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CANADIAN CONTRACT RECORD

A WEEKLY JOURNAL OF
PUBLIC WORKS • TENDERS • ADVANCE INFORMATION • AND MUNICIPAL PROGRESS

EVERY SATURDAY

Vol. 3.

Toronto and Montreal, Canada, May 21, 1892.

No. 15

THE CANADIAN CONTRACT RECORD,

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Information solicited from any part of the Dominion regarding contracts open to tender.

ADVERTISING RATES ON APPLICATION.

At its Convention held in Toronto, Nov. 20 and 21, 1890, the Ontario Association of Architects signified its approval of the CANADIAN CONTRACT RECORD, and pledged its members to use this journal as their medium of communication with contractors with respect to advertisements for Tenders.

The following resolution was unanimously adopted at the First Annual Meeting of the Province of Quebec Association of Architects, held in Montreal, Oct. 10th and 11th, 1890: "Moved by M. Perrault, seconded by A. P. Dunlop, that we the Architects of the Province of Quebec now assembled in Convention do hereby sanction the CANADIAN CONTRACT RECORD as a direct communication with the Contractors. Resolved, that we pledge our support to it by using its columns when calling for Tenders."

Subscribers who may change their address should give prompt notice of same. In doing so, give both old and new address. Notify the publisher of any irregularity in delivery of paper.

TENDERS.

Tenders will be received up to THURSDAY, JUNE 2ND, for the whole of the several trades required in the erection of a pair of semi-detached stone and pressed brick residences on the east side of Jarvis street, near Bloor. The lowest or any tender not necessarily accepted. Plans and specifications may be seen at my office on and after Tuesday, the 24th inst.

F. H. HERBERT, Architect,
24 Toronto Arcade, Toronto.

TO CONTRACTORS.

Tenders will be received at the office of the undersigned until noon, SATURDAY, MAY 28TH, for the several works required in the enlargement of the Church of St. Simons, Howard Street.

The lowest or any tender not necessarily accepted.

STRICKLAND & SYMONS, Architects,
18 Toronto Street, Toronto.

TO BUILDERS AND CONTRACTORS.

Separate or whole tenders, addressed to the undersigned, will be received up to five o'clock p.m. of THURSDAY, THE SECOND OF JUNE, 1892, for the several works required in connection with the erection of

Two Public Schools in the Town of North Toronto.

Plans and specifications may be seen and forms of tender obtained at the office of Mr. M. Willmot, Architect, No. 828 Yonge Street, Toronto, on and after Monday, May 23rd.

The bona fide signatures of two responsible persons willing to become security for the proper fulfillment of the contract, must also accompany each tender.

CHARLES BONNICK,

Chairman Building and Sites Committee, Public School Board, North Toronto.

TO STEAM FITTERS.

Tenders will be received until 5 p.m. on WEDNESDAY, THE 25TH INST., for the Steam Heating Apparatus for the Church of The Messiah, Toronto.

The lowest or any tender will not necessarily be accepted.

GORDON & HELLIWELL, Architects,
26 King Street East, Toronto.



NOTICE TO CONTRACTORS.

Tenders will be received by registered post, addressed to the City Engineer, Toronto, up to Eleven o'clock a.m. on TUESDAY, MAY 31ST, 1892, for the following works.

SEWERS

Emerson avenue, from Wallace to Bloor street.
Tyndal avenue, from Huxley street to the G. T. R. tracks.

Glen Road, from Elm avenue to Maple avenue.
Roxboro street, from present terminus to Avenue Road.

St. Clarens avenue, from Wallace avenue to Bloor street.

Rosedale Road, from Park Road to Pine Hill Road.
Pine Hill Road, from Rosedale Road westerly.

PAVEMENTS

On lane off Jordan street, in rear of Standard Bank (scoria and concrete sidewalk).

On Bruce street, from Shaw street to Gevins street (cedar block).

On lane south of Pearl street, between York and Simcoe street (cobble).

Plans can be seen and forms of tender obtained at the City Engineer's office on and after Tuesday, the 24th inst.

