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# CANADIAN CONTRACT RECORD

A WEEKLY JOURNAL

PUBLIC • WORKS • TENDERS •  
ADVANCE • INFORMATION •  
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EVERY THURSDAY

This paper reaches every week the Town and City Clerks, Town and City Engineers, County Clerks and County Engineers, Purchasers of Municipal Debentures and leading Contractors in all lines throughout Canada.

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## THE CANADIAN CONTRACT RECORD,

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### EXTRA WORK.

Extra work, better known as "extras," says the Contract Journal, is the *dete noire* of the engineer and architect, and frequently of the contractor as well. Yet, in contracts of any magnitude, it is simply impossible to avoid them, and we might also add small contracts. There are often more trouble, more discussion, recrimination, and almost wrangling over the "passing" of a few odd pounds for extras than there are over as many thousands for the regular contract work. Municipal and other engineers in the service of local corporate authorities, particularly if they should have the misfortune, by no means an uncommon one, of sitting under a cheese-paring Board, will no doubt endorse our statement. It is no wonder, therefore, that both engineers and architects do their utmost to frame their specifications in a manner so that the frequently

inevitable but objectionable contingency may be at all events reduced to proportions as small as possible. Specifications, however, unfortunately in this respect very much resemble Acts of Parliament, of which it has been stated there never was one passed through which one could not drive a coach-and-four.

However laudable it may be for a professional man to draw up his specifications strictly, or even stringently, there is, nevertheless, a certain *modus in rebus* which should be fairly adhered to in all such documents. The ominous phrase "without extra charge" should not be employed too often, nor applied to details of work or materials, which ought properly to be included in the category of extras. It is not a very unusual occurrence to find the following phrase in a specification: "The contractor shall excavate the foundations to such and such a depth, or as much deeper as the engineer shall direct." It may be said that it is comparatively an easy matter for the contractor to satisfy himself of the nature of the substratum by means of borings and trial pits, and having thus determined the depth he must go, base his estimate accordingly. But every practical engineer is aware of the constant uncertainty attending borings and trial pits, although they must be made. Omitting all consideration of "faults," the composition and character of the ground has been frequently found to vary in a most astonishing manner, at a distance of even only a few feet from a boring or pit. Again, there is no absolute rule for the depth to which a foundation should be carried. There is no doubt a minimum depth which would always be observed, but the maximum will depend upon the judgment, experience, and opinion of the engineer or architect. His decision will very probably be that the depth must be greater than the contractor bargained for, which in large works would be a serious matter for the latter. It is therefore essential that a certain depth should be definitely fixed as the contract depth, and any excess treated and paid for as an extra.

The amount of extras fairly permissible in any contract will depend in some measure upon its magnitude, but in a greater upon the character of it. Except in large subterranean works in populous cities, notably in our own Metropolis, they should bear some reasonable proportion to the total amount of the contract. In those manifestly exceptional instances the unknown contingencies are so numerous and on so large a scale as to completely baffle all judgment, foresight, and experience.

### CONTRACTS OPEN.

SINCOE, ONT. Harding & Son propose erecting a shoddy mill.

LINDSAY, ONT.—The town will probably erect an isolation hospital.

MEGANTIC, QUE.—It is probable that a convent will be built at this place at an early date.

MITCHELL, ONT.—Trinity church congregation are agitating for a new church.

SOUTH WOODSLEE, ONT.—H. C. Rees will rebuild his stave mill burned last week.

PAKENHAM, ONT.—St. Andrews congregation are considering the erection of a new church.

ST. JOHNS, QUE.—A. Bisailon will shortly erect a three story building on Champlain street.

GUELPH, ONT.—Wm. Hearn will erect a new residence on the corner of Waterloo avenue and Yorkshire streets.

HAWTHORNE, ONT.—Tenders are invited until the 22nd inst., for the erection of a cheese and butter factory here.

NORTH BAY, ONT.—Plans are being prepared at the Department of Public Works, Ottawa, for a new dock to be built here.

BLENHEIM, ONT.—The Presbyterian congregation have decided to erect a new church, with a seating capacity of 450; estimated cost \$7,000.

GLEN WALTER, ONT. Tenders will be received either by E. Thomson or C. Farlinger until the 23rd inst., for the erection of a new school building.

KNOWLTON, QUE.—Mr. Husbands, C. E., of Cookshire, has been making surveys in connection with the waterworks project. It is proposed to obtain the supply from springs.

GRANBY, QUE.—A. L. Husbands and A. W. Mitchell, civil engineers, have submitted estimates to the council for a sewerage system, the cost being placed at \$43,997 for eight miles of pipe line.

AURORA, ONT.—The council are advertising for tenders for five thousand feet of cedar scantling and twenty five thousand feet of pine plank for sidewalks. Tenders to be sent in by the 1st of March.

FREDERICTON, N. B.—The Fredericton Boom Co. will ask authority from the Legislature to transfer their operations from Oromocto Island to the eastern shore of the St. John River. The new Works necessary will necessitate an expenditure of about \$70,000.

