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CANADIAN CONTRACT RECORD

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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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NOTICE TO CONTRACTORS

Tenders will be received by registered post only, addressed to the City Engineer, Toronto, up to 11 o'clock a. m. of SATURDAY, THE 15TH OF FEBRUARY, 1896, for the supply and delivery of

2350 Feet of Steel or Cast Iron Pipe,

6 feet in diameter, with the necessary flexible joints. Specifications and plans may be seen at the office of the City Engineer, Toronto, on and after Wednesday, the 11th inst.

A deposit in the form of a marked cheque, payable to the order of the City Treasurer, for the sum of 2½ per cent. on the value of the work tendered for, must accompany each and every tender. Otherwise they will not be entertained.

Tenders must bear the bona fide signatures of the contractor and his sureties or they will be ruled out as informal.

Lowest or any tender not necessarily accepted.

DANIEL LAMB,
Chairman Committee on Works.

Toronto, Dec. 3rd, 1895.

TENDERS WANTED

Sealed Tenders, whole or separate, will be received by the undersigned, up to and including

Saturday, February 15th, 1896,

for the various trades (except painting and glazing) required in the erection and completion of a Residence in the Town of Smith's Falls, according to the plans, specifications, contract, etc., of JAMES A. ELLIS, Architect, 4½ Adelaide St. E., Toronto.

Said plans and specifications may be seen at the offices of the Architect and the undersigned.

Satisfactory security will be required. No tender necessarily accepted.

F. T. FROST,
Smith's Falls, Ontario.

TO CONTRACTORS

Tenders will be received until 17th inst. for the erection of a

Large Brick Factory

for the Cobban Manufacturing Company, Ltd., on the corner of Lake and Lorne streets.

Plans, specifications, and all other information can be had at my office.

E. J. LENNOX,
Architect.

A NEW METHOD OF MAKING METAL PIPES.—Consul Monaghan, of Chemnitz, reports, June 16, that Laval in Stockholm, has invented a machine for making pipes without the welded seam. The mandrel inserted between two rotating rolls is fitted, at the point where the pipe is formed, with two opposite or adjacent right-angled or nearly right-angled corners, and the rolls are fitted to correspond. In this way the form-giving parts of the rolls, when producing pipes of nearly the same thickness of material, can retain sufficient strength.

THE QUALITY OF GALVANIZED IRON.—The attention of a writer in the Tradesman has recently been called to the decrease in strength of iron after being galvanized. Some very interesting tests were made in this direction. A dozen eye-bolts, all precisely alike so far as could be perceived by external inspection, were carefully selected. Six of these eye-bolts were laid on one side, and the other six sent away to be galvanized. A testing machine was not at hand, but the six bolts were connected together, one being connected to each of the ungalvanized ones. Then they were placed between two pieces of iron and the nuts screwed up until the eye-bolts broke. Invariably it was found that the galvanized eye-bolts were the ones to break; not in any instance did the ungalvanized bolts give way.

CONTRACTS OPEN.

ORILLIA, ONT.—Geo. McCormick proposes building at once.

FULLARTON, ONT.—L. Seebach will build a flax mill in the spring.

COLCHESTER SOUTH, ONT.—E. Beeman will build a residence next summer.

LISTOWEL, ONT.—The by-law has been carried to establish a House of Refuge.

ST. ANNE DE LA PERADE, QUE.—The bridge across the St. Anne river has been carried away.

SUSSEX, N. B.—It is said that Mrs. McLean will greatly enlarge the depot house next spring.

ST. JOHNS, Nfld.—Two competing companies are applying for a charter to construct an electric railway here.

KINGSTON, ONT.—The by-law to raise \$20,000 to build a new school was carried by the ratepayers on Monday last.

SARNIA, ONT.—Johr. Dalziel, County Clerk, invites tenders until the 17th inst. for the purchase of \$16,000 of debentures.

BRANTFORD, ONT.—The new school building for which the ratepayers are asked to provide funds, will cost \$19,000.

WEST ZORRA, ONT.—Mr. Dunlop is preparing to build a stone house in the spring and Mr. McLeod a brick residence.

