	14 hours Stonecutter at 30 cents per hour			4 20	
	39 " Mason	30 cents	"	11 70	
	46 " Laborer	12½ cents	"	5 75	
	3 " Carpenter	20 cents	"	60	
					40 22

James Walker.

No. 120. Building coal-hole, narrowing and resetting hatch :—

Aug. 14.	One Granite Coal-hole, $9 ; Metal Cover for do., 84 cts.	9 84	
	One bbl. of Cement at $2.50 per bbl	2 50	
	3 bush. of Sand at 7 cents	21	
	18 hours Mason at 30 cents.	5 20	
	15 " Laborer 12½ cents	1 88	
	Cartage	40	
			20 23

James Walker.

No. 122. Narrowing and resetting hatch :—

Aug. 12.	½ bbl. of Cement at $2.50	1 25	
	2 bush. of Sand at 7 cents	14	
	12 hours Mason at 30 cents	3 60	
	12 " Laborer 12½ cents	1 50	
			6 49

T. C. Allen.

No. 124 and 126. Building coal holes, narrowing and re-setting hatches :—
1893.

Aug. 10.	2 Granite Coal-holes at $9.00 each	18 00	
	2 Metal Covers for same at 84 cents	1 68	
	1 ½ bbls. of Cement at $2.50	3 75	
	5 bushels of Sand at 7 cents	35	
	30 hours Mason at 30 cents	9 00	
	30 hours Laborer at 12½ cents	3 75	
	Cartage	40	
			36 93

Thomas Brown.

No. 128 and 130. Re-setting hatch :—

Aug. 9.	¼ bbl. Cement at $2.50	63	
	1 bush Sand at 7 cents	7	
	6 hours Mason at 30 cents	1 80	
	8 " Laborer at 12½ cents	1 00	
			3 50

Dalhousie College.

No. 132. Resetting two hatches and coal-holes :—

Aug. 8.	¾ bbls. of Cement at $2.50	1 88	
	3 bush of Sand at 7 cent	21	
	12 hours Mason at 30 cents	3 60	
	12 " Laborer at 12½	1 50	
			7 19

Dalhousie College.

No. 134. Resetting 2 hatches and coal-holes :—

1893.			
Aug. 7.	1 bbl. of Cement at $2.50	2 50	
	3 bush. of Sand at 7 cents	21	
	14 hours Mason at 30 cents	4 20	
	14 " Laborer 12½ cents	1 75	
			8 66

A. S. Kaizer.

No. 136, 138, 140 and 142. Resetting hatches and building coal-holes :—

Aug. 4.	2 Granite Coal-holes at $9.00	18 00	
	2 Metal Covers for do. at 84 cents	1 68	
	1½ bbl. of Cement at $2.50	3 75	
	5 bush. of Sand at 7 cents	35	
	36 hours Mason at 30 cents	10 80	
	30 " Laborer 12½ cents	3 75	
	Cartage	60	
			38 93

A. G. Kaizer.

No. 144. Resetting hatch :—

Aug. 3.	¼ bbl of Cement at $2.50	63	
	1 bush. Sand at 7 cents	7	
	5 hours Mason at 30 cents	1 50	
	5 " Laborer 12½ cents	63	
			2 83
			$164 98

GRANVILLE STREET, BETWEEN PRINCE AND SACKVILLE.

Cost of Resetting Hatches.

Mahon Brothers.

No. 66 and 70. To resetting coal holes :—

1893.			
Aug. 2.	¼ bbl. of Cement at $2.50	63	
	1 bash. Sand at 7 cents	7	
	6 hours Mason at 30 cents	1 80	
	8 " Laborer at 12½ cents	1 00	
			3 50

Miss Wallace, J. Wallace, Agent.

No. 62 and 64. Resetting two hatches and repairing walls :—

Aug. 1.	1 bbl. of Cement at $2.50	2 50	
	3 bush. of Sand at 7 cents	21	
	10 hours Mason at 30 cents	3 00	
	12 " Laborer at 12½ cents	1 50	
			7 21

Herald Office.

No. 60. Resetting hatch, repairing walls and building up hatch :—

July 31.	1 bbl. of Cement at $2.50	2 50	
	3 bush. of Sand at 7 cents	21	
	10 hours Mason at 30 cents	3 00	
	10 " Laborer at 12½ cents	1 25	
			6 96
			17 67

GRANVILLE STREET, BETWEEN DUKE AND BUCKINGHAM.

Cost of Resetting Hatches.