HILLSBURG, ONT.—The sum of \$1,300 has been subscribed for the erection of a manse for St. Andrew's church. At a special meeting held last week it was decided to proceed with the work, a site having already been purchased. R. A. Reed is treasurer of the Building Committee.

GRAND FALLS, N. B.—Edward Jack, solicitor for applicant, gives notice that application will be made to the Dominion

Legislature for incorporation of a company for the purpose of utilizing and developing the water power of the Saint John river at this place, and for the construction of dams, sluices, piers, booms, mills or manufactories.

**LONGUEUIL, QUE.**—A house of Refuge for the countries of Chambly, Vercheres and Laprairie will be built.

**HULL, QUE.**—Gilmour & Hewson, lumbermen propose enlarging their boiler house and adding two new boilers.

**L'AVENIS, P. Q.**—The citizens of this place have decided to build a convent, \$1,700 has already been subscribed for the purpose.

**PORT HOPE, ONT.**—At a special meeting of the Town Council a grant of \$1,000 was made to Trinity College to assist in rebuilding.

**KINGSTON, ONT.**—The bridge connecting the city with the township of Pittsburg requires to be rebuilt. An iron or steel structure will likely be constructed.

**VALLEYFIELD, QUE.**—Plans of the new Canada Atlantic railway depot have been prepared. It is not known when work will be commenced, as arrangements with the town are still pending.

**SOUTH MARCH, ONT.**—Tenders are invited by Rev. W. H. Stiles, until the 25th inst. for the erection of a stone church building at Dunrobin, Ont. Plans may be seen at the rectory.

**MORDEN, MAN.**—Among the new buildings to be erected here in the spring will be a first-class brick hotel. It is likely all the buildings erected on the burned district will be of brick.

**VANCOUVER, B. C.**—Thos. F. McGuigan, City Clerk, invites tenders until Thursday the 28th inst. for the delivery of a large quantity of crushed rock and for the annual supply of hardware.

**DENBIGH, ONT.**—The Lutheran congregation have decided to rebuild their parsonage recently burned. A building committee has been appointed consisting of Rev. Gunther Bracebusch, and Messrs. G. Stein and E. Berudt.

**NANAIMO, B. C.**—The Nanaimo Electric Tramway Co. have submitted a proposition to the Council to construct a line between Nanaimo and Wellington, providing the Council will guarantee the interest on \$50,000 bonds.

**HALIFAX, N. S.**—The City Council has passed a report from the Board of Firewardens asking for authority to borrow \$5,000 for a new engine house on West street, and for \$2,650 for a new chemical engine for the North end.

**OTTAWA, EAST, ONT.** The Ottawa East council has decided to submit a by-law to the ratepayers providing for the issue of debentures for \$2,500 for the erection of a new town hall. Additional plans have been submitted by Messrs. P. J. Horwood and Gregg & Gregg.

**STRATFORD, ONT.**—The erection of a new fire hall will be proceeded with as soon as the spring opens. The cost will be \$3,500.—Two Bay City, Mich., capitalists are said to be endeavoring to organize a company to build a street railway here, extending to the adjacent towns.

**QUEBEC, QUE.**—It is probable that tenders will shortly be called for the erection of the Champlain monument. Some \$20,000 has already been subscribed and the committee appointed to select a site has decided to recommend in favor of the plot of land adjoining Dufferin terrace and situated between the post office and the Chateau Frontenac.

**PETERBORO', ONT.**—H. Closé of the Universal Knitting Co., Toronto, contemplates building a factory here, 100 ft. long by 45 ft. wide.—A deputation from South Monaghan, consisting of Reeve Fisher, ex-reeve Morrison and several others,

waited upon the Minister of Public Works last week, soliciting aid for the re-erection of a new iron bridge across the river Otonabee, to replace the one destroyed by fire some time ago. Consideration was promised.

**HAMILTON, ONT.**—The Hamilton Radial Electric Railway Company has given notice that application will be made for an amendment of its charter to allow it to operate the Guelph and Berlin branches by either steam or electricity.—John Fridd has been granted a permit for three brick cottages and alterations to a frame dwelling on New street, to cost \$1,800.—At a meeting of the Board of Works held on Tuesday last it was decided to ask the City Council for a grant of \$7,000 for an asphalt pavement on the south side of the James street market, from James to McNab street.

**WINNIPEG, MAN.**—Tenders are invited until the 26th inst. for the electric lighting of the city with from 120 to 200 lights for a term of one year and for three years from April next, tenders to be addressed to B. E. Chaffey, Chairman Fire and Light Committee.—The outlook for the erection of a Masonic Temple in this city is said to be exceedingly bright, a large number of the shares having already been taken. The secretary is J. Obed Smith.—The City Council has resolved to submit a by-law to the ratepayers to raise the sum of \$60,000 by the issue of debentures for school purposes, the amount to be expended as follows: repairs and improvements, \$2,000; new buildings, \$50,000; new foundations, \$6,000.