WINNIPEG, MAN.—Another opera house project is spoken of, several capitalists having offered to subscribe sufficient funds to erect a suitable building.

AMHERST, N. S.—T. E. Bunker, of Kingston, Ont., is endeavoring to secure the necessary stock to start a vehicle factory here. The capital required is \$50,000.

WEST SELKIRK, MAN.—It is the intention of the town to proceed with the erection of an \$8,000 school building in the spring. Rev. C. R. Littler can give particulars.

NIAGARA FALLS, ONT.—The by-law to expend the sum of \$109,000 on a sewerage system has been carried. \$40,000 will be for trunk sewers and \$69,000 for laterals.

SIMCOE, ONT.—N. C. Ford, Town Clerk, will receive proposals until the 16th inst., for the purchase of two lots of local improvement debentures of \$5,327 and \$1,352, bearing interest at 5 per cent.

WINDSOR, ONT.—The Boxstal property at the corner of Windsor avenue and Sandwich street, Windsor, has been purchased by Patrick Navin, who will erect on it a brick block containing stores and offices.

ST. HENRI, QUE.—Councillors Leduc, Derome and Berard have been appointed delegates to wait on the authorities of the Grand Trunk Railway Company with reference to the proposed new station and freight shed.

CAMPBELLTON, N. B.—The Restigouche and Bonaventure Bridge and Railway Co. is applying for incorporation,

to build a railway and highway bridge across the Restigouche river, from Campbellton to Mission City.

LONDON, ONT.—McBride & Jones, architects, are asking for tenders until the 11th inst. for the erection of a brick cottage in East London.—The Western Fair by-law, granting the sum of \$25,000 to the directors for improvements, has been carried.

HARRISTON, ONT.—The building committee of the Harriston Lodge I. O. O. F. have instructed Geo. Gray, architect, to prepare plans for a two storey brick block, with stone basement, to have stores on the ground floor, and lodge rooms on the second floor.

NEW WESTMINSTER, B. C.—The City Council has again taken up the question of constructing a bridge over the Fraser river. The Provincial Government has made a grant of \$126,000, and the Dominion Government will be asked to grant 100,000. D. Robson is city clerk.

ARNPRIOR, ONT.—A public meeting to discuss the question of waterworks was held last week, at which the opinion seemed to prevail that the scheme could not be carried out at present.—Mr. Beatty, C. E., of Ottawa, last week surveyed the site for the new post-office to be built here. The information secured is for the use of the architects in preparing plans.

TORONTO, ONT. The Property Committee have recommended that new buildings be erected and repairs made to the Yonge street wharf at a cost of \$8,600.—Acting engineer Rust has recommended the construction of a 24 foot asphalt pavement with stone kerbs on Berkeley street, from the north side of Gerrard street to the south side of Carlton street, at a cost of \$5,630.

HAMILTON, ONT.—The city engineer states that the extension of the west end sewer on Robinson street to James street, and the completion of the Wood street sewer between John and James streets, are works of great necessity, and should be proceeded with as soon as possible. He also considers it necessary to make repairs to the inverts of the brick sewers on James and Catharine streets.

ALEXANDRIA, ONT.—The new Dominion reformatory will be proceeded with at once. Tenders for the dome and one of the wings are advertised for, and will be let by contract. The dome will be between 80 and 100 feet square, and the wing 100 feet long and two stories high. There are to be five wings, each of 150 feet in length, and the cost of the one to be let immediately will be about \$150,000. The building is to accommodate over 1000 convicts.

HALIFAX, N. S.—A project is on foot to transfer Rhodes, Curry & Co.'s car works from Amherst to this city. A free site of twelve acres of land has been offered.—Re proposed immigration buildings in this city, Mr. C. E. W. Dodwell, engineer in charge, writes: The buildings will be of wood, two storied portion, 160 x 50 ft. on solid cribwork, one storied portion, 160 feet long x 14 to 42 feet wide, on creosoted piles; estimated cost \$30,000. Tenders close Jan. 15th.—The city invites tenders until the 13th February for the supply of 2,000 barrels of Portland cement. Address F. W. W. Doane, City Engineer.