A deposit in the form of a marked cheque, payable to the order of the City Treasurer, for the sum of 5 per cent, on the value of the work tendered for under \$1,000, and 2 1/2 per cent, on the value of the work tendered for over that amount, must accompany each and every tender, otherwise it will not be entertained. All tenders must bear the bona fide signatures of the contractor and his sureties (see specifications), or they will be ruled out as informal.

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

JOHN SHAW,

Chairman Committee on Works,
Committee Room, Toronto, May 17, 1892.

Business Men,

SHORTHAND, TYPEWRITING, COPYING, SPECIFICATIONS and GENERAL CORRESPONDENCE neatly and rapidly executed.

Would be pleased to wait upon Architects, Builders, etc., requiring work of this description.

Neatness and accuracy guaranteed.

Testimonials furnished. - Terms, reasonable.

DAVID A. PHILLIPS,

123 Borden Street, Toronto,

or care CANADIAN ARCHITECT AND BUILDER.

It is claimed that a scheme is now being developed in Scotland by which a high grade of brick is being made from clipped granite and clay. The experiments so far have been more than successful, and when perfection has been reached it is quite likely that the method will be introduced in this country. Brickmakers in the neighborhood of Philadelphia are said to be particularly interested in the experiments.

CONTRACTS OPEN.

NEWBORO, ONT.—A new Methodist church will be erected here this summer.

ADELAIDE, ONT.—W. J. Zaritz is about to build a large detached residence.

ORCHARDVILLE, ONT.—Funds have been subscribed for a new Methodist church.

REGINA, N. W. T.—Mr. S. Rice will erect a number of residences this summer.

EGANVILLE, ONT.—The Council proposes to purchase a fire engine, at a cost of \$500.

GANANQUE, ONT.—An agitation has been commenced for a new high school building.

CORDEN, ONT.—Mr. Alex. McLaren, of Osceola, contemplates building a flour mill at this place.

WROXETER, ONT.—Work has been commenced on the excavations for the new Presbyterian church.

NALANEE MILLS, ONT.—The Railton Co. intend erecting a number of residences for their employees.

ROMNEY, ONT.—Messrs. Sutherland, Jones & Co. intend erecting a large saw mill on lot 23, concession 3.

DONALD, B. C.—An effort is being made with hope of success, to build a district hospital and Church of England parsonage at this place.

WATERLOO, QUE.—Messrs. Barrington, Temple and Wilson will each erect new dwelling houses.—Mr. Lawrence will shortly rebuild his store.

WALLACEBURG, ONT.—The construction of a system of waterworks is being discussed. The cost of putting in a complete system would be about \$15,000.

WHITBY, ONT.—The Town Council has selected a site on Dundas street for the new post office and custom house building, and have notified the Minister of Public Works.

THILSONBURG, ONT.—The question of erecting a High School building is being considered, the present building proving too small for both public and High School purposes.

LONDON, ONT.—The congregation of the First Presbyterian church have decided to proceed at once with the erection of a large addition to their present edifice on Park avenue.

MONCTON, N. B.—D. Pottinger, Chief Superintendent Intercolonial Railway, will receive tenders until the 26th inst for a car barge 125 feet long, for use on the Strait of Canso.

FAIRVILLE, N. B.—A number of new buildings will be erected as a result of the recent fire in this town. Mr. Masson will rebuild his carriage factory and Mr. Fair will erect a number of tenement houses.

PORTAGE LA PRAIRIE, MAN.—It is the intention of the town council shortly to call for tenders for laying about 15,500 square yards of tamarack block paving and make other improvements on Saskatchewan avenue.

PRESCOTT, ONT.—The Government will shortly ask for tenders for repainting and decorating the inner walls of the post office and court house.—A large amount of stock has been subscribed towards the erection of a grain elevator.

GALT, ONT.—Mr. R. Struthers, dry goods merchant, intends erecting a pressed brick residence on the corner of Lansdowne Road and Dickson avenue.—The Bank of Commerce contemplate making some improvements to their building, to cost in the neighborhood of \$2,500.

MONTREAL, QUE.—Four tenders have been received for the construction of the proposed electric railway in this city. They will be considered at the next meeting of the City Council. A site has been selected for the new Eskime church at the corner of St. Luke and Guy streets.