**VICTORIA, B. C.**—The Victoria, Vancouver and Westminster Railway Co. has been incorporated to build a line from a point near Garry Point on the Fraser River, through Richmond, South Vancouver and Burnaby to Westminster, with a branch to Vancouver.—The filter bed plans in connection with the waterworks improvements have been sent to Toronto to be examined by Mr. E. H. Keating, City Engineer of that city, and Mr. Wm. Haskins, City Engineer of Hamilton.—In an interview, D. C. Corbin, of the Nelson and Fort Sheppard, and Spokane Falls and Northern railways, stated that the defeat of the Red Mountain railway bill in the Provincial Legislature would not prevent the building of the road. The bill asked for an extension of time in which to commence operations, but as this had been refused, work would be commenced at once.

**LONDON, ONT.**—The Queen's avenue Methodist church will be rebuilt on the old site.—W. Moore, of South London, has taken out a permit for the erection of a two-story brick residence on the Wortley road, to cost \$2,000.—Additional school accommodation will be provided at an early date. It is proposed by the trustees to add two rooms to St. George's school, two to Aberdeen and to build new and larger schools at Colborne and Chesley avenue.—The present intention of the trustees of the Dundas Street Centre Methodist church, the destruction by fire, of which was mentioned in our last issue, is to build a lecture room at once, and to rebuild the church during the coming season. A committee has been appointed to obtain plans.—The question of erecting an addition to the hospital, at a cost of \$16,000, was again considered by No. 1 Committee of the City Council. Col. Lewis and Mr. C. F. Complin submitted plans of the proposed wing. It was finally decided to leave the matter over until the estimates had been prepared, which would be about the middle of March.

**MONTREAL, QUE.**—Tenders are being received by J. A. Chausse, architect, for the erection of a cut stone front residence to be erected on Delorimier avenue. The same architect is also preparing plans for a Presbytery for the parish of St. Eliza-

beth, P. Q., two stores on St. Catherine street, and a residence at Longueuil, P. Q.—A. E. Delorimier has written to the Council of the Municipality of Westmount asking permission to erect a factory within the limits of the village.—At the last meeting of the St. Louis du Mile End Council, it was decided to light the municipality with electricity, and estimates will be obtained at once for 25 arc lamps of 2,000 candle power. At the last meeting of the Protestant School Commissioners the plans for the proposed new school on St. Denis street were approved, and the work will be proceeded with at once.—Messrs. J. B. Resther & Son, architects, have prepared plans for the following work: skating rink and concert hall at Valleyfield, Que.; alterations to two houses on St. Antoine st. for Geo. H. Matthews; alterations to house on Victoria street for J. B. Resther.

**OTTAWA, ONT.**—E. J. Swan, of New York, who recently purchased the Ward limits on the Rouge River, contemplates erecting large mills on the property.—Tenders are being asked for the construction of a bridge over the Nation River at Casselman to replace the iron structure recently swept away.—The Finance Committee has decided to issue \$300,000 of debentures.—The Department of Railways and Canals invites tenders until Saturday, the 23rd of March, for the construction of about six and one-half miles of canal on the Peterboro' and Lakefield division of the Trent Valley Canal. Plans of the work can be seen at the above department and at the superintending Engineer's office, Peterboro'. The section to be constructed extends from deep water in the river at Lakefield to Nassau, a distance of about six and a half miles. There will be five locks, each 142 feet in length. At the point where the canal crosses Bridge street, in the village of Lakefield, it will be spanned by a high level bridge, with a clear span of 81 feet. At different points dams will be constructed, varying from 250 to 300 feet in length. The works are to be completed by the 1st of October, 1896.

**TORONTO, ONT.**—It is reported that a new building will shortly be erected in this city, to be used as the head offices of the Independent Order of Foresters. The probable cost is \$150,000 to \$200,000, and the site spoken of the Northwest corner of Bay and Richmond streets.—It has been suggested that the City Council should make a grant for the purpose of fitting up the old Empire building as a club-room for newsboys. The idea has been received with favor, and action will probably be taken by the Council.—At the meeting of the City Council on Monday, the recommendation of the Board of Works to lay car tracks on Avenue road was finally passed, and the work will now be proceeded with. The report of the City Engineer, recommending an expenditure of \$225,000 on new water mains, as mentioned in our last issue, was also passed. Ald. Davies, Dunn and Saunders have been appointed a sub-committee to confer with the Technical School Board with a view to altering and improving the St. Lawrence Hall building to meet the requirements of the school. The City Commissioner was instructed to prepare a plan, with estimate of cost, for improving the Yonge street wharf, recently taken over from the C. P. R.—The Property Committee will be asked to place a sum in the estimates for a new clock and bell in Cowan avenue fire hall.—A sub-committee has been appointed to report to the Fire and Light Committee on the proposal to erect a fire hall on Dundas street, to replace the Brock avenue hall.—A special meeting of the City Council was held last week to consider Mr. Gage's offer of \$25,000 for the erection of a consumptive hospital. Ald. Lamb suggested that an annex be erected to the Home for

Incurables, and it was resolved to ask Mr. Gage to make the grant in affiliation with the Home.—Mr. E. J. Lennox, architect has prepared plans for additions and alterations to the House of Industry on Elm street.—Building permits have been granted as follows: Jas. Wood, 61 Mitland st., re-erection of the Osgooby Building, Melinda st., cost \$35,000; Toronto General Trusts Co., bk. add. to rear of store 58 Bay st., cost \$1,500.

