

PAGES

MISSING

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For the benefit of Advertisers, a copy of this Journal is mailed each week to persons mentioned in the CONTRACT RECORD reports as intending to build, with a request to consult our advertisement pages and write advertisers for material, machinery, etc.

Retirement of Mr. Fuller.

ADVERTING to the reference contained in our last issue regarding the superannuation allowance of Mr. Thos. Fuller, late chief architect of the Dominion Public Works Department, it has since been learned that it is not Mr. Fuller's intention, as stated in that article, to bring up in Parliament the question of his allowance. We cheerfully make this correction lest the publication of the statement should in any way prejudice Mr. Fuller's chances of receiving an allowance commensurate with his lengthened and valuable services.

Queen's Park Improvements.

THE City Council and citizens of Toronto are to be congratulated upon the transformation which is being effected as the result of recent expenditures for the improvement of Queen's Park. As the site of the Legislative and several university buildings, and surrounded by handsome residences, this park is visited by most travellers who come to the city. It is therefore an important factor towards enhancing or retarding the city's fame. For a number of years past, its condition has been little better than a common, and in consequence the city's reputation has suffered. Last autumn the City Council was induced to appropriate twenty-five or thirty thousand dollars for the improvement of these public grounds. Under the direction of Ald. Hallam, Chairman of the Parks and Gardens Committee, and Mr. Chambers, Superintendent of Parks, this money is apparently being laid out to good advantage, and the park is beginning to assume an appearance which is creditable to the city and in keeping with the character of public grounds in the large cities of America and Europe. It is to be hoped that the citizens will heartily co-operate with the authorities in enhancing and maintaining the beauty of these and other public grounds throughout the city.

Decoration of the New City Buildings at Toronto.

THE City Council of Toronto have declined at present to accept the offer made on behalf of various art societies of a scheme of mural decorations for the new city buildings. Several well known artists, selected by these societies as competent to design and execute work of this character, at the expense of a great deal of thought and effort have elaborated a scheme of decoration which is intended to be illustrative of the history of the city and province. The purpose is that this scheme should be carried out gradually, by native artists, in

such a way as to form when complete an harmonious whole. An offer was made to the Council to execute a first instalment of the scheme, viz., the Council Chamber, entrances, etc., at a cost slightly exceeding what would be required for decorative work of an ordinary character. It is to be hoped that the proposal of those who have this undertaking in hand may yet be accepted and carried out. The time has come when Canadians should, as far as their resources will allow, exercise regard for what is aesthetic as well as what is purely utilitarian. We are rapidly making history, and it is due to our future greatness and the interest of coming generations that the notable events of the past and present should be perpetuated in our public buildings and monuments. Only once or twice in a century are buildings of such importance as these likely to be erected, and the opportunity should not be allowed to pass of making them an object of the greatest possible interest. Probably in no other way could this object be better fulfilled than by the proposed series of historical paintings.

Building in
Toronto.

BUILDING operations in Toronto give promise of being on a more satisfactory scale than there was reason to anticipate earlier in the season. In contradistinction to last season there is comparatively little work being done on the line of erecting new or repairing old business premises. The concentration of business due to the development of departmental stores, has been an important factor in restricting expenditure for alterations and repairs to store property. The bulk of the work in progress this year relates to the construction of new residences of a substantial character, which in most instances are designed to be occupied by the owners. The prevailing low price for real estate, building materials and labor, has no doubt had a considerable influence towards inducing those who have the means to erect for themselves homes suited to their tastes and requirements. The present cost of building is stated on good authority to be from one to four cents per cubic foot less than the ruling figures of six or seven years ago.

An Apartment House
for Toronto.

A PROPOSAL has recently been made looking to the erection of an apartment house on the lines of those which have been built in New York and other large American cities. Articles have recently appeared in the newspapers in which the opinion is expressed that there is pressing need for such a building in Toronto. The writers state that the cost of living could be greatly reduced by means of this Bellamy plan as compared with the present method of each family occupying and maintaining a separate establishment. There is doubtless some ground for this contention, but those who advance the argument have either overlooked, or have purposely kept in the background the many disadvantages of living in apartment house flats as compared with individual houses. The high average of health and comfort which prevail in Toronto to-day is due in large measure to the fact that it is a city of individual homes, and that surrounding each home is sufficient open space to afford recreation for the children and fresh air for all. We do not believe that any considerable number of the citizens will attempt to effect a small saving in cost of living at the expense of present advantages. The meagre attendance at the meetings called by the promoters of the apartment house enterprise appears to bear out this view of the case.

ILLUSTRATIONS.

CHURCH AT QUEBEC.—VALLEE & TANGUAY, ARCHITECTS.
VIEWS AT CREDIT FORKS MINING AND MANUFACTURING CO.'S QUARRY, CREDIT FORKS, ONT.
DESIGN FOR THREE HOUSES, SCOLLARD STREET, TORONTO.
—DICK & WICKSON, ARCHITECTS.

A PROPOSED SIX-ROOM COTTAGE TO BE BUILT IN COL-
LINGWOOD, ONT.—FRED. T. HODGSON, ARCHITECT.

SYNOPSIS OF SPECIFICATION: Cellar to be six feet in the clear, and to be excavated under dining room and kitchen only. Quarried stone to be used in foundation walls.

Superstructure to be baloon frame, composed of 2 x 4 scantlings. To be boarded diagonally on the outside with hemlock or pine 1" boards, and horizontally on the inside with common inch lumber.

Building paper or felt to cover all outside boarding, including roof, before siding or shingles are put on.

Outside to be covered with No. 2 siding and picked shingles. To be shingled with No. 1 cedar shingles laid 5 inches to weather.

Sashes in dining room, parlor, kitchen and front chamber to be double-hung and furnished with sashlocks and lifts. Small panes in all sashes to have assorted colored glass.

All outside doors to be 1 3/4" thick, inside doors to be 1 3/8" thick.

Cellar floor to be of concrete and cement, finished off smooth, and to have weeping tiles underneath for drainage.

Lower joists to be 2" x 10", second floor joists to be 2" x 8", and to be bridged every 8 feet of their length.

Ceiling posts to be 2" x 6", rafters, cellar beams and ties to be formed of 2" x 6" stuff. All inside studding in partitions, etc., to be 2" x 4" scantling.

Parlor to be finished throughout with good seasoned cherry, oak or black birch, including mantel and overmantel. Bevel plate mirror in overmantel in parlor not less than 20" x 32".

All other wood finish to be of pine or elm.