OTTAWA, ONT.—W. H. Cuddie is excavating for a four-storey furniture storage building on Albert street. The contracts for the completion of 47 miles of the Ottawa, Arnprior and Parry Sound railway between the eastern and western portions of the line, will likely be let this month.—A movement has been started to establish a coffin manufactory here. The promoters are gentlemen from Niagara Falls and Carleton Place and a leading undertaker. Exemption from taxation

will be asked for, and if granted construction will be proceeded with. An expensive iron and woodworking plant will be required.

ST. THOMAS, ONT.—E. R. Cameron, of London, the electric railway projector, accompanied by Mr. T. H. Smallman, the well known London capitalist, went over the proposed route to be taken by the railway. It is understood that Mr. Smallman and other moneyed men will be induced to take hold of the scheme.—A by-law to issue debentures for \$3,000 to build a bridge at Palm street, forming a second link between the north and south sections of the city, was carried at the municipal elections.

FIRES.

Thibault & Brober's sash and door factory at Montmagny, Que., has been burned. Loss, \$6,000.—A large block at Montreal West, Que., containing the post office and several stores, was burned on December 31st.—The car sheds of the Oshawa Electric Railway Company were burned on the 2nd inst. Loss on buildings, owned by Wm. Thomas, \$2,000.—A large portion of the village of Drummondville, Que., is reported to have been wiped out by fire. Total loss, \$100,000; partially covered by insurance. The residence of E. Marshall, at Langton, Ont., was destroyed by fire on the 30th December. Insurance, \$400.—J. D. Williamson & Co.'s large dry goods house at London, Ont., was almost completely gutted by fire on Saturday last. The building was owned by the J. D. Williamson Estate, and was insured for \$9,000.—A building on Adelaide street west, Toronto, owned by D. M. Defoe, was badly damaged by fire last week.—The Royal Canadian Yacht Club's building at the foot of York street, was burned on Monday last. Loss, \$8,000; covered by insurance.—Sheriff Proctor's brick residence about one mile east of Brighton, Ont., has been burned. The storehouse and office of the Holland & Emery Lumber Co., at Wahnapiatae, Ont., were consumed by fire recently.—The residence of Thomas McKay, at West Prince Albert, Ont., has been burned.—John Tweed's hotel at Elmvale, Ont., was destroyed by fire on Monday last. Loss partially covered by insurance. He will rebuild at once.—The flour and carding mills of Louis Carle at St. Ursule, Que., were burned on January 4th. Loss, \$10,000; insurance, \$4,000.

CONTRACTS AWARDED.

WALLACEBURG, ONT.—The Town Council has disposed of \$16,000 of debentures to G. A. Stimson, of Toronto.

WINDSOR, ONT.—John Davis has secured a contract from the G. T. R. authorities to erect a building on Sandwich street, three stories high and 90 feet long.

MONTREAL, QUE.—It is announced that the Montreal Bridge Company have given the contract to a New York syndicate to construct a bridge over the St. Lawrence from Montreal to Longueuil, the cost of which, including the terminus, will be about \$6,000,000.

ST. JOHN, N. B.—J. H. Noble has been awarded the contract for the plumbing and heating apparatus of the new Manchester, Robertson & Allison building on Germain street, also for the plumbing and brass finishing work in the new Hotel Aberdeen office. The brass finishings are to be provided by T. McAvery & Sons.

W. Leek & Co. has succeeded Wm. Leak, plumber, Vancouver, B. C.

E. E. Gilbert & Son, contractors, Montreal, have dissolved partnership.

Joseph F. Lelanger, painter, Ottawa, is reported to have assigned for the benefit of his creditors.

NEW COMPANIES.

BRANTFORD ONT.—Bain Waggon Co., incorporated; capital \$25,000.

ST. CATHARINES, ONT.—Power Rope & Belting Co., incorporated; capital \$20,000.

THESSALON, ONT.—Algoma Copper Mining Co., applying for incorporation; capital, \$1,000; to engage in the business of mining, etc.

USEFUL HINTS.