#### FIRES.

The Chicory mills at Outremont, a suburb of Montreal, were burned last week. The mills were owned by Joseph Beaubieu and were valued at \$8,000; no insurance.—M. C. Wells' residence at Chatham, Ont., has been destroyed by fire.—Fire at Neepawa, Man., on the 14th inst., destroyed the *News* printing office and the Northwestern Hotel. Loss, \$14,000; small in amount.—The carriage factory of Robert Blow and tin shop of W. Bailey, at South Mountain, Ont., were burned on the 13th inst. Damage to buildings, \$15,000. No insurance.—G. Carter, Son & Co.'s warehouse at St. Marys, Ont., was totally destroyed by fire last week. The loss is \$3,500, fully covered by insurance.—A residence at Lakeview, N. S., owned by Alexander Robertson, was burned a few days ago. Loss, \$1,500; insurance, \$1,000.—The workshops of the Clarry Carriage Works, Millbrook, Ont., were destroyed by fire on Thursday of last week. Loss, \$1,800; insurance, \$800.—D. Zant's dry goods store at Tilsonburg, Ont., was badly damaged by fire recently. The loss is covered by insurance.—The residence of Mrs. Rieves at Point-Aux-Trembles, Que., has been burned. Loss, \$2,000.—The Royal Hotel at Brandon, Man., owned by Charles Pilling, was damaged by fire recently to the extent of \$1,500, fully covered by insurance.

#### CONTRACTS AWARDED.

WINNIPEG, MAN.—The contract for placing a stone foundation under the Harris block for Crotty & Cross has been awarded to D. D. Wood.—The following tenders were received by the Board of Works cedar blocks paving for Main street: Doidge & Co., 2,000 cords at \$8.45 per cord; Ontario and Western Lumber Company, 2,000 cords, \$8.90; Thos. D. Robinson, 1,000 cords, \$8.50; John Sinnett, 500 cords, \$7.30; Robinson & Co., 2,000 cords, \$9.75; John King, Fort William, 1,000 cords, \$11; F. D. McDougall, 500 cords, \$8 with bark, \$9 for peeled; J. C. Cox, 400 cords, \$5 free on board cars at Duluth; Kelly Bros. & Co., 2,000 cords, \$10.45; J. G. Hargrave, 2,000 cords, \$6.62 ½ with bark, \$7.12 ½ peeled. The latter tender has been accepted by the Board.

OTTAWA, ONT.—The Road and Bridge Committee of the County Council received the following tenders for the construction of the new Hurdman's bridge over the Rideau river: Wm. Fennegan, Ottawa, wooden structure, \$3,000, including repairs of piers; John Alexander Hawthorne, wooden \$2,950; John J. Lyons, Ottawa, wooden, \$4,190; iron and oak structure, \$4,970; John Sullivan, Ottawa, wooden \$2,550, iron and oak, \$3,750; Johnston & Co., Ottawa, iron and oak, \$3,618, wooden, \$3,311, with \$210 additional for raising piers and filling in approaches. Chas. C. Cummings, Cummings bridge, wooden, \$2,975; Richard Tobin, Ottawa, wooden, \$3,400; iron and oak, \$4,800; Geo. Tomlinson, Ottawa East, wooden, \$2,795, iron and oak, \$3,789; Wm. Alexander, Ottawa, wooden, \$3,370, iron and oak, \$6,622.50; Viau and Lachance, Hull, wooden, \$3,350, iron and oak, \$4,600; H. J. Ross, Hintonburg, \$3,935; Benj. Savage, Janeville, wooden, \$3,408; A. W. Lang, Ottawa, wooden, \$3,175; Joseph White, Ottawa, wooden

\$2,995; F. A. Hibbard, all wood, \$2,762, iron and oak, \$3,632. The contract has been awarded to F. A. Hibbard, for an iron and oak structure at the above price.

#### ROOFING SLATE.

Professor H. Brunner, of Lausanne, Switzerland, has just published a valuable essay on the proper technical examination of roofing slate, from which we translate the following extracts. Some slates used for roofing are so poor that in a short time they disintegrate from exposure to the weather. Numerous instances are given of slate roofs which had entirely failed in less than two years after they had been thus covered. We have as yet but little data upon which to fix any standard of examination. The professor furnishes a remedy whereby such a standard can be fixed—his methods are simple and sure.

The proper examination of slate may be divided into two processes, one physical, the other chemical. The physical examination may be divided as follows:—

1. Colour.—This gives a certain indication of quality and is only useful as a matter of evenness and taste.

2. Structure.—On every slate there can be seen, especially when examined at an oblique angle lengthways, fine streaks; the direction of these is of importance. These stripes should run lengthwise, and parallel to the longer axis of the slate, and not perpendicular or at an angle to it. If the latter is the case, the slate will break easy between the nail and the exposed portion, either from pressure or movement. Connected closely with this comes:—

3. Tenacity and Elasticity.—A good slate should be hard, not easily scratched by the finger-nail; but the hardness alone is not sufficient. The power of resistance of a compact slate is greater than that of a scaly specimen. Good slate can be broken or sawed without scaling off.