KINGSTON, ONT.—Mr. W. Snowden will erect a new brick building on Brock street on the site of the structure recently destroyed by fire. W. Newlands, architect, will receive tenders until Monday, 30th inst., for the erection of an 8-roomed public school building on Union street.

GLENBORO, MAN.—Mr. J. L. Dunford, of St. Paul, purposes erecting a 300-barrel flour mill at this place during the present year.—The Council will purchase a chemical fire engine.—The Church of England congregation will erect a new church on Broadway street. A farmer's elevator is to be erected here this summer.

VANCOUVER, B. C.—The congregation of the First Presbyterian church have approved of the plans prepared by Mr. Towle, of New Westminster, for their new church.—Steps will shortly be taken to enlarge St. Paul's church and increase the seating capacity about one-third. The Texas Lake Ice Company will erect a storage warehouse.

WINNIPEG, MAN.—It is said that a new Salvation Army barracks will be erected here this summer, to cost about \$10,000. The Exhibition Committee have decided to call for tenders for making the several additions to their buildings, a list of which appeared in the RECORD recently.—It is estimated that about three hundred residences will be erected in this city during the present year.

GUELPH, ONT.—Mr. R. E. Nelson wants tenders until to-day for the erection of a brick residence.—Mr. James Hewer, Chairman Board of Works, will receive tenders until to-day for the construction of a number of cement concrete sidewalks.—Mr. Thos. Gowdy, Glasgow street, will receive tenders until the 28th inst. for the erection of a curling and skating rink for the Guelph Curling & Skating Rink Company.

QUEBEC, QUE.—David Ouellet, architect, has prepared plans for a dwelling house for Mr. Thos. Houghton, to be erected on St. Eustache street, this city, to be 47 ft. x 32 ft., two stories, built of common and pressed brick, stone foundation, galvanized iron roof, cast iron columns, hot-water heating and ventilators, cost about \$3,500.—The Board of Trade have written to the Minister of Public Works urging the construction of a deep water wharf at the Grosse Isle quarantine station.

HAMILTON, ONT.—Another electric railway is being talked of in this city. The promoter of the scheme is Mr. Maitland Young, who proposes to build an electric railway from the north pier at Burlington beach to Port Nelson, with a spur line to the C. I. R. station at Burlington.—The City Council have decided to construct a pipe sewer on Margaret street from Main to King street, to cost \$800.—Improvements are to be

made on Mary street, to cost \$2,940.—L. Hills, architect, is calling for tenders for the erection of a flour mill.—The following building permits have been granted: The Hamilton Gaslight Company a stone building at the entrance to the gas works, on Mulberry street, cost \$2,700; Frederick Boehm, a two-story brick dwelling and shop on Main street, between Catharine and Walnut streets, cost \$1,500.—Charles Bush, two 2-story brick dwellings on Euclid avenue, between Copeland avenue and Barton street, cost \$2,000; George T. Tuckett, brick residence on King street, between Queen and Ray streets, cost \$30,000; Robert Thomson, two 2-story brick dwellings on Hannah street, between By and Caroline streets, cost \$3,000.

OTTAWA, ONT.—E. F. E. Roy, Secretary Department of Public Works, will receive tenders until the 3rd of June for the construction of a hull for a steam elevator dredge, 152 feet in length of keel and 30½ feet in breadth. Plans may be seen at the office of Superintendent of Dredging, Sorel, Que., at the office of the Public Works Department, Kingston, and at the Department of Public Works, this city.—A deputation from Deseronto were in the city recently for the purpose of urging upon the Government the necessity of granting a subsidy to the Kingston, Napanee and Western Railway for extensions of their line to Sydenham and Bridgewater.—The City Council recently received a letter from Messrs. Moodie & Son, of Terrebonne, Que., offering to remove to this city and erect large factory buildings providing the city would grant them a bonus of \$25,000 or \$30,000. The Council has decided to offer them exemption from taxation for twenty years in lieu of the bonus.—Robert Sirters, City Engineer, will receive tenders until Tuesday, 7th June, for the iron superstructure of a bridge of four spans to be erected across the Rideau river at Cummings Island, connecting the city of Ottawa and the County of Carleton.—The City Council has granted exemption from taxation for ten years to Mr. Thackeray for the rebuilding of his mills. These mills and machinery will cost in the neighborhood of \$30,000.