Maple is not so light as generally supposed, weighing 46.87 pounds to the cubic foot, a little more than locust or hickory.

ENGINEERING CALCULATIONS.—In an article in the Practical Engineer for November 29th, A. H. Barker argues that many expensive mistakes in the drawing office would be avoided if engineers would bestow a little more thought on the method of their calculation. The habit of carrying calculations on paper to a greater degree of accuracy than is absolutely necessary is worse than useless to an engineer, both because it is a waste of time and because attention bestowed on the decimal places is apt to be withdrawn from the all important hundreds and thousands, not to mention the position of the decimal point. Thus, if an accident happen owing to a certain stress having been written 4563.52 instead of 45635.2, it is a very sorry satisfaction to reflect that all the figures were correct. It is in general true in engineering that if calculations are correct to 1 per cent. it is amply sufficient, because the actual conditions under which machines or structures are used in practice can rarely be estimated even to this degree of accuracy.

THE METROPOLITAN CONCRETE AND WIRE FLOOR.—Among the numerous flat and fireproof floors designed for use in modern buildings in order to allow of greater spans between the floor beams than would be practicable with brick jack arches, and to effect a lighter and cheaper construction than with such arches, the "Metropolitan" system is singled out for description and illustration in the Engineering News of November 14th. Across the floor beams are stretched small wire cables, like fence wires, each composed of two galvanized wires twisted together, the distance between these cables varying to the load for which the floor is designed. Round bars are then laid across the cables, parallel with the beams, and halfway between them, thus giving a uniform deflection to the cables. Forms, or centres, are then placed under the cables, and a composition consisting principally of plaster of Paris and wood chips (in proportions of 75 and 25% by weight) is poured on, the cables being thus embedded in the concrete mixture, which solidifies in a few minutes. The vertical part of the concrete, enclosing the floor beams, is supported by wire netting passed around the flanges of the beams.

The firm of J. Brunet & Son, contractors, Montreal, is dissolved. Mr. J. W. R. Brunet will do business under that name alone.

INFLUENCE OF COLOUR ON HEALTH.

The influence of colour on health is not understood as it should be by the general public. A writer recently called attention to the impropriety of employing large masses of depressing and cold French grey on the walls of school rooms and other public buildings, protesting that this colour exerts a baneful influence on the mind, and that it is not cheaper or neater, or more cleanly than half a dozen other tints that might be used. And such a circumstance would be impossible if the public were educated to the right use of colour. French grey is a mixture of white, Prussian blue and vermilion, or of white, lampblack and Indian red, all in certain proportions, but with the cold blue or black predominant. Blue possesses in the greatest degree, the quality technically called coldness in colouring, and it communicates this property variously to all colours with which it is compounded. Orange is the complimentary of the cold blue, and represents the maximum of the heat attained by the gradually ascending series of warm colours. Midway between the cold blue and hot orange the medium is found at purple yellow and yellowish-green. Having ascertained what are cold and what hot colours, it is easy enough to arrange suitable colourings for the interiors of buildings of any kind. A room done in warm or hot colours always possesses a cheerful, inviting appearance. Done in cool or cold colours it seems cold and uninviting. And not only seems so, but is so, as has been demonstrated by experiment. As great a difference as four degrees of violet and red by passing the prismatic colours slowly and gradually before a finely graduated thermometer at the bulb.

In hot weather cool colours are useful. Then soft and delicate shades of green and greys in which blue or green predominate are the most grateful to the eye. Such colours are restful, and to the normal eye especially agreeable. But public places and buildings sheltering patients suffering from various mental or physical diseases should use such colours at all seasons as especially fit the nature of the patient's ailment. Where it is well to excite the imagination the reds will be found useful; for the hypochondriacal, yellow is good, while for the convalescing and those suffering from certain maladies, where it is desirable that the mind should be soothed and rested, the blues in various tints may be used.

REMARKABLE FEAT IN BUILDING MOVING.