Floor in kitchen to be of hardwood—birch or maple; other floors to be: First story, pine; second story, pine or basswood.

Closets provided with shelves, drawers and wardrobe hooks. Fit up pantry with shelves, drawers, bins and china closet.

Fit up bath room—Victoria metal tub and necessary appliances for hot and cold water.

Provide water-closet with all necessary requirements.

Build chimney stack from cellar floor, containing three flues. Form in stack: two fire places, one in parlor and one in dining room. Provide grates for same with tile-facings and hearths. The one in dining room to cost not less than \$18.00 complete, and the one in parlor to cost not less than \$25.00 complete. Stacks to be built of hard-burned bricks. Chimney top to be of design as shown on drawings. Flues to be well and smoothly parged.

Lath and plaster in usual way, plastering to be three coat work. Run beads on margin of arches and on all projecting angles in inside walls. Run cornice 9" x 11" in parlor.

Paint all woodwork inside and out, not otherwise provided for, three coat work with white lead and linseed oil paint, and in such colors as may be determined upon. Hardwood finish in parlor to be filled, finished in "hard oil" and rubbed.

All glass to be of approved quality, to be "putty set" well fastened in sashes with zinc points and evenly glazed.

Hardware (specified) to be of good quality and approved.

Workmanship in all departments to be good and honest and of a durable quality.

The architect states that this cottage can be built and completed in good style for from \$1,200 to \$1,600, according to locality, amount of plumbing, style of finish and quality of materials employed in its construction.

It is convenient, not lacking in tastefulness, and well suited to the wants of a small family of limited means.

CONCRETE AS MADE ON THE TRENT CANAL.*

By H. F. GREENWOOD, M. Can. Soc. C. E.

BEFORE beginning the paper proper, it might be well to mention when and how concrete has been utilized on the great canal works of Canada. These will be taken somewhat in the order in which they were built.

In the first enlargement of the Welland Canal, the foundations of the locks were generally made of concrete and timber. Concrete was used very extensively in foundations, when the Lachine Canal was enlarged, and also in the locks along the Ottawa River. The canals along the St. Lawrence River, between the head of the Galops Rapids and the foot of the Cornwall Canal, have concrete and timber foundations in all their locks, some of these bottoms containing as much as 2,000 cubic yards of concrete. Then the Sault Ste. Marie lock advanced concrete a step by showing its utility as a material for backing walls. It was also used in foundations and culverts at the same place. But the Soulages Canal is really the pioneer as regards concrete for walls. Here the entrance piers, (about 1,100 feet in length) at the head of the canal are made of crib-work as high as the level of low water mark. After these cribs had properly settled, a wall of concrete eight or nine feet high was built upon them. Besides being very substantial, this has proven a success and looks quite as well as masonry. When the work on this canal was let, alternative bids were asked for masonry throughout and for concrete walls faced and coped with cut stone. Which of these kinds of work will be used the writer cannot say.

This brings us to the Trent Canal structures which were built wholly of concrete, no stone work being used at all. The concrete works constructed during the season

of 1896 were on the Peterborough-Lakefield division, of which the writer has charge. This division consists of sections Nos. 1 and 2, with a firm of contractors for each section.

The work on section No. 1 consisted of one lock, and the concrete in connection with two dams which were in the course of construction across the Otonabee River, for the purpose of raising it to the proper level for navigation.

The concrete works on section No. 2 consisted of the following:—Pivot piers and abutments for two swing bridges, abutments for one high level bridge, these latter abutments being 33 feet above the bottom of the canal, concrete in connection with a pipe culvert which conducts a creek under the canal, and concrete walls in two water tight embankments.

The writer proposes to give, as briefly as possible, a description of the methods used and the precautions taken in constructing some of these works.

The specifications state that the contractors shall supply at their own cost, all plant, labor, moulds and materials necessary for the satisfactory execution and completion of the works, with the exception of the cement, which is supplied by the government.

SAND AND GRAVEL.—Extreme care was used in selecting the materials for concrete. The sand and gravel

for section No. 1 were hauled in the winter, and were not at all difficult to find, as the conical and hog's-back hills in the vicinity are formed of these materials. Yet to find them free from clay, and to get coarse, sharp and well proportioned sand caused some delay. The contractors sub-let this to the surrounding farmers and local men with teams at so much per cubic yard delivered on the works. Samples were brought to the engineer's office by these people, and it was some weeks before the proper kind of sand was obtained. The well-intentioned sub-contractor thought that what he dug out should go into his sleigh box and none be wasted. So it was necessary to put an inspector at the pit to see that earthy matter, very fine sand and clayey gravel were all rejected, as it would be much more difficult to detect these after the material had been hauled to the works.

On section No. 2 the sand and gravel were obtained in a similar way; and, as the work progressed, delivered by dump-wagons at the side of the mixing platforms. These self-dumping wagons were of advantage to the contractors for this purpose, as they carried large loads and saved delay in emptying. Hauling the material as it was required saved moving it a second time; but unless the contractor had his own teams and wagons he could not be sure of a constant supply.

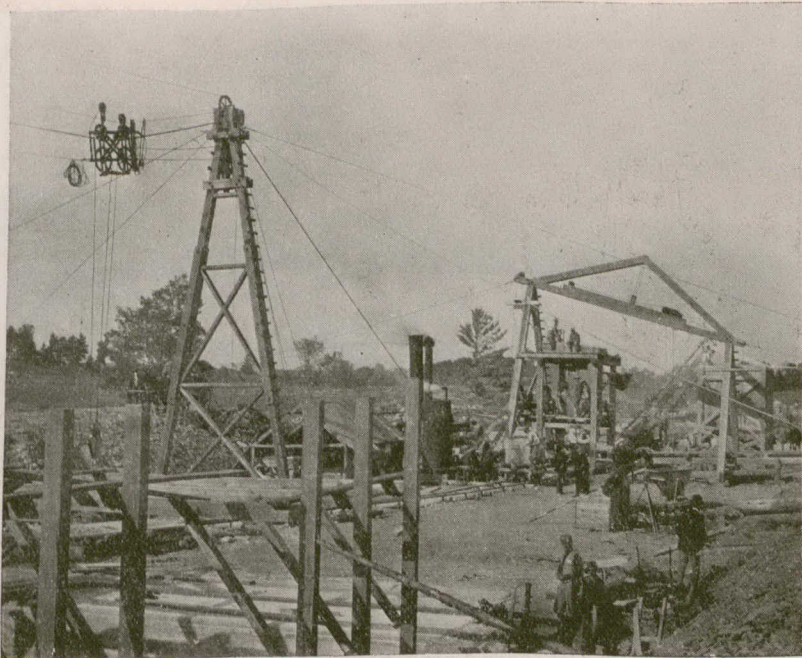
The following table is the result of sifting samples from two different grits:

	Residue on 400.	R. on 900.	R. on 2,500.	Passed 2,500.
1st samp. ...	19%	51%	22%	7%
2nd samp. ...	8	42	38	12

Both of these have given good results.