Smith Brothers.

No. 150. To taking down vault, shifting coal, building coal hole and hatches :—

1893.			
Oct. 2.	54 hours Laborer, shifting coal, etc., at 12½ cents	6 75	
	1 Granite Coal-hole at $9 00	9 00	
	1 Metal Cover for do., 84 cents	84	
	3 bbls. of Cement at $2.50	7 50	
	10 bush. of Sand at 7 cents	70	
	34 hours Mason and Stonecutter at 30 cents	10 20	
	34 " Laborer at 12½ cents	4 25	
	Truckage	60	
			39 84

Rev. H. Gordon, B. G. Gray, Agent.

Nos. 152 and 154. Building coal-holes, narrowing and resetting hatches :—

Sept. 28.	2 Granite Coal-holes at $9.00	18 00	
	2 Metal Covers for do., 84 cents	1 68	
	8 bush. of Sand at 7 cents	56	
	2½ bbls. of Cement at $2.50	6 25	
	4 Iron Holdfasts for Grating at 20 cents	80	
	37 hours Mason and Stonecutter at 30 cents	11 10	
	33 " Laborer at 12½ cents	4 13	
	Truckage	1 00	
			43 52

Hon. R. Boak.

No. 156 and 158. Building coal-holes, resetting hatch and building up hatch :—

Sept. 27.	2 Granite Coal-holes at $9 ($18) ; Metal Covers for do. at 84 cents ($1.68)	19 68	
	3 bbls. of Cement at $2.50	7 50	
	10 bush. of Sand at 7 cents	70	
	39 hours Mason at 30 cents	11 70	
	35 " Laborer at 12½ cents	4 38	
	Truckage	1 00	
			44 96

Miss A. Barron.

No. 160. Building up hatch, narrowing and resetting hatch :—

Sept. 26.	1 bbl. of Cement at $2.50	2 50	
	3 bush. of Sand at 7 cents	21	
	15 hours Mason at 30 cents	4 50	
	12 " Laborer 12½ cents	1 50	
			8 71

B. H. Collins.

No. 162. Building up hatch, narrowing and building up hatch :—

Sept. 24.	1 bbl. of Cement at $2.50	2 50	
	3 bush. of Sand at 7 cents	21	
	15 hours Mason at 30 cents	4 50	
	20 " Laborer 12½ cents	2 50	
			9 71

Dev. E. Billing, Hon. S. L. Shannon, Agent.

Nos. 164 and 166. Building coal-hole, narrowing and resetting hatch :—

Sept. 21.	1 Granite Coal-hole at $9.00	9 00	
	1 Metal Cover for do. at 84 cents	84	
	2 bbls. of Cement at $2.50	5 00	
	6 bush. of Sand at 7 cents	42	
	35 hours Mason at 30 cents	10 50	
	30 " Laborer 12½ cents	3 75	
	Truckage	40	
			29 91

Heirs of J. Thompson, J. Thompson, Agent.

No 168. Building Coal-hole, narrowing and resetting Hatch :

1 granite Coal-hole, at $9.00	9 00	
1 metal cover, at 84c., 2 iron holdfasts for grating, at 20c., 40c.	1 24	
1½ barrels of Cement, $2.50	3 75	
5 bushels of Sand, 7c.	35	
18 hours Mason, at 30c	5 40	
15 hours Laborer, at 12½c.	1 88	
Truckage	40	
		22 02

Miss A. Lawson.

No. 172.	Building Coal-hole, narrowing and resetting Hatch :		
Sept. 18.	1 granite Coal-hole, at $9.00	9 00	
	1½ barrels Cement, at $2.50	3 75	
	5 bushels of Sand, at 7c	35	
	1 metal cover for Coal-hole, at 84c.	84	
	2 iron holdfasts for grating, at 20c.	40	
	500 old Bricks, at $5.00 per 1000	2 50	
	18 hours Mason, at 30c.	5 40	
	15 hours Laborer, at 12½c	1 88	
	Truckage	60	
			24 72

James Walker, C. J. Spike, Agent.

No. 174 and 178.	Building up Hatch, narrowing and resetting 5 Hatches :		
Sept. 15.	3 barrels of Cement, at $2.50	7 50	
	10 bushels of Sand, at 7c	70	
	7 iron holdfast for Hatch grating, 20c.	1 40	
	64 hours Mason and Stonecutter, at 30c.	19 20	
	59 hours Laborer, at 12½c	6 25	
			35 05
			258 44

BARRINGTON STREET, FROM BLOWERS ST., SOUTH.