4 and 5. Hardness and specific weight gives no positive data.

6. Sound.—When a good slate is struck a blow it rings; but poor slate gives a dull sound.

7. Microscopical Examinations.—To make this it is not necessary to grind a slate down thin; it is not sufficient to split off thin pieces and use the polarization microscope. Then it is easy to recognize the carbonate of lime, the pyrites (sulphurite of iron), and the markasite, or white arsenical pyrites. The latter is easily affected by the weather and therefore an injurious ingredient. If pyrites are present, brown spots of iron oxide are often to be seen, caused by the partial chemical changes. In serpentine least there are sometimes to be seen black, shiny magnetite spots. This is harmless.

8. Absorption.—To test for the amount of water slate will absorb, saw off a piece about 4 ¼ in. long and 2 ¾ in. wide and immerse it in a beaker glass, the bottom of which is covered with an inch of water. Cover with a glass plate and let stand for twenty-four hours. A good slate will not be found moist more than a line or two above the water level, while a scaly and porous slate will absorb a great deal, if not all, of the water, and is therefore less likely to resist the chemical and physical influences of the atmosphere.

The chemical examination need not be very extensive. A thorough analysis is unnecessary. All that is required is the determination of the carbonates of lime and magnesia, and also the pyrites. In addition tests are to be made of the powers of resistance of the slate to atmospheric influences.

9. Determination of the Lime.—Finely pulverized slate is thoroughly stirred on a water bath with muriatic acid and a slight addition of nitric acid, filtered, washed, and the filtrate dried to separate the silicic acid, and after separating the oxide of

iron and clay, determine the lime in the filtrate, then the magnesia.

10. Determination of Pyrites.—The slate, after having been digested in aqua regia, obtain the determination of the pyrite Fe S<sub>2</sub> by the sulphuric acid method.

11. Tests for Resistance to Atmospheric Influences. These are of the utmost importance, and by means of these, after considering the physical properties of the slate, the technical value can be established.

A piece of slate 3 in. long and 1 ½ in. wide is hung by a cord in a glass cylinder containing on the bottom a saturated aqueous solution of sulphurous acid, the vessel to be well corked, and let stand at ordinary temperature. A bad slate will begin to disintegrate within twenty-four hours; it will begin to flake off, or, if compact, become spongy and friable. A good slate will resist this action from four to six weeks, and sometimes for months. The rapid disintegration is due to the pyrites and carbonates contained in it. The first is partially changed into sulphuric acid, which will in turn act destructively on the other minerals, while the carbonates, under the action of the carbonic acid and water, are converted into bicarbonates, which become soluble, making the slate spongy, and by giving off CO<sub>2</sub> will heat and further loosen the slate. In these artificial atmospheric tests the carbonate of lime is attacked. The action of the atmosphere goes hand in hand with the carbonates present.

The slate may also be tested for resistance to cold by immersion in snow and salt, and for heat by exposure for five or six hours to a temperature of 480 degrees to 575 degrees Fahr.

For a quick, approximate test of the technical value of a slate examine its physical properties and try the following reactions:—

1. Muriatic acid is poured on the pulverized slate. Strong effervescence indicates a bad slate, because it shows that it contains too much lime.

2. Heat some of the powdered slate in a glass tube. A yellowish sublimate of sulphur and giving off sulphurous odour shows the presence of pyrites, a bad slate.

As an example, four specimens of slate were tested with the following result:—

No. 1, under the microscope, showed presence of pyrites, specific gravity 2.6901, completely saturated in the absorption test, disintegrated in three days, contained 16.252 carbonate of lime and 0.9801 pyrites—pronounced bad.

No. 2 showed, under microscopic pyrites, specific gravity 2.9090, absorbed considerable water, disintegrated in sulphuric acid in eleven days, contained 4.831 carbonate of lime and 0.882 pyrites—pronounced bad.

No. 3, little pyrites, specific gravity 3.0812, absorbed water only slightly, remained unaltered in sulphuric acid six weeks, had only a trace of carbonate of lime and pyrites pronounced very good quality.

No. 4 contained much pyrite, specific gravity 2.7913, absorbed only a trifle of the water, disintegrated in nine days, contained 3.972 carbonate of lime and 1.1017 pyrites—pronounced not good.

Geological conditions cannot be used to determine the quality of a slate, because we find slate of the same geological formation and age but even from the same quarry with essentially varying qualities. It may be said, in conclusion, that good qualities of slate are much more rare than is generally believed. A good slate being so hard to find makes the good very valuable.