CEMENT.—The cement for the season was let by contract, to be delivered in cars at the railway siding nearest the work, where it was handed over to the contractor. One of our Canadian firms, the manufacturers of the Star brand,

secured the contract, but they were not able to keep the works supplied and also satisfy the demand from outside customers. The consequence was that after a time they supplied us with the Condor and Jossion brands of Belgian cement. All cements were subjected to the following tests:—Color: the cement to be of a uniform quality and of a light gray tint, after being made into thin cakes and exposed to the air, and in no case must it show yellowish blotches. Weight: the specific gravity to be not less than 3.1. Tensile strength, per square inch of section, to be as follows: neat cement after three days 250 lbs., seven days 400 lbs., twenty-eight days 550 lbs. Fineness: All cement to be ground of such a fineness that 90% of it passes through a sieve of 10,000 holes to the square inch. Soundness: This was determined by the Fajjas apparatus. All pats when subjected to a moist heat of 110° Fahr. and warm water, to show no signs of blowing, for 24 hours after the tests were begun. All the above mentioned brands gave good satisfaction, but the Star brand was found to be more finely ground than the other cements. Unlike the other brands, it was supplied in "jute" sacks, which were found by the contractors to be more easily handled when using the mixing machine; but the writer considers that there is more waste, as a certain amount remains in the sack when emptying them. Six samples of cement were taken from each car as soon as



CONCRETE MIXER.

* Paper read before the Engineering Society of the School of Practical Science, Toronto, and reprinted from the copyrighted report by permission of the Society.

it arrived in Peterborough, and these had to pass the following tests, viz., sifting, specific gravity, and blowing, before the car could be sent to the contractor's siding, where it remained until the three-day test for tensile strength had been made. If this proved up to standard, the car-load could be transferred to the cement-shed erected by the contractor close to the railway siding.

BROKEN STONE.—The specifications called for this to be free from earthy matter and to pass through a two-inch ring. The crusher used on each section was well adapted for the work it had to do. On section No. 1 they used a "Blake" jaw crusher to break the selected stone from the excavated limestone strata. On section No. 2 a "Gates" crusher of coffee-mill type was used, and there the stone were principally hard-heads from the fields, or boulders from the excavation. The jaw crusher on section No. 1, run by steam, crushed about 150 cubic yards per day, while with the machine on section No. 2 electricity was used, and a cubic yard of broken stone was obtained in $3\frac{1}{2}$ minutes.

MOULDS.—The moulds for shaping the face of the lock walls were made by placing braced rectangular frames every five feet apart, and arranged so as to extend across that part of the lock for which they were intended. When they were in place, three-inch planed plank with half-inch lap joints were spiked to the vertical pieces and thus formed the face of the wall. Moulds of unplanned boards, made like very long doors and placed end to end on edge, formed the back of the wall. These moulds, the same height as the proposed steps, were braced from the face of the excavation.

The moulds for the concrete, placed in front of the timber dams, were made in a similar way. In order to avoid sharp edges, mouldings with radii of from two to four inches were placed at all exposed angles less than 120 degrees.

For the bridges, the water-tight embankments, etc., the moulds were formed of scantling and plank placed in the same way as the moulds for the face walls of the lock, but were held in position by braces from the surface of the ground. Nearly all the face walls of bridges were built to a batter; whereas those of the locks were built plumb. In the high level bridge the moulds at the back were held in position by iron rods passing from front to rear of wall.

METHODS OF MAKING CONCRETE.—On section No. 1 the concrete for the locks was mixed by machinery and that for the face of the dams by hand.

The mixing machine consisted of a cubical sheet-iron box revolving on its diagonal axis about six feet above the ground. This box was held up by a framework which also supported a platform above the box, and let into this platform was a hopper for receiving the materials. In the rear of the mixer was a crusher with a carrier leading from it into a large box hoisted on posts, to receive the broken stone. The stone was let out of this box, by a small sliding door, into a car that held one cubic yard of stone. The stone was then taken by car and dumped into a large oak box, holding $1\frac{1}{4}$ yards, placed near the mixer. The cement which had been deposited on a platform close at hand was dumped in upon the stone. Then the sand and gravel, brought in from the sand pile by another car, was dumped in last

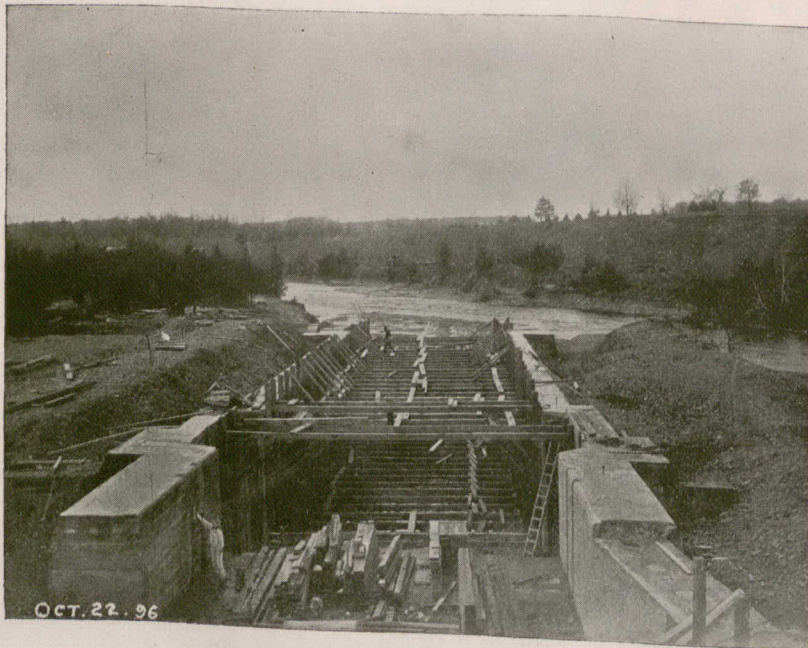
and about filled the box. The box was then hoisted and the contents dumped in the hopper. A barrel on the platform of the hopper was kept filled with water by a force-pump at the river bank, and from this barrel a graduated tub was filled to the required height. When everything was ready the door of the cubical box was opened, and, when the slide door of the hopper was shot back, the tub of water was poured in as the materials were falling through in the mixer, which was then closed and revolved. It was found necessary to strike the mixer with mallets to keep the materials from sticking to the sides. After about sixteen or seventeen revolutions, the mixer was stopped and the concrete dropped into a box on a flat car beneath. It was then conveyed to the cableway, hoisted and run into the lock where, for the foundation, it was dumped, spread out in a layer of eight or ten inches and well rammed. For the walls the face was formed of mortar of proportion two to one, and two to five inches in width, as the case required, placed against the face mould, and this mortar was backed up by concrete in eight to ten inch layers, well rammed. Where bolts were built into the concrete, for the purpose of holding the wallings or iron casings, a three to six inch square turn was made on the end imbedded, which gave the bolts an L-shaped