A very remarkable feat in building moving was recently performed at Jamaica Station, on the Providence division of the New York, New Haven and Hartford railroad, when the large factory of the Sturtevant Blower Works was moved four hundred feet without stopping work in the building. An interesting part of this work, to the electrical interests in particular, is the fact that the work in the three-story building was carried on during

the entire time while the building was being moved, except on the lower floor, which being laid on the ground, necessitated the removing of all the tools from that floor, the second story, in which a part of the smaller steel plate blowers are made and tested, and the upper story, in which blast wheels and other blower appurtenances are built, were kept running all the time during the moving process.

An electric motor of about twenty horse power was located in the second floor of the building, and belted to main line of shaft.

On this floor was erected a reel of wire, one end being connected to the motor, and the other end to the generator set in the engine room, and as the building was moved the wire was unreel, and in this way an electric current was furnished for the driving of the motor at all times during the moving of the building. The building is one hundred and seventy-five feet long, fifty feet wide and three stories high, with brick walls twenty inches thick at the first floor and sixteen inches thick at the second floor, with a heavily timbered and monitor roof, and is one of the largest and heaviest buildings ever moved in New England. The speed in moving was at the rate of about sixty feet per day.

It is believed that this is the first instance of any building being moved while the work was carried on in it at the same time. Especially interesting is the fact that the building is so large and heavy, and was so successfully moved under the conditions that would not have been possible except by means of electricity.—*New Ideas.*

EGYPTIAN BRICKS.

Egyptian bricks were generally crude, mixed with straw and dried in the sun, says Architecture and Building. Kiln burnt bricks were occasionally used in foundations, quays, the raised terraces on which the towns were built, or in any situation where they would be exposed to frequent contact with water. The crude bricks were about 15 inches in length, 7 inches in breadth, and a little more than 5 inches in thickness; this simple material was found to be peculiarly suitable to that dry, hot climate, where rain scarcely ever falls, and were further recommended by the ease and rapidity with which they could be made. The brick fields afforded abundant occupation for numerous laborers, and the demand was so great and the trade so profitable that the Egyptian Government took it into their own hands and considerably increased the revenue by this monopoly. In order to prevent unau-

thorized persons from engaging in this manufacture, a seal containing the name of the king or some other privileged person was stamped upon the bricks before they were dried; numerous bricks thus stamped, have been found at Thebes and elsewhere. According to Vitruvius, crude bricks should only be manufactured in spring or autumn, in order that they may dry slowly; those which are made in the heat of summer speedily dry outside, while the inside remains moist; the brick thus becomes defective and easily gives way. He further observes that bricks ought to have been dried five years before they can be considered fit for use, and that their having been so should be certified by a magistrate. If these rules originated with the ancient Egyptians, it is probable that the stamp before mentioned may also have been a warrant of the solidity of the bricks.

USEFUL HINTS.

American pine when green weighs forty four pounds twelve ounces to the cubic foot. When seasoned, its weight is reduced to thirty pounds eleven ounces.

A cubic foot of the best English oak when green weighs seventy-one pounds ten ounces. When seasoned, the wood is reduced to forty three pounds eight ounces.

TRANSVERSE STRENGTH OF BRICKS.—The value of knowing the transverse (as distinct from the compressive) strength of bricks was never better exemplified than at the present time, says the British Clayworker. The drought of the past summer has led to considerable "settlement" in houses in various parts of the country, especially those built on soil clay. The result of the unequal strains produced by this movement has naturally tended to form large cracks in the walls, and these do not always follow along the mortar joints, but frequently pass through the bricks. It is often stated that no practical results accrue from knowing the strength of a brick. In proof of this we are told that the strain that is brought about by the weight of the superstructure of an immense building like that of St. Peter's at Rome, for example, is not sufficient to crack any but the very poorest class of brick; the inference is that, for ordinary buildings, practically any kind of brick will do, so far as its "crushing weight" is concerned. But though this is perfectly correct so far as actual compressive strength goes, it will not hold good for transverse strength. Hardly any results have been published on the latter; our knowledge is sadly wanting in that respect.