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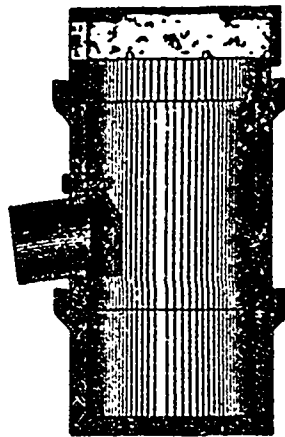
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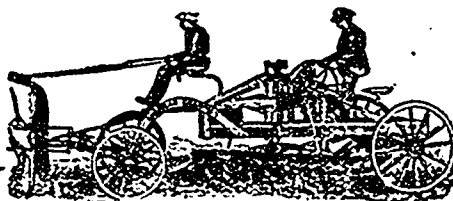
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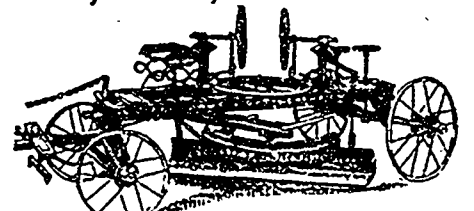
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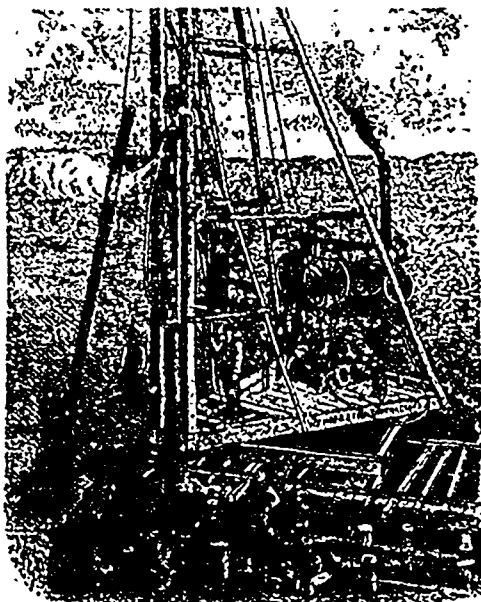


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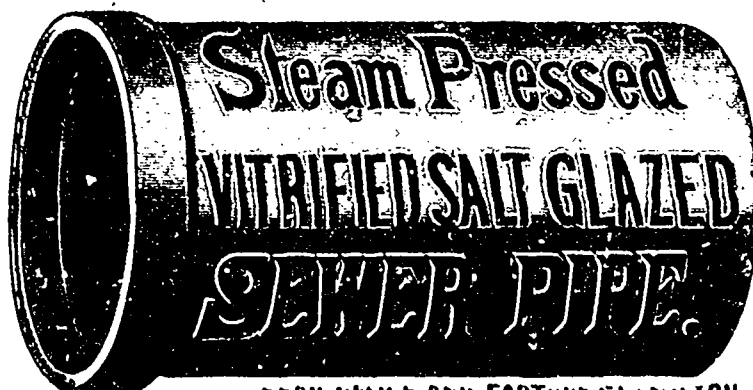


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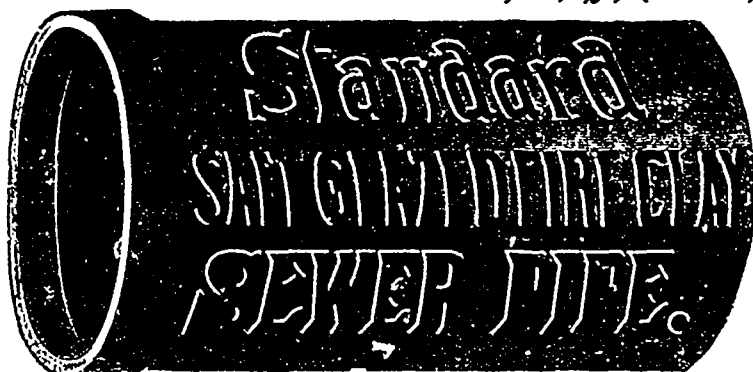
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# MUNICIPAL DEPARTMENT

## CONCUSSION IN SEWER PIPES.

During the construction of the sewerage system in Victoria, B. C., about 2,000 feet of 20-inch pipe was laid and before many weeks had elapsed it was found that many of the lengths were broken. The matter was investigated by Mr. E. Mohun, M. Can. Soc. C. E., the Chief Engineer of the work, and his views of the cause of the accident were presented to the Canadian Society of Civil Engineers, bringing out considerable discussion. The examination showed that near a ventilator or a manhole on a straight line the pipes were intact, while in a manhole on a curve they were sometimes fractured. In rock tunnel, where there was open space above the pipes and a clear entrance to a manhole, the pipes were undamaged, while after being backfilled in earth, near which blasting had been necessary, they were sometimes cracked. Every precaution was taken to secure the full bedding of the pipes and a solid backfilling around them. No pipe was laid except in the presence of an inspector; the work was daily and hourly visited by the chief and resident engineers and the chief inspector. At the commencement of the undertaking all subinspectors did their work under continuous supervision, until it was ascertained that they thoroughly understood their duties. No pipe was allowed to be covered until after examination. In some places where breakage was subsequently found to have occurred, Mr. Mohun was present when the pipes were laid and saw them tamped with fine, dry material. A transverse cut was made in the bottom of the trench to receive each socket, which was not tamped until the pipe had been bedded for its full length. In rock the trench was excavated to an extra depth of 6 inches and then brought up to grade with a 14 to 1 concrete of fine shingle and sand, which was carried up to the haunch and well rammed around the pipe with a curved T-shaped iron. The pipes were similarly bedded where bad material had to be removed.