appearance; the other end of these bolts had a nut and washer on them. This arrangement was continued throughout, and a three-inch layer of mortar properly smoothed over formed the coping. By this process a cubic yard was manufactured every five minutes. The best ten hours' mixing was 140 cubic yards.

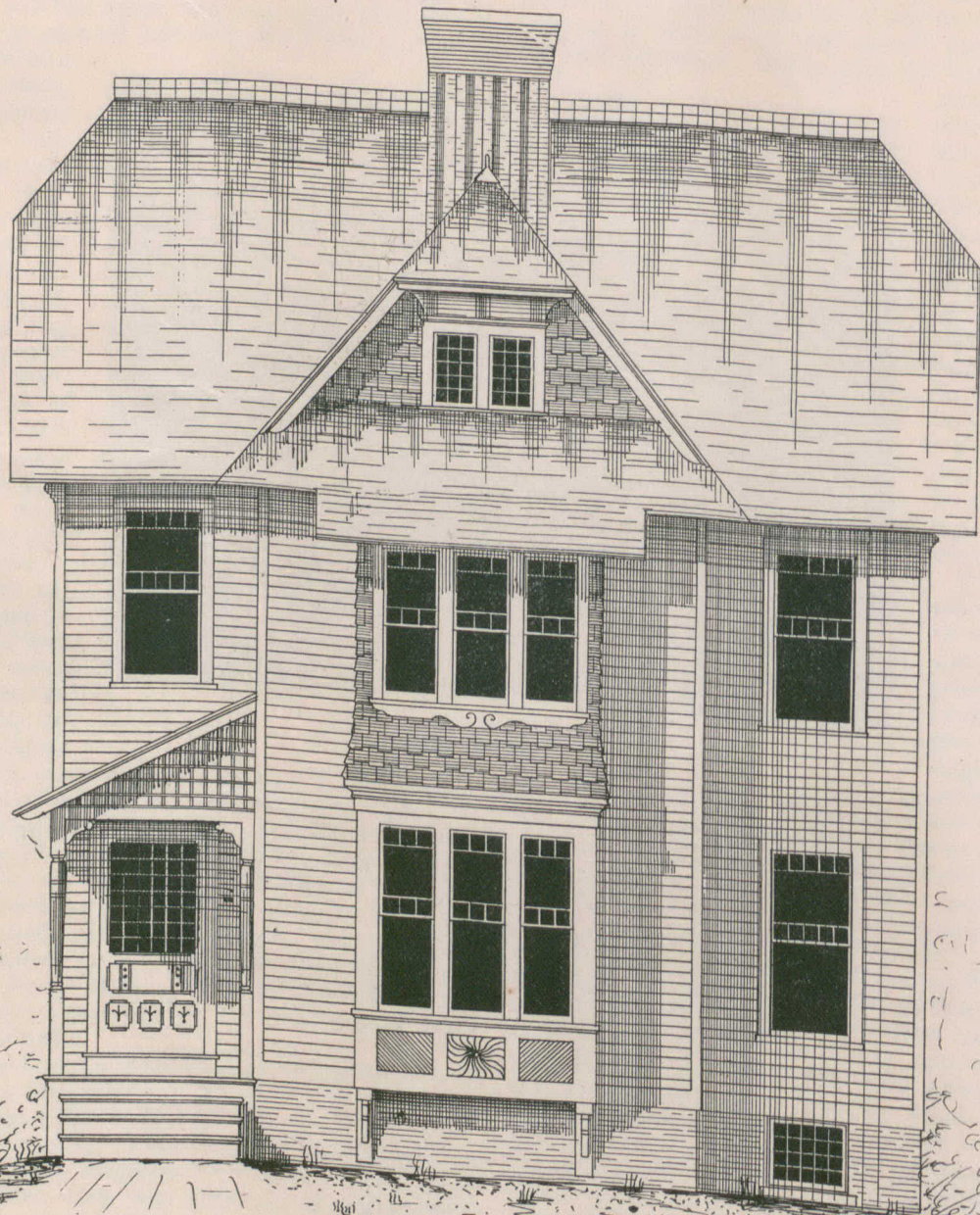
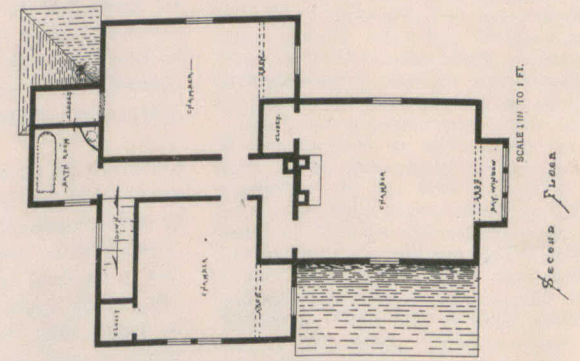
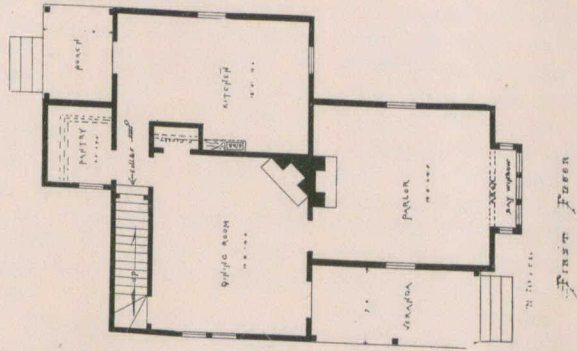
The concrete on section No. 2 was all mixed by hand, and here the proper proportions of cement, sand and gravel were thoroughly mixed together on the plat-

form and spread out. Clean water was now added and the mass well worked with hose. Broken stone was then spread over this and the whole turned over twice. It was then put into barrows, wheeled and dumped into work, where the layers were well rammed, and the face of the wall treated as on section No. 1. The concrete along the face of the dams on section No. 1 was made and put in place in a way similar to that on section No. 2, except where it had to be placed in three or four feet of water, and then the following apparatus was used, viz.: a galvanized sheet-iron tube about one foot in diameter, and long enough to stand, when vertical, about two feet above the water. The upper end of the pipe was funnel-shaped. When the concrete was mixed it was shovelled into the tube, and, when this was full, it was raised about one foot and moved about. This allowed the concrete to slip down and more was added. Thus the concrete was put in without becoming saturated, as after the tube was once filled its contents did not come into contact with the water until it had left the bottom of the tube, when it was in the place intended in the wall. After a few days an examination showed that this concrete was quite satisfactory.