Cost of Resetting Hatches, etc.

Miss Walsh.

No. 17.	Building hatch and setting curb :—		
Aug. 28.	1 Hatch Curb (granite), 6 ft. 6 in., 75 cents per foot	4 87	
	¾ bbl. of Cement at $2.50	1 88	
	2 bush. of Sand at 7 cents	14	
	8 hours Mason at 30 cents.	2 40	
	8 " Laborer at 12½ cents	1 00	
	Truckage	25	
			10 54

Henry A. McDonald.

No. 9 and 13.	Building hatches and setting 3 iron coal-holes :—		
Aug. 31.	1 bbl. of Cement at $2.50	2 50	
	3 bush. of Sand at 7 cents	21	
	14 hours Mason at 30 cents	4 20	
	14 " Laborer at 12½ cents	1 75	
			8 66
			19 20

HOLLIS STREET, FROM SACKVILLE ST., SOUTH.

Cost of Resetting Hatches, &c.

A. McManus, Tailor.

Breaking hole in wall, building hatch and setting iron coal hole :—

1893.				
Oct. 5.	1 bbl. of Cement at $2.50		2 50	
	3 bush. of Sand at 7 cents		21	
	14 hours Mason at 30 cents		4 20	
	14 " Laborer at 12½ cents		1 75	
				8 66

Hesslein Brothers.

No. 117 to 123. Resetting hatches and coal-holes :—

Oct. 14.	1½ bbls. of Cement at $2.50		3 75	
	5 bush. of Sand at 7 cents		35	
	18 hours Mason at 30 cents		5 40	
	18 " Laborer at 12½ cents		2 25	
				11 75

Queen Hotel.

Building hatches and setting iron coal-holes :—

Oct. 14.	½ bbl. of Cement at $2.50		1 25	
	2 bush. of Sand at 7 cents		14	
	18 hours Mason at 30 cents		5 40	
	18 " Laborer at 12½ cents		2 25	
				9 04
	2 coal-holes and covers	16 00		
		9 04		
		$25 04		
	Total of hatches			$489 74

BUILDING CATCH PITS.

GRANVILLE ST., WEST SIDE, BETWEEN PRINCE AND SACKVILLE.

Labor.

To 198 hours, at 12½c	24 75	24 75

Cartage.

To 10 hours, at 20c	2 00	2 00

Materials.

To 3 barrels Cement, at $2.45	7 35	
24 feet of 9-in. Crock Pipe, at 35c	8 40	
1 9-in Bend, at $1.75	1 75	
28 bushels Stone, at 4c	1 12	
42 " Gravel and Sand, at 5c	2 10	
		20 72
Total cost		$47 47

GRANVILLE ST., NEAR BUCKINGHAM ST., WARD 3.

Labor.

To 27 hours, at 14c	3 78	
64 " at 12½c	8 00	
		11 78

Cartage.

To 10 hours, at 20c	2 00	2 00

Materials.

To 27 feet of 9-in. Crock Pipe, at 35c	9 45	
1 9-in. Bend, at $1.75	1 75	
3½ barrels Cement, at $2.45	8 57	
28 bushels Stone, at 4c	1 12	
56 " Sand and Gravel, at 5c	2 80	
		23 69
Total cost		$37 47

CATCH PIT AT ORDNANCE AND DIVERTING SEWER.

Labor.

To 10 hours Superintending at 40 cents	4 00	
36 " at 14 cents	5 04	
100 " at 12½ cents	12 50	
59 " at 11 cents	6 49	
		28 03

Cartage.

To 35 hours at 20 cents	7 00	7 00

Materials.

To 28 bush. Stone at 4 cents	1 12	
28 " Sand at 5 cents	1 40	
28 " Gravel at 5 cents	1 40	
4 bbls. Cement at $2.45	9 80	
		13 72
Total cost		$48 75

TWO CATCH PITS SOUTH PARK STREET, AND CONNECTING WITH SEWER.

Labor.

To 223 hours at 12½ cents	27 88	
20 " of Superintending at 40 cents	8 00	
40 " of Cartage at 20 cents	8 00	
		43 88

Materials.

To 6 bbls. Cement at $2.45	14 70	
56 bush. Stones at 4 cents	2 24	
84 " Sand and Gravel at 5 cents	4 20	
38 feet Crock Pipe at 35 cents	13 30	
Four 9-in. Bends at $1.75	7 00	
		41 44
		$85 32