The first and natural inference was that the breakage was due to improper laying and insufficient tamping, but it was believed afterward that the damage could not be properly attributed to such a cause. The pipes had been tested for crushing, while unsupported at the sides, up to 2,500 pounds per linear foot without fracture. They were examined when received at the corporation yard, when delivered to the contractor's teamster, and when delivered at the trench. An inspector was present when each pipe was laid, whose duty it was to see the backfilling tamped properly, and the work was frequently visited at uncertain intervals by the engineers and the chief inspector. Further, it was found that in work performed by

the same men, when the superincumbent weight was far in excess of that above the broken pipes, no damage had been done. The conclusion was finally reached that the damage arose from concussion caused by the blasting in the trenches and tunnels beyond the point where the pipes had been laid.

Between six-tenths and seven-tenths of this pipe was laid through solid, very hard trap rock, nearly all in tunnel. This tunnel was not backfilled in order to afford access to the pipes. The rock was so firm that with a day and night shift the progress was only 5 feet a week to the face. The charges were heavy, and the air was naturally driven out of the tunnel with great force. After the discovery was made all pipes in the neighborhood of the blasting were stopped at their upper ends and covered with sacks of earth, and no pipe was laid into the lower end of a tunnel until the latter had been driven through. These precautions proved successful and no further damage was done. The total cost of replacing the injured pipes was about \$1,700, which was paid by the contractor before the final acceptance of the work. It will be noticed from the above statements that the accident is practically attributed to stresses similar to those in a gun barrel when a charge is fired from it.

In discussing this paper, Mr. C. H. Rust stated that in Toronto there are no pipe sewers larger than 18 inches, and it is only in 18-inch pipe that breakages have been found. This size has not been laid for some years, and where 15-inch pipe is used the haunches are usually filled in with concrete. The percentage of breakages appears to be greater with pipe laid in sand, where the crack usually commences at a manhole and extends along the whole length of the pipe. When removed the pipe generally falls into four equal parts, but it is rare that a sewer collapses completely. It is believed that in sand trenches the planking to support the sides is generally carried below the pipe, and in removing the timbers the sides of the trench have fallen in, cracking the pipe. In clay trenches the breakage is attributed to neglect to bed the pipes properly and to carelessness in tamping the sides. The Toronto specifications call for a thickness of 1 inch in a 12-inch pipe, 1¼ inches in a 15-inch pipe, and 1½ inches in an 18-inch pipe.

## SELECTION OF A SCHOOLHOUSE SITE.

The Pennsylvania State Board of Health gives the following suggestions for the selection of a schoolhouse site:

For a schoolhouse, it is desirable to secure the healthiest possible site in the district where the school is to be located. Pure air, and sunlight in abundance, are to be sought, while foul air and dampness are to be avoided. In the country a damp soil and the region of wet-weather ponds is always to be avoided. A hillside, because it is dryer and warmer, is better than a hollow, or the top of a hill, if the latter is exposed to cold winds. In towns it is not necessary to locate the school-

house on a principal street, a quiet side street is preferable. It should be located away from offensive industries, as gas works, tanneries, oil refineries, etc., while the school lot should be so large that two sides have the adjacent buildings at least sixty feet distant, and in both town and country a playground as large as possible should be secured. This should be on the south and west sides of the school buildings, rather than on the north. If, in cities, it is not otherwise possible to secure a playground, one should be made in the cellar, or even on the roof, or possibly in both places, one being assigned to the boys, the other to the girls, where both sexes are in the same school.

The school grounds may be planted with trees, but these should not overshadow the buildings, thus producing dampness, nor should they be permitted to darken the windows. In the country, wind-breaks of evergreen trees may be planted on the northwest side of the building; in some localities on the southeast, to protect from the cold winds coming from those directions. To secure a large lot it would, in towns, be well to go to the suburbs rather than to build in the seemingly most convenient spot. In country places, children frequently walk one, two and even more miles to school, and it would seem that in towns and cities, where there are well-kept sidewalks, children could do as much when necessary. In fact, it would be much better for their health if they were compelled to walk at least a mile before school every morning. It is a matter of surpassing importance that there be a considerable area of open ground about every schoolhouse and great exertions should be made to secure it.

According to a paper recently contributed by Dr. David Arthur, demonstrator to the Laboratory of State Medicine, at King's College, the air of sewers is in a better condition than that of naturally ventilated schools; and, with the exception of organic matter, better than most mechanically ventilated schools.

The utility of water meters in preventing waste has been demonstrated in Wilmington, Del., in a clear manner. In the annual report of Chief Engineer J. A. Bond, the following statement is made: "The experience of this department, I think, confirms the statements made by other water departments that have used the meters longer and more extensively, of their effectiveness in reducing wilful waste and of the more equitable adjustment of the charges to the consumer. The decreased pumpage referred to in another part of this report is largely due to their use."