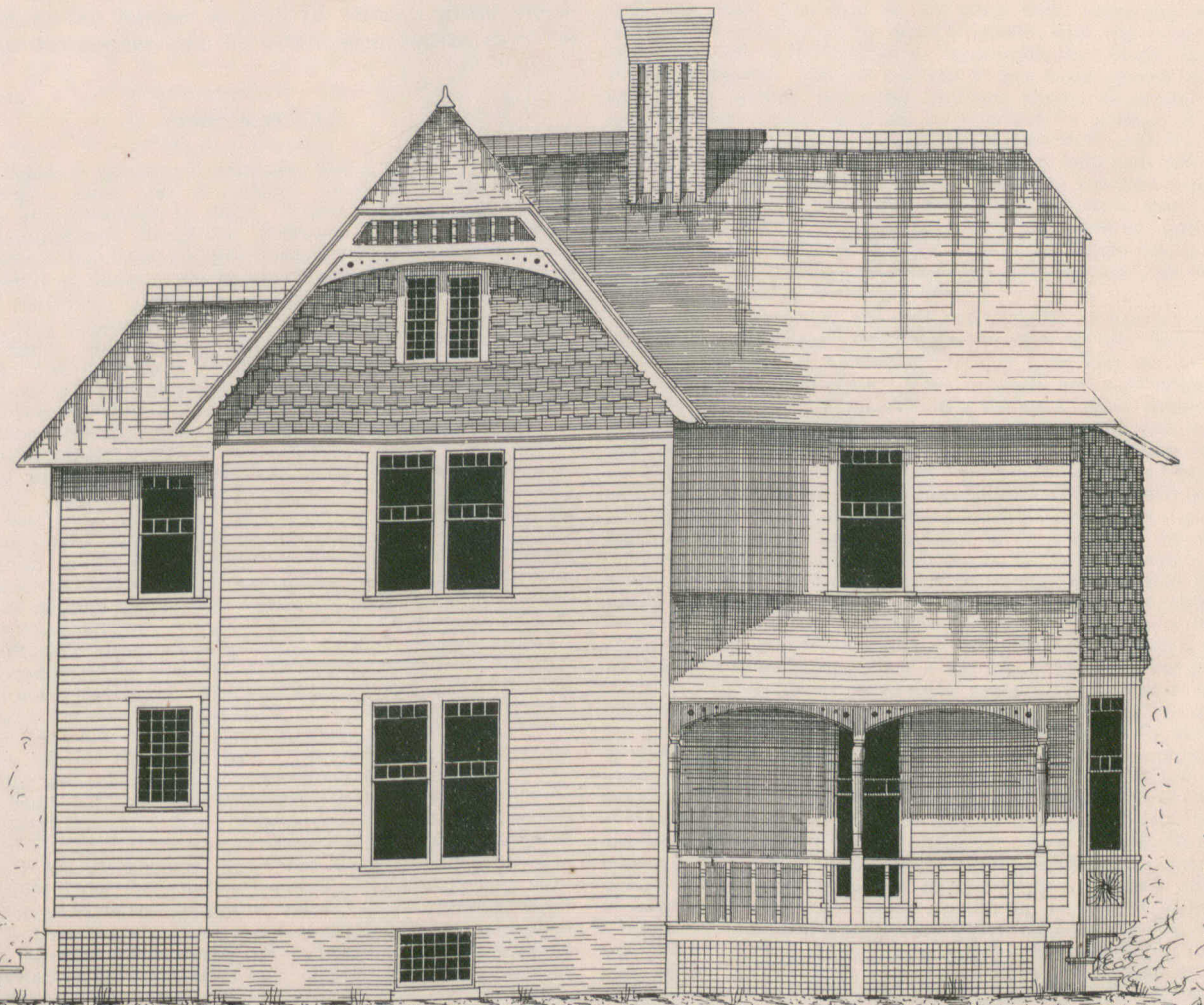
On section No. 1 a portion of the stone was much finer than the size called for, and consequently less gravel was required. After several trials it was found that the following proportions were most suitable, viz.: One part cement, two parts sand, two and one quarter gravel and seven of broken stone. On section No. 2



CONCRETE LOCKS, SHOWING MOULDS.



FRONT ELEVATION



SIDE ELEVATION

A PROPOSED SIX-ROOM HOUSE AT COLLINGWOOD, ONT.
 FRED. T. HARRIS, ARCHITECT.

there was a less proportion of finely broken stone, and hence it will be seen that more gravel had to be used. The parts here taken were: cement, 1; sand, 2; gravel, $3\frac{1}{2}$, and broken stone, 7.

REMOVAL OF MOULDS.—The moulds for the smaller walls were not removed until after five or six days, and those of the higher, and, consequently, heavier walls, were kept on for several weeks.

After the removal of these moulds the walls present a very fair appearance, although there were occasional small projections where the plank had drawn apart and mortar had worked in; but these were easily removed with the edge of the trowel. The outlines of the plank were left visible, and gave one the impression of masonry courses. Where there were pine knots in the plank an impression of these knots was left on the wall, and these spots were found not to have hardened like the rest of the surface. However, a wash of water and cement, with which the faces of nearly all the walls were treated, remedied this.

ADVANTAGES.—About 11,000 cubic yards of concrete works were built during the season, and in the same classes of work the cost was not over two-thirds that of masonry. Its advantages are cheapness, expediency, the utilization of the ordinary laborer instead of the skilled mason and stone-cutter; and, besides these, the stone is more easily found. The use of this class of stone has a tendency to beautify the surrounding country, as the farmer is paid to remove those objectionable stone-piles one so often sees dotted over his farm.