TORONTO, ONT.—Mr. G. M. Miller architect, wants tenders until to-day for the erection of a stable on Huron street.—A deputation of ladies waited on the City Council during the past week asking for assistance to enable them to erect a new building, for the Prison Gate Mission on Seaton street. Plans have been prepared for a building to cost \$23,000. Messrs. S. H. Blake and G. A. Cox have promised that if the Council will provide the sum of \$14,000, they will furnish the remainder.—The City Council want applications for the position of City Engineer.—James Gowanlock, Chairman Waterworks Committee, will receive tenders until Monday, 30th inst., for one ten-ton weighing scale required at the main pumping station.—The City Engineer has recommended the laying of sidewalks on various streets, to cost \$13,456.—Messrs. Smith & Gemmill, architects, 26 Bank of Commerce building, will receive tenders until to-day for the erection of a brick and stone school building for the College street Presbyterian church.—The promoters of the Infants' Home on St. Mary street are endeavoring to secure funds for the erection of a new wing to the present building.—The following building permits have been granted: George Warrell, five att. 2-story, b. f. dwellings, 152-60 Sydenham st., cost \$5,000; Davidson Todd, two pr. s. d. 2-story & attic bk. dwellings, s. w. cor. Admiral Road & Bernard st., cost \$20,000; Wm. G. Osgoodby, 5-story bk. & stone warehouse, s. side Melinda st., w. of Jordan st., cost \$30,000; Adam Beatty, addition to 89 Berkeley st., cost \$1,000; J. W. T. Harrison, det. 2-story and attic bk. dwelling, s. side Dunbar Road, Rosedale, cost \$4,000; A. E. Walker, 37 Sussex ave., pr. s. d. 2-story & attic bk. dwellings w. side Spadina Rd., s. of Dupont st., cost \$17,000; Isaac Anderson, 2-story bk. stable & coach house, rear of 140 Dowling ave., cost \$1,200; John Crouch, pr. s. d. 2-story bk. dwellings, 213-15 Euclid ave., cost \$4,000; B. G. Turner, five attached 2-story and attic brick dwellings, adjoining Salvation Army barracks Farley avenue, cost \$10,000.—It is understood to be the intention of Mr. Thos. Thompson, dry goods merchant, King st. east, to make improvements to his premises by converting them into an arcade, extending to Jarvis street.—

Rev. C. E. Thompson is about to erect a detached residence on Davenport avenue. Mr. J. A. Fowler, Elgin block, Yonge st., is the architect.—The old school building on Yonge st. Thornhill is to be pulled down and rebuilt.

FIRES.

The pulp department of the paper mills at Georgetown, Ont., was partially destroyed by fire on the 15th inst. They were owned by Messrs. Barber Bros. Loss, \$8,000.—The furniture factory of Messrs. Dowling & Leighton, at Harrison, Ont., was badly damaged by fire on Saturday last, destroying most of the machinery and tools.—A dwelling house at Coverdale, N. B., owned by E. S. Outhouse, was destroyed by fire last week. Loss \$1,600; insurance \$500.—Fire at Midland, Ont., on Wednesday last, destroyed N. Laraman's store, loss on building \$1,200; and E. O. Donohue's clothing store, loss \$1,300.

CONTRACTS AWARDED.

LONDON, ONT.—Messrs. Tambling & Jones will erect a new brick store on Dundas street for Mr. John Morman.

QUELPIH, ONT.—The Stratford Bridge Company have been given the contract to construct a bridge at Allan's dam, at the price of \$1,850.

GLENBORO, MAN.—The contract for the erection of a new school house has been awarded to Messrs. McDonald & Sifferdecker, of Bolton, Ont., at \$2,500.

NORTH BAY, ONT.—The contract for the construction of a system of waterworks has been awarded to Messrs. Garson & Purser, St. Catharines. Their tender was \$28,900.

GALT, ONT.—Mr. John Cherry has let the contract to Messrs. Griffin Bros for a two-storey residence on Lansdowne road. The building will be of red pressed brick, and will cost about \$5,000.

HALIFAX, N. S.—The contract for Mr. Cohn's new laundry building on Barrington street has been awarded to John Causey, the contract price being between \$8,000 and \$9,000.—Samuel Marshall has been awarded the contract for the new building for the Good Shepherd monastery on Quinport street. The contract price is \$18,000.