A novel housing scheme has been adopted by the Manchester Town Council. It is proposed to clear a space of about five acres in the centre of the city, in an overcrowded and unhealthy area, and to erect blocks of workmen's dwellings. Large areas will be left for playgrounds, and the roofs of the buildings will be left flat and adapted as recreation and playgrounds, and drying grounds. Trees and flower beds will be planted in the open spaces. Several novel features will be introduced into the construction of the dwellings. The cost of clearing the area will be about \$250,000.

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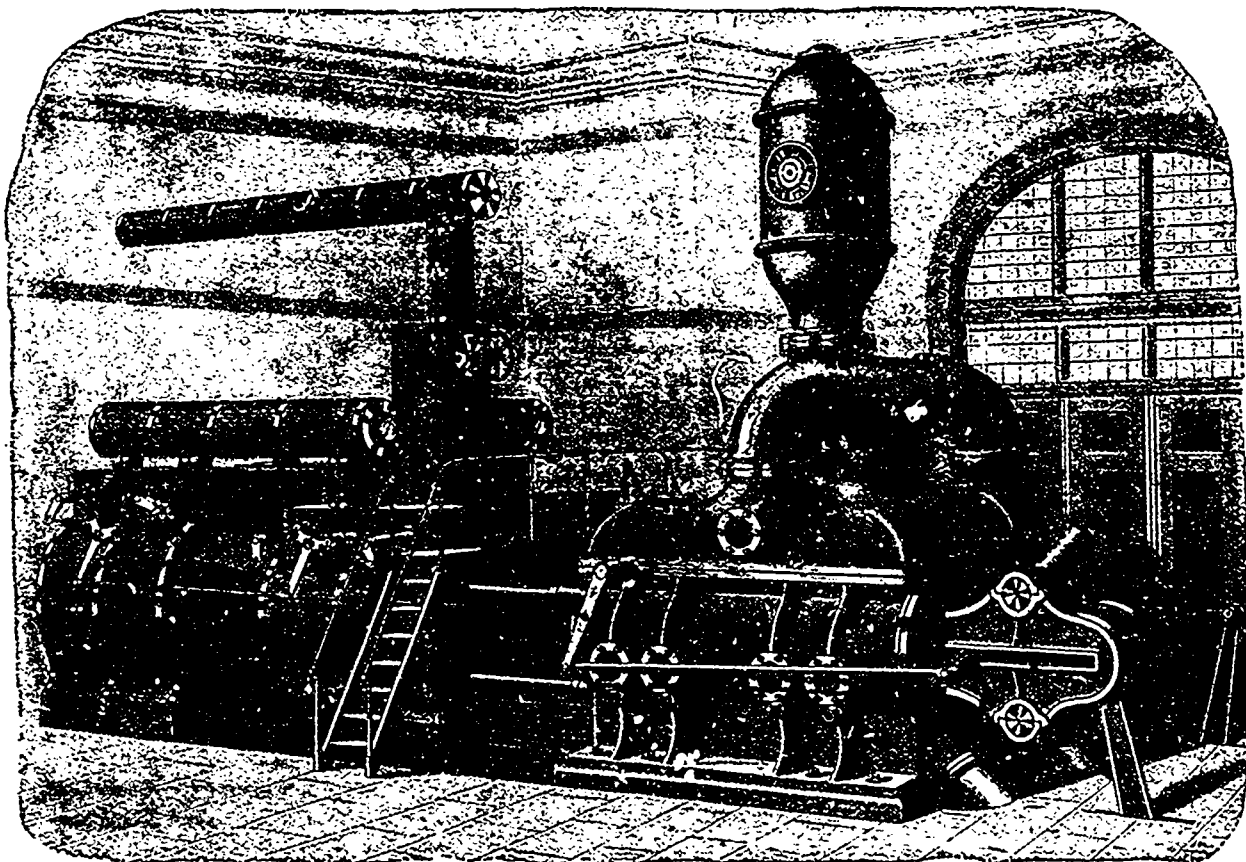
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Table listing cement prices, including Belgian, Canadian, Roman, Parian, Superfine, and other types.

HARDWARE.

Table listing hardware prices, including cut nails, steel, and various types of cut nails and spikes.

FINE BLUED NAILS.

Table listing prices for fine blued nails in different sizes.

CASING AND BOX, FLOORING, SHOOK AND TOBACCO BOX

Table listing prices for casing, flooring, and tobacco boxes.

FINISHING NAILS.

Table listing prices for finishing nails in various sizes.

SLATING NAILS.

Table listing prices for slating nails in different sizes.

COMMON BARREL NAILS.

Table listing prices for common barrel nails.

CLINCH NAILS.

Table listing prices for clinch nails in various sizes.

SHARP AND FLAT PRESSED NAILS.

Table listing prices for sharp and flat pressed nails.

STEEL WIRE NAILS.

Steel Wire Nails, 75, 10 and 5 % discount from printed list.

Iron Pipe:

Table listing prices for iron pipe in different diameters.

Lead Pipe:

Table listing prices for lead pipe.

Galvanized Iron:

Table listing prices for galvanized iron in various gauges.

Structural Iron:

Table listing prices for structural iron, including steel beams, channels, angles, tees, plates, and sheared steel bridge plate.