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MUNICIPAL ENGINEERS, CONTRACTORS AND MATERIALS**BUILDING CONTRACTS.**

When a building must be speedily completed it is generally easier to attain that object by putting the whole contract into the hands of one man. Two contractors, responsible only to the owner and jealous or indifferent in regard to each other's interests, always charge each other with the responsibility for the delays which usually occur under such circumstances, and the owner finds it difficult, if not impossible, either to enforce his contract as to time of completion or to collect indemnity for the delay without doing injustice. Where, however, the time is not restricted to the shortest possible space, most architects will agree that the best results are obtained by making at least four separate agreements—the cellar work and grading forming the subject of one; the carpenter work, including painting and glazing, of a second; the brickwork and plastering of a third; and the plumbing of the fourth. It is often desirable to make a fifth agreement for the painting and glazing; but if the carpenter is trustworthy, there is generally some advantage in allowing these to be included in his contract.

By the system of separate contracts better work is usually to be obtained in each branch, and, considering its quality, at a cheaper rate; although speculative builders have ways of making sub-contracts at prices which seem incredibly low to those who are not familiar with the difference between the good and the "jerry" style of work. The best mechanics always prefer to treat directly with the owner; they are in this way sure of their pay, and can therefore afford to work at a lower rate; while the owner saves the percentage of profits which the principal contractor feels himself entitled to charge upon the tenders made to him by his sub-contractors. Whatever mode is adopted, too much care cannot be taken to have the plans and specifications as full and explicit as possible. If these are what they should be, a building, so simple as a dwelling house can be, and generally is, when the owner knows his own mind in regard to the kind of house he wishes, and takes the trouble to see that the plans express it, carried out to completion without any "extras" whatever; generally to the great surprise of the proprietor, who is sure to be informed by volunteer counsellors before he begins operations that his extra bill will inevitably be "at least as large as the contract price;" That he "ought to restrict the architect to half the sum that he intends to spend," and so on.

We make separate contracts for the cellar work, the carpentry, the brickwork and plastering, and the plumbing, and have also selected a good furnace, and arranged with the makers to put in the requisite pipes and registers in the best manner when the proper time comes, under a guarantee that the apparatus shall heat a given number of rooms to a temperature of seventy degrees when the thermometer outside stands at 0 degrees, without taking air from the cellar or any

other part of the house, and without regard to the direction of the wind.

Occasionally the heating apparatus is included in the principal contract, but this is most unwise. As with plumbing, the work to be done is so difficult for anyone but an expert to understand and criticise, and the difference between good and inferior work is so great in value, even more than in cost, that it should never be made the interest of any man to get it done as cheaply as possible.

CURIOUS BRICK CONSTRUCTION.—The London Architect and Contract Reporter is authority for the following description of arch building in Turkey: At Bassara, where they have no timber but the wood of the date tree, which is like a cabbage stalk, they make arches without any frame. The mason, with a nail and a bit of string, describes a semi-circle on

the ground, lays his bricks, fastened together with a gypsum cement on the lines just traced, and having thus formed his arch, except the crown brick, it is carefully raised and in two parts placed upon the walls. They proceed thus till the whole arch is finished. This part is only half a brick thick, but it serves them to turn a stronger arch over it.