CONTRACTS.*

By R. J. EDWARDS.

NOT being a lawyer, I naturally feel a certain diffidence in attempting a paper on a subject involved in legal complexities and obscured in what, to the lay mind, appear to be many contradictory decisions. Perhaps the first solid ground one reaches is that it will not do to assume a thing is certain because it is stated in so many words in a text book on the law relating to building contracts. One must read on and turn back, consult all possible and impossible decisions relating to the matter and go over it again. At this stage one may take encouragement from a remark made by the late Sir John Thompson, and coming from a great lawyer it is of especial value in this connection. He said "no one was so likely to be mistaken as the man who was cock sure." Some one may ask, "why not give it up and insist on having all contracts prepared by lawyers." Well, I have seen it stated in the *Building News* that that was the practice in a certain city in Scotland, while in an adjacent city it was the rule with the architects to do it themselves, and it was said that in the former place there were floods of litigation in connection with building contracts, while in the latter place the stream was an exceedingly small one and was in danger of drying up entirely. Perhaps, long ere this, enough decisions have been recorded in the flood city to clear up all possible doubts and the inundations have become a thing of the past, and the wisdom of the lawyers has been demonstrated in our generation if not in their own. The best book on contracts I know of, is entitled "A Treatise on the Law of Building and Buildings," especially referring to building contracts, &c. It is by Mr. A. P. Lloyd, of the Baltimore bar. The frequent references to English law and cases, together, of course, with American, make the work more valuable to us here than any purely English work, as decisions in our courts have been more or less influenced by the findings of United States courts. If there is a Canadian work of the kind I do not know of it. I may mention that I shall frequently quote from Mr. Lloyd's treatise. In his preface he says "while the plan of consulting a lawyer before entering into a contract is always advisable, it is a fact that attorneys sometimes omit, or wrongly state, important provisions. Many instances could be cited where legal lights have unintentionally transformed proper contracts into faulty ones, leading to legal complications, etc." This he ascribes in part to lack of proper attention on the part of text-writers to the subject of building contracts.

This, I think, will support the contention that the architect is really the person who ought to prepare the contracts, as he knows thoroughly what is intended to be accomplished. With us the object of a contract is to make it possible to insist that the plans and specifications are faithfully carried out in their entirety, with the least risk, or if possible, none at all, of litigation should it become necessary to enforce the correction of defective work or to employ other builders to complete the contract if neglected or abandoned by the original contractor. With this view our friends of the legal profession, I have no doubt will agree. To attain this object something more is necessary than the mere insertion of a number of clauses in the contract giving the architect unheard of and arbitrary powers, and imposing penalties on the contractor. It has been well said that "nothing is settled until it is settled rightly," and if a contract is to stand if attacked in the courts it must be drawn up with reference to the accepted

principles of law and in the light of experience gained by the study of decisions.

The plans and specifications shew and state in detail what is to be done, and no form of contract, however carefully drawn, can make up for defects or omissions therein. As the contract, therefore, is of little or no account without the specifications, there are the best of reasons for combining the two in one document. We all know that a slight difference in wording between the specifications on the one hand, written by the architect, and the contract on the other hand, prepared, I suppose, by the then City Solicitor, led to long and costly litigation as to the proper form of the notice dismissing the contractor for the new City Hall and Court House. If, however, the architect is to undertake the preparation of the contracts, it is not saying too much to assert that the client has as much right to demand knowledge and skill in the work as in the making of the plans and specifications.

Assuming that the plans and specifications are comprehensive and complete, what is necessary to be added to or incorporated in them to make the contract complete? The specifications will have already described the kinds and qualities of the materials. The contractor undertakes to carry these out, and it remains to provide against possible shortcomings or neglect on his part, and for payments on the part of the owner.

There are complications which experience has shewn are sure to crop up, such as settlements for extras and omissions and so forth. The ever-changing lien act is sometimes a cause of trouble; I do not feel competent to say anything about its provisions, but I may venture the assertion that if one keeps back plenty of money it will not cause inconvenience. There should be a clause in every contract providing that no extras shall be allowed or paid for unless the same have been authorized by an order in writing, signed by the owner, and stating the amount to be paid therefor. When this is done nothing but the written order will support the claim. Another clause should be inserted providing that where such an order is given, but the parties fail to agree upon the sum to be paid for the extra work contemplated, the work shall nevertheless be done forthwith, and the valuation of the same left to the architect. In practice this would rarely be found necessary. Where the extras are to be covered in each case by a written order the architect should be careful not to sanction any extra work not so provided for, because the contractor would perhaps fail to recover for such work even if assisted by the architect's certificate, for it has been held that where the contract provided that no extras should be incurred without a written order of the owner's engineer, the extra work done during progress, particulars of which were stated upon the certificates issued from time to time by the architect, was not authorized, and could not be recovered for, as these certificates were not counted as written orders.

A clause in a building contract providing for arbitration is considered, by Mr. Lloyd, to be objectionable, for the reason that the architect is the natural and proper arbitrator and in every way competent to decide. This supports the contention that every contract ought to contain an arbitration clause making the architect sole arbitrator in cases of disputes or doubt and binding both parties to the contract to accept his decisions without appeal. Such a clause will hold good, but it may be said it should be acted on promptly. His decision, in the absence of fraud, will be conclusive; but in a California case, where the contract stipulated that all disputes should be settled by the architect, the parties refusing to submit to his decision and he did not act in the matter, it was held that his testimony was not conclusive and that it was competent for the plaintiff to show by other persons the extent of the deficiencies. An arbitration clause will not confer on the architect any power to change the terms of the specifications without special authority, nor will his power as arbitrator permit him to give a certificate when there has been a substantial deviation from the owner's plans. An architect, however, occupying the position of an arbitrator is not liable to an action for refusing to reconsider his certificate or give the grounds of his opinion, no fraud or collusion being alleged, nor is any person called upon to act as arbitrator liable to an action for alleged want of care or skill or negligence. It will thus be seen that an architect who is arbitrator occupies a good position in regard to both client and contractor to check any desire on the part of either to get up a law suit owing to stubbornness or bad temper. If he is capable as an architect he will be quite capable as an arbitrator, and as he will be fully acquainted with every phase of the dispute, he will be far more likely to decide justly—especially as he can be coerced by neither party—than a court where at least half the testimony must be considered untrustworthy before a decision can be arrived at.

The architect's position is much strengthened as an arbitrator by the insertion of a clause making his certificate a condition precedent to the payment of money. In such a case the contractor cannot sue the owner without complying with this condition unless the same can be proved to have been fraudulently or capriciously refused. The decision of a party passing upon work may of course always be impeached for fraud or mistake.