QUEBEC, QUE.—David Ouellet, architect, has awarded the contract to Mr. Jos. St. Hilarie for the inside decoration of the church of the parish of St. Lawrence, Orleans Island. Rev. W. Blais curate; value \$2,300. The same architect has awarded the contract to Mr. Alphonse Matte, of Rimouski, for the inside work of a church in the parish of the Sacred Heart of Rimouski; Rev. A. Audet, curate; value, \$8,000.

KINGSTON, ONT.—Contracts have been awarded as follows for converting the Regiopolis College into an hospital: Masonry, carpentering, painting and glazing, T. H. Fitzgibbon, Brockville; plumbing and gasfiting, McKelvey & Birch; elevator, Leitch & Turnbull, Hamilton. The work will cost about \$50,000.—Mr. W. H. Rogers, of Williamsville, has received the contract to build a grand stand, bicycle track and 2,100 feet of fence on the bicycle grounds, at the price of \$2,670.

TORONTO, ONT.—The Board of Works has recommended the acceptance of the tender of the Gutta Percha & Rubber Manufacturing Company for 300 feet of 2½ inch hose at 90 cents per foot, also that of the Toronto Rubber Company for 300 feet of 2½ inch hose at 90 cents per foot, less 10 per cent.—Mr. E. J. Lennox, architect, has awarded the contract for brickwork for the new hotel and bank building, corner King and Jarvis streets, to Messrs. Farquhar & Yorke, at the price of \$27,000, also for a factory on Duke street, for Messrs. Christie, Brown & Co. as follows: Carpentering, T. G. Gearing, \$10,000; ironwork, G. F. Bostwick, \$15,000.—The Sanson brand Portland cement, manufactured near Owen Sound, Ont., has been selected for building a new gas-holder tank to be constructed on Bathurst street, for the Consumers Gas Co., Toronto. About 7,000 barrels will be required.

The force exerted in the act of expansion of material is very great. Brick walls have sometimes been misplaced by the expansive force of a steam pipe. In many cases it is indispensable that some provision be made for such change of dimensions.

MUNICIPAL DEPARTMENT.

ROCK EXCAVATION OF TRENCHES FOR WATER WORKS PURPOSES.*

By A. L. McCULLOUGH, A. M. CAN. SOC. C. E.

(Continued from last week.)

Some distance in the rear of the drilling gang come the blasting gang who first sand pump from each drilled hole any dirt accumulation and then sponge out with a long wooden bar about one inch thick, usually of balsam or some evergreen wood with the bark peeled off, the bar also serves as a tamping bar. The sponging finished, the hole is then filled with the explosive. Judgment must be exercised in the kind, the strength and form of an explosive needed in the different classes of work. There can be no difference of opinion in the results required in trenching operations such as I am here describing—the rock must be so shattered that it can be handled with pick and shovel. In thick bedded rock a strong explosive is necessary, but in the thin bedded rock such as is met with in Galt, an explosive with 30 to 35% nitro glycerine proved sufficient for all purposes and did its work well. I do not think, though, that an easier rock for blasting than here met with is often found, nor would it be wise to use duclim or dynamite with less than 30% of nitro glycerine in its composition. The explosive used was duclim, made by the Hamilton Powder Co., put up in cylindrical paper covered cartridges about ten inches long and 1¼ inches in diameter, but furnished to order in any required size. Duclim or "false dynamite" is a mixture of nitro-glycerine with some granular absorbent of explosive substance. Fine dynamite has in it granular absorbent. The nitro glycerine undergoes no chemical change by this absorption, but retains all its characteristics—it freezes, burns, explodes, etc., under the same conditions as when in the liquid form, the absorbent minimizing the danger of explosion in transportation and handling by acting as a cushion to the nitro glycerine. The Duclim cartridges or "sticks" as they are always called by men on the work, are packed in saw dust in wooden boxes containing 25 or 50 lbs. each. Its transportation is very expensive, some of the railway companies refusing to carry nitro glycerine in any form, while with those that do it is with the following instructions: "That each car must be labelled "dangerous explosive," that cartridges must be packed in saw dust, as must also the box containing them that a man must accompany each car to its destination. The company I believe do not ship in smaller quantities than in lots of 50 cases. For these reasons dynamite is rarely used on small undertakings unless there happens to be a quantity stored in the locality. When bought in large quantities it costs about 25 cents per lb. After being brought to the place of destination, as a guarantee to the security of property, the dynamite must be stored in some isolated place; usually it will pay best to put up a temporary store house with stove for heating and shelving for spreading out the dynamite when thawing. Dynamite freezes at about 45° Fah., and when frozen is very difficult to explode, so that before use it must be thawed, which should be done gradually by spreading the cartridges out on some shelving in a warm room some distance from the fire. The dynamite cartridges are exploded by the use of a fulminating cap and safety fuse with a Siemens magneto-electric blasting apparatus. The cap or exploder used with ordinary safety fuse is a hollow copper cylinder about ¼ inch in diameter and an inch or two in length containing 15 to 20% or more of fulminate of mercury mixed with some other ingredient into a cement. The mouth of the cap is closed with a sulphur cement through which pass two fine wires about ⅛ inch apart connected in the fulminate with a fine platinum wire which is heated to redness with the current of