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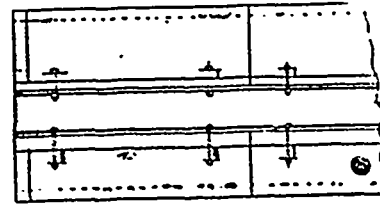
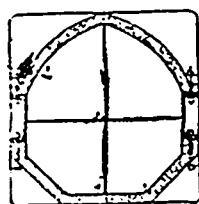
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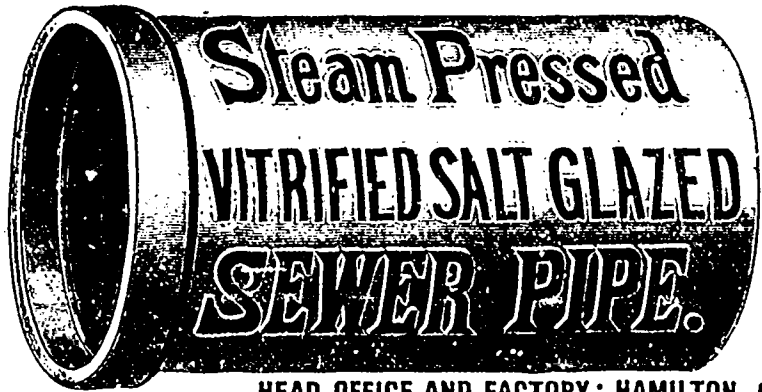
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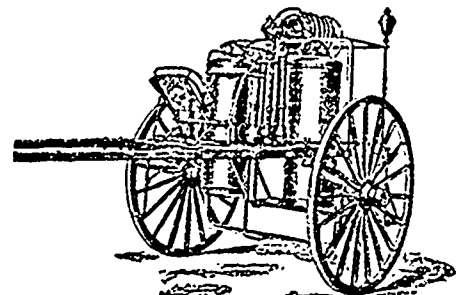
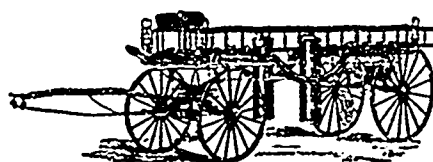
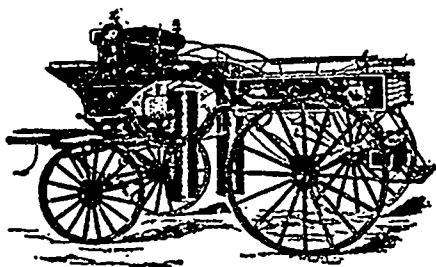
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MUNICIPAL DEPARTMENT

THE INVESTIGATION OF PUBLIC WATER SUPPLIES.

By FRED DAVIS.

(Continued.)

From whatever source a public water supply is derived, it should be borne in mind that it will not remain constant in purity throughout a whole season, for there are fluctuations depending upon rainfall, temperature, season, vegetable and animal contamination, and communication with other morbid agents. These variations and probable degree of contamination of the public water supply should be investigated by the health officers, city physician, or other responsible and capable person, who should communicate his results to the people; and these investigations should extend to the surface wells and other sources of water, which the more ignorant and less fortunate classes are often compelled to use. It is a comparatively easy matter for one somewhat skilled in scientific manipulation to make a few qualitative tests that will enable him to determine with considerable accuracy whether or not a given water is badly polluted. For such examination I usually recommend two tests, one for chlorine and the other for decaying organic matter.

In most parts of the country away from the sea and salt wells the purest ground and surface waters do not contain more chlorine than suffices to give, with a solution of silver nitrate, a faint opalescence. In testing water with this reagent, its action on a sample of known purity near by should be determined, to use as a guide in comparing other water. And, whenever an experimental sample shows a decided milkiness with this reagent, then sewage contamination is to be suspected, in proportion to the amount of the precipitate; for sewage, dish water, cess-pool drainage, and other similar polluting agencies generally contain much chlorine. This test is also a valuable means of detecting drainage from a privy vault into a well. It may be made by first determining the degree of opacity produced in the water by this reagent, and then throwing about 50 lbs. of salt into the vault, together with several barrels of water. After a few days, again examine the well water with a silver solution, and, if there is a noticeable increase of chlorine, contamination is quite certain, because the salt, which contains this element, has probably washed from the vault into the well. This method of testing gives results which will frequently surprise those unfamiliar with the subject.

Decaying organic matter is never found in appreciable quantity in pure water. If to a glassful of such water a few drops of sulphuric acid and a few drops of a dilute solution of potassium permanganate be

added, a permanent pink color is produced; but, if the water contains decaying organic matter, then the pink color becomes fainter and finally disappears. In the hands of an expert this is an important test, but it cannot be relied on with a novice, since ferrous sulphate, hydrogen sulphid, and other reducing agents, sometimes present in water, produce similar results. But, when a water shows an excess of chlorine and bleaches potassium permanganate, it is certainly suspicious, and should be analyzed by an expert. My advice in all cases where persons seek counsel is to make the experiments given above, and, if the results are not satisfactory, to send the water to an experienced chemist, with necessary information regarding its source, and have a thorough analysis made.