There should be clauses providing for the dismissal of the contractor for neglect or abandonment of the work and there might with advantage be a clause conferring power on the architect to correct minor defects, where there is neglect or refusal, and charge the cost to the contract, without having to go the length of dismissing the contractor. Such action might be limited to a sum to be agreed upon not to be exceeded in any single instance.

To enforce the completion of the work within a limited time it is usual to insert a clause naming a certain sum to be allowed or paid to the owner for each day's or week's delay in finishing the work beyond the date agreed upon. Sometimes this sum is

* Paper read before the Toronto Chapter of Architects.

called "liquidated damages," at other times it is a "penalty." There is a very fine distinction between these two terms. If it chances to be of the nature of a penalty, but the contract states distinctly it is "liquidated damages, agreed on by the parties, and is not in the nature of a penalty," it will make no difference in the interpretation the court will put upon the matter. Where the amount stated to be paid is evidently what the parties assess the damages caused by the breach of the contract, the stipulation will be upheld as liquidated damages, but where the object is to secure its performance by the imposition of an amount in excess of the loss likely to be sustained it will be considered a penalty and will not be enforced. It will not be difficult in most building contracts to fix beforehand the amount of liquidated damages and if an honest attempt has been made to ascertain the fair and proper amount even where there is more or less uncertainty it will be recoverable as liquidated damages.

In the case of a dwelling the probable amount of the rent that would be received may be taken or the owner may have sold the dwelling in which he was living at the time of making the contract and may have rented another. In any case the object ought to be to put the matter in such shape that there will be little likelihood of an attempt being made to drag it into court. It would seem that if the damages named are in the nature of a penalty, they cannot be enforced without applying to the courts. If they are really liquidated damages there is small chance of the amount being attacked.

At some future time I may attempt to draft a model contract, for discussion on the lines roughly laid down in this paper. For the present, though I have not exhausted the subject, I think I have covered the main points to be embodied in a working contract for everyday use.

THE CREDIT FORKS STONE QUARRIES.

SITUATED at Credit Forks, Ont., on the Orangeville branch of the C.P.R., about forty miles from Toronto, are the quarries from which the celebrated Credit Valley stone is obtained. This stone has a wide reputation owing to its adaptability for building purposes, and the interest taken therein by architects and builders justifies a brief description of the quarries and the method of developing them.

The quarries were first opened about seventeen years ago by Messrs. Scott & Pattullo and K. C. Chisholm, ex-M.P.P., of Brampton, who operated them in a moderate way for a number of years. In the year 1890 the property was purchased by Messrs. Carroll & Vick, of Toronto, they having the contract at that time for the Parliament buildings in Toronto, which were built of Credit Valley stone. This firm proceeded to operate the quarries on a more extensive scale, and as the stone became better known a much greater demand was the result. In the spring of 1896 the firm name was changed to the Credit Forks Mining & Manufacturing Company, Ltd., Messrs. Carroll and Vick still retaining the largest interest. The officers of the company are: R. Carroll, president; J. B. Vick, 1st vice-president; J. H. McKnight, 2nd vice-president; F. J. Beharriell, secretary-treasurer.

One of the first important buildings to be built of Credit Valley stone was the Hamilton post office, and since the erection of this building the demand for the stone has increased greatly, owing to its fine color and texture. In many of the best public and private buildings, churches, etc., this stone has been used, until to-day we find it being employed in all the principal cities of the Dominion, such as Montreal, Toronto, Hamilton, London, Peterboro', Woodstock, St. Thomas, Brantford and others. The Foresters' Temple and the new Union Station in Toronto, which speak for themselves as to beauty of appearance, are two recent buildings constructed of this stone. One of the essential features of the exterior of a building is that the materials should harmonize one with the other, and this quality is possessed to a large extent by the Credit Valley brown stone. It gives the appearance of weight and solidity to the building and does not require dressing to any great extent, a great deal of the beauty of the stone being in the natural rock, while the color is not deadened by the use of the tool.

The quarries are equipped with the best appliances, such as steam hoists, derricks, etc., to facilitate the quarrying of the stone in large quantities. The situation of the quarries is about 200 feet above the river bed, and upwards of 100 feet from the top of the mountain. On account of the great distance from the top, it is impossible to strip to work an open quarry. It therefore becomes necessary to mine by drifting in at the level of

the freestone bed, and on a line with the brown stone, the five or six feet of grey and off color underneath making the floor of the mine. This leaves about eight feet of brown and two feet of grey on top. As will be seen by reference to the illustrations printed on another page, it is operated by means of two tunnels or gateways 150 feet apart and 12 feet wide, which permits of a tramway. These tunnels are now about 400 feet long, and at the end of each a drift 30 feet wide and from 75 to 100 feet long each way is mined. This is done by practical miners. First, they remove the shale between the freestone and limestone rock with picks, then break down the layers of limestone for say five feet up, this material being used for building supporting walls in old drifts. Sufficient room is thus provided to place in the timber to support the roof, which is done by placing large timbers across the drift about two feet apart, the temporary props used in the progress of the mining being removed in sections as the timbers are placed and wedged tightly to the roof. The work is then ready for the rock getters, who drill and blast out the rock in the usual way, taking great care in using the powder so as to cut the dimensions required without fracturing the rock. When the rock is cut it is placed on cars by means of wire cables running from the steam hoist through sheaf blocks hung from the timber of roof, the cars being propelled on tramways by steam power. The rock is then lifted off the cars by the derrick outside, and cut up into smaller dimensions by the quarrymen. When ready for shipment it is lowered to the siding by a tramway, the distance being 100 feet. Two trucks are used, which carry about six tons each. The loaded truck is lowered by a large drum with a brake at each end, and as it descends the empty truck is drawn up by a wire cable. About one hour is occupied in loading a car.

PERSONAL.

Mr. Benjamin Brick, contractor, of Toronto, is at present on a six weeks' trip to the Pacific coast.

Messrs. Jos. H. MacDuff and Ludger Lemieux, architects, have formed a partnership, with office in Montreal.

At Charlottetown, P.E.I., Mr. John W. Morrison, Secretary of Public Works for Prince Edward Island, died on April 12th, at the age of 77 years.

Mr. John Heyman, of John Heyman & Sons, contractors, London, Ont., has returned from a trip to England, and appears to be much benefitted in health by his visit.

The plumbing firm of Worthington, Garratt & Armstrong, Toronto, has been dissolved, Mr. Thos. Worthington retiring. The business will be continued by Mr. Armstrong under the old name.

Mr. W. H. Powell, architect, who has for a number of years practised at Stratford, has formed a partnership with Mr. James Carswell, of Chatham. The new firm will probably have offices in both the above cities.

Mr. J. H. McGregor, who has had charge of the Toronto agency of the Dominion Bridge Company, has resigned, and will engage in the mining business at Rat Portage. His successor is Mr. Geo. Evans, who will occupy the same offices in the Canada Life Building.

Messrs. Henry Simpson and J. A. Ellis, architects, of Toronto, have formed a partnership under the name of Simpson & Ellis. The arrangement will take effect on the first of June, and the new firm will occupy offices at 9½ Adelaide street. We predict for them a fair share of patronage.

Mr. J. Gill, one of the oldest citizens of Montreal, died in that city last month. Deceased was born in Edinburghshire, Scotland, on the 14th of February, 1806. He arrived in Montreal on the 21st June, 1833, and up to ten years ago carried on business as contractor and box manufacturer.

Mr. Alfred Bodley is the latest addition to the architects of London, having opened an office in the Hiscox building. Mr. Bodley, although a young man and a native of London, has already had a large experience both in Canada and the United States, and will no doubt succeed in establishing a good practice.

The fifteenth annual convention of the National Association of Master Plumbers is announced to take place in New York, opening June 15th and continuing for three days.

Mr. Charles Baillairge, city engineer of Quebec, is fitting up a room for a museum of samples of building materials, models of paving and mechanical appliances used in corporation works. This will be found a convenience for contractors, engineers, etc.

New plumbing associations continue to be formed in the cities and towns of the Dominion. The latest effort in this direction is at St. Thomas, Ont., where Mr. J. Flaherty, assisted by other members of the trade, hopes to succeed in organizing an active association.

THE LATE MR. ALAN MACDOUGALL.

In the death of Mr. Alan Macdougall, the well-known civil engineer of Toronto, the city has lost an honored citizen and the engineering profession one of its most valued and popular members. It was generally known that for some time past Mr. Macdougall's health had been failing, and last year he visited Europe in the hope of gaining renewed strength. At one time he was thought to be on the road to recovery, but a few weeks ago the report was received in Toronto of his death, which occurred on the 23rd of April, at Exmouth, Devon, in the south of England.

Deceased was born in the year 1842, and was the third son of the late Col. Macdougall, of Edinburgh, Scotland, in which city he received an education of a high standard. In the year 1859, when seventeen years of age, he was articled to Mr. Charles Jopp, consulting engineer of the North British Railway Company, Edinburgh, finishing his term in 1863. Two years later found him resident engineer for the Monctonhall, Ormiston and Dalkeith branches of the above railway, which position he retained until coming to Canada in 1868. He was first employed in this country in making preliminary and location surveys and as chief assistant on construction of the Toronto, Grey and Bruce railway, under Mr. Wragge, then as resident engineer for the North Grey branch of the Northern Railway of Canada. For four years following 1873 he was employed on the staff of the Department of Public Works, Ottawa, having charge of construction of improvements on the upper lakes and lower St. Lawrence.

In 1877 Mr. Macdougall returned to his native land, and was placed in charge of the head office of the North British Railway Company, as chief draughtsman, a position which he held for five years, after which he returned to Canada. For one season he was divisional engineer for the Canadian Pacific Railway Company on their South Western branch, and during the following four years practised as consulting engineer at Toronto, being for two years in partnership with Mr. Gray under the firm name of Macdougall & Gray.

Early in the year 1887 Mr. Macdougall received the appointment of assistant city engineer of Toronto, under Mr. Sproatt, in which capacity he rendered valuable service to the city, including some experiments to determine the direction and velocity of the currents in Lake Ontario. He also made the first surveys, in accordance with the report of Messrs. McAlpine & Tulley, in connection with the proposal to obtain water from the Ridges and Lake Simcoe. Owing to failing health, Mr. Macdougall obtained leave of absence from the city in 1888 to visit Great Britain. Shortly after his return his resignation was presented to the City Council, since which time he has been engaged in consulting practice in Toronto, devoting much of his time to sanitary science. Having given careful study to the subject of sanitary engineering, his services have been sought by municipalities in different parts of the Dominion. He was engaged by the city of Toronto to report on the sanitary condition of Ashbridge's Bay, and prepared plans for sewerage systems at St. Catharines, Stratford, Peterboro', Belleville, Vancouver, B. C., Brandon, Man., and other places. The valuable assistance rendered during an outbreak of diphtheria at St. Johns, Newfoundland, was such that he was solicited by the authorities of that city to accept the position of city engineer, which, however, he declined.

The late Mr. Macdougall was honored, in 1887, by being elected a member of the British Institute of Civil Engineers. He was also a Fellow of the Royal Society, Edinburgh, and the Royal Scottish Society of Arts, and in 1880 received the last named society's honorary silver medal for his paper on "Canadian Light Rays." He was prominently connected with the Canadian Society of Civil Engineers, and largely through his persistent efforts the organization of the Society was effected in 1887. For many years he served as a member of the Council, and in 1894 was chosen vice-president. From the time of the organization of the association until his death he labored faithfully to obtain such legislation as would make the society a close corporation, not with the object of personal advantage, but in the hope that by this means the professional status of engineering would be elevated. He was without doubt the most enthusiastic and earnest advocate of professional ethics in the society, and a perusal of the transactions of that body will show the time and attention which he devoted to the cause. An interesting paper on the subject, entitled "The Professional Status, a Plea for a Close Corporation," was read at the annual meeting in 1892, and created much discussion.

Mr. Macdougall took an active interest in the Canadian Institute in this city, was elected secretary in the year 1886, and held the position until his death. The portrait which appears on this page was taken from a painting by Mr. W. Sherwood in the possession of the Institute. As secretary of the committee Mr. Macdougall took the first steps to secure the approaching visit to the city of the British Association for the Advancement of Science. Deceased was elected a member of the St. Andrews Society in 1869 and appointed secretary in 1894. He was also a member of the Gaelic Society, and for two terms served as examiner at Toronto University.

Mr. Macdougall married a daughter of the late Dr. McFaul, of Toronto, and leaves a widow and four daughters. Personally, it may be said of him that all who knew him were his friends. A striking feature of his character was

his consideration for others, and the kindly interest which he always evinced in the welfare of young men secured for him a host of friends. He was a great student, and might ever be found adding to his wealth of knowledge.