electricity, ignites the fulminate and explodes the cap. These exploders, called platinum caps are sold in bunches of fifty, are always kept separate from the dynamite until wanted for use, when they are fastened into the cartridge.

The electrical machine consists of a wooden box about the size of a small transit box, in the side of which are two openings for attaching the two leading wires to the exploders. From the top of the box projects a handle on a vortical bar, which is toothed and gears with a small pinion inside the box. When a blast is to be fired this handle is raised as far as it will come and then pressed down quickly, putting into operation by means of the pinion the magneto-electric apparatus inside the box, generating the electricity which is liberated the moment the handle in its downward motion strikes a spring near the bottom of the box. The electrical machine is usually placed about 60 to 100 ft. or more as the necessity of the case requires, from the blast, and is connected thereto by two cotton covered copper "leading wires."

It is always better in trenching work to fire a number of holes simultaneously thereby getting the maximum effect from each charge, the number so fired being only limited by the length of the blasting shield and of the capacity of the electrical machine. Where this is done each hole has a platinum cap inserted in its charge, and one of the short wires attached to each cap is joined to one of those of the next cap, so that at each end of the series there is one free end of a short wire to one of each a "leading wire" is fastened thus producing a circuit from the electrical machine. The electrical machine size No. 3 weighs about 16 lbs. and costs about \$25.00, while the next size costs about double that. After each hole is sponged out it is loaded with the dynamite. The paper covering to the cartridges or sticks as the men call them, should be slit open the whole length with a sharp knife thereby allowing the dynamite to get free and to thoroughly fill the hole when pressed down with the wooden tamping bar. This operation should be repeated with each stick. When within two feet of the surface a half stick with exploder attached is put in with another stick on top of that, the top of the hole is then filled with sand tamped solid, when the hole is ready for the charge, and such a charge will let daylight into any rock. A half dozen of these holes charged simultaneously will break the rock almost as fine as macadam for a length of fifteen to twenty feet, so that the men can handle it entirely with pick and shovel. The results may be better illustrated when I explain that according to the specification no rock greater in weight than 50 pounds is to be returned to the trench, and we had no trouble in enforcing it; for the simple reason that there were rarely any left to go back. With such a blast then as this; in order to prevent injury to person and property on the public streets from scattering stones and debris, it was necessary to cover the blast. The method of covering with loose timbers, brush, etc., might possibly do with an exceedingly light blast or with work in the open country, but on public streets lined with houses with people constantly passing and repassing, some method more economical of time, more satisfactory and secure in its results is necessary. For the purpose the contractors used a shield made on the following simple principle: 5 oak timbers 12 x 12 and 20 feet long placed side by side and thoroughly bolted together, forming a platform 5 feet wide, sheeted on the bottom and sides with ¾ inch boiler plate riveted into one piece and with the timbers thoroughly bolted together. The shield weighed about 5 tons and did its work most effectively. By its use the contractors could load each hole to the surface without fear of results. I have yet to hear of any person who was injured in any way during the construction of the works, and probably not more than a half dozen window lights were broken after the first week's

* Paper read at annual convention of Association of Provincial Land Surveyors of Ontario.