The most extensive investigation of the quality of a water supply involves questions of a chemical, microscopical biological, and physiological character, together with an examination of the surroundings of the source of supply; and in all this much depends upon the judgment and experience of the analyst, for water analysis is certainly among the most delicate of all chemical operations, and its proper interpretation requires great experience. The chemical analysis should determine the present and past pollution of water, and distinguish between vegetable and animal matter; the microscope should reveal floating substances, like fragments of hair, excreta, and other filth derived from surface drainage or sewage, which show at once that the water containing them is loathsome and unfit for domestic use; the bacteriological investigation should be for the purpose of detecting infectious germs, but it is more frequently to determine the number of micro-organisms in a given volume of water; while the physiological test should be made in order to afford opportunity for studying the effect of the water on the lower mammals. Since bacteria are now believed to be the direct or indirect agents of all zymotic diseases, the determination of the conditions favorable for their development, as shown by the chemist, or of their actual existence in water, as shown by the bacteriologist, is the real aim of sanitary water analysis. Without discussing the relative importance of the chemical, microscopical, bacteriological, and physiological examinations, it is only necessary to say here that, whenever a chemical and microscopical analysis reveals an excess of filth or sewage in a water, its use should be discontinued without further investigation; for the time required for a thorough bacteriological analysis renders such too expensive for general use, to say nothing of the common failure to recognize the infectious germs. The most experienced water analysts look more to the chemical and microscopical results than to the bacteriological, because the chemical and microscopical methods of study are highly perfected, while the bacteriological methods are yet in a chaotic state so far as utility is concerned.

It is my opinion that the past history

and associations of many waters are often sufficient to condemn them, no matter how free they may seem to be from organic impurity; and it is not always necessary to make a laboratory investigation to condemn some of the polluted ones. Then, too, every analyst knows, or should know, the importance of having a thorough knowledge of the surroundings of the source of supply, before giving an opinion of the quality of a water for drinking; and I believe that no competent chemist will claim that a water high in chlorids and nitrates, although organically quite pure, is good, without a knowledge of the agencies which may pollute it. Inexperienced chemists are in error in sometimes relying wholly, in testing a water, upon the Wanklyn process, which determines the free and albuminoid ammonia, but gives no knowledge of its past history, or of the products of oxidation of its organic matter. Any analyst who finds a water contaminated beyond a reasonable limit of safety is justified in condemning it; but, because he may fail to find any of the immediate products of decomposition of organic matter, he would not, in my judgment, be warranted in pronouncing such water good, unless he knows that such products have never existed in it; for it frequently happens that a water having direct communication through the soil with cesspools and privies has but little organic matter in it. The same is true when lime is used to disinfect a privy-vault. In all such cases the amount of chlorids and nitrates in the water is excessively high, and generally the total solids and loss-on-ignition are also large. Still, this is not different from what we often find in good mineral waters; and a chemist who relies solely on his laboratory determinations might claim that such water is good and safely potable, while in fact it may be a most dangerous beverage and badly infested with disease germs. Thus it is that an opinion of the quality of a water should be given only after a careful consideration of the surroundings of the source of supply. More than this, I believe that no chemist should, and no experienced reputable chemist would, venture a decisive opinion as to the purity and wholesomeness of a water supply for a city or town without a personal inspection of the topography of the surrounding territory. It is unwise, it not impossible, to predicate an opinion upon the investigation and report of inexperienced men, or to determine the present and prospective soil pollution without a personal inspection of the entire drainage area.

England formerly led the world in the investigation of public water supplies, but in recent years Massachusetts has given us classic results in this as well as in the filtration of water; so in this country we are just beginning to realize that pure water, which was once the luxury of the few, is now the necessity and pleasure of the many. The benefits which have resulted from these and other investigations are attested by the healthful development and increased civilization of our race; for it is now admitted by all competent judges that the progress made by the inhabitants of manufacturing towns, in decency, cleanliness, self-respect, and morality, since the introduction of a pure public water supply, is as striking as the improvement in their health, which shows that pure water is a great moral as well as hygienic agent.

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