MUNICIPAL ENGINEERS, CONTRACTORS, AND MATERIALS.

use. Notwithstanding the immense weight of this shield it was on a number of occasions thrown high enough into the air to come down reverse side up. It will be readily understood how a blast with such lifting power would shatter the rock fine enough to be shovelled and that too with very little use of the pick. The width of trench so shattered was seldom more than 4 feet and never wider than the five feet to prevent the use of the shield.

From its weight and form this shield was very difficult to handle, but by the use of two pairs of wheels that could be readily detached and removed from danger when firing a blast, there was very little loss of time in moving it forward its own length into position for the next blast. These wheels were 60 inches in diameter made on the same principle as the ordinary cart wheel, the wheel was two and one quarter inches thick, four inches wide, covered with a tire one half inch thick. The axles were of machinery steel three inches square, five feet in length between inside of hubs, and seven feet four inches in length over all. At its centre for a length of sixteen inches this axle was widened to six inches, and had an opening four inches by two and one half inches, through which passed a square threaded screw one and one-half inches in diameter and three feet long with a swivel link attached to the lower end of the screw for linking into a hook in the shield. This screw has no direct connection with the axle but passes through a nut with both ends working on the axle, with journal caps bolted to the axle keeping it in position, thus giving it a side swing motion, the axle giving the forward and back motion. When brought into use the wheels are run into position at the front and rear end of the shield and each screw is linked to the hook on the shield, which by means of a hand wheel eighteen inches in diameter at the upper end of the screw is screwed up from the ground until suspended from the axle by means of these two screws. The whole is then moved forward, the wheels running on planks on either side of the trench. When over its new position the shield is lowered over the trench by the screws, the wheels detached and removed until wanted to again move the shield forward after the blast.

By means of this shield five men could blast in about 2/3 of a day what the two drills would cover in one day, so that it was not kept continuously in use. It was easily moved in continuous trench blasting, but when moved any distance to a new street was trouble sure enough, for as each set of wheels was entirely independent of the other, they could not be guided when drawn by a team, for the wheels would persist in going any way but the right way, in just about as helpless a fashion as a man without a backbone. In moving the shield then to a distance, it was necessary to do so by hand, laying down planks for the wheels to run on with a man at each wheel, a rather slow operation, but one which was so seldom required that it did not prove a great inconvenience. But this difficulty might be overcome if it was often necessary to move the shield any distance at a time, as it seldom was on this work.

Drilling operations commenced about the middle of April and were carried on continuously thereafter with 25 steam drills until the middle of August in doing about 25000 lineal feet of trenching with a probable average of about 5 feet in depth of rock. Part of the time, for a few weeks when running day and night, there was drilled, blasted, excavated with pipe laid complete, about an average of 400 ft. per day. With trench well opened ahead so as not to delay pipe laying, the biggest day laying of 12 inch pipe in a rock trench was about 380 feet of six inch pipe, about 120 feet including hydrant, settings, etc. The biggest day's pipe laying of 8 inch was 710 feet without any hydrant settings.

It was impossible, however, to keep a pipe laying gang continuously at work using only two drills, so that the average day's pipe laying on each size pipe was much smaller than the above. Usually when the pipe gang caught up to the blasting gang they were shifted to some contiguous street in an earth trench and kept there for some days, allowing them to have a good clear run in the rock trench before commencing again.

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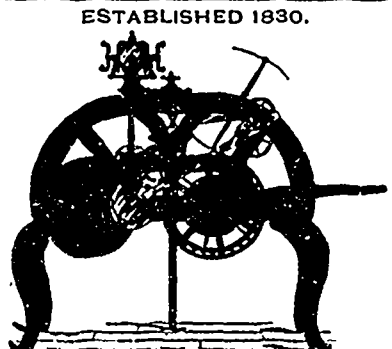
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Table listing building materials and their prices for Toronto and Montreal, including items like lumber, stone, and roofing.

Table listing building materials and their prices for Toronto and Montreal, including items like cement, iron, and hardware.

Table listing building materials and their prices for Toronto and Montreal, including items like nails, sheet metal, and structural iron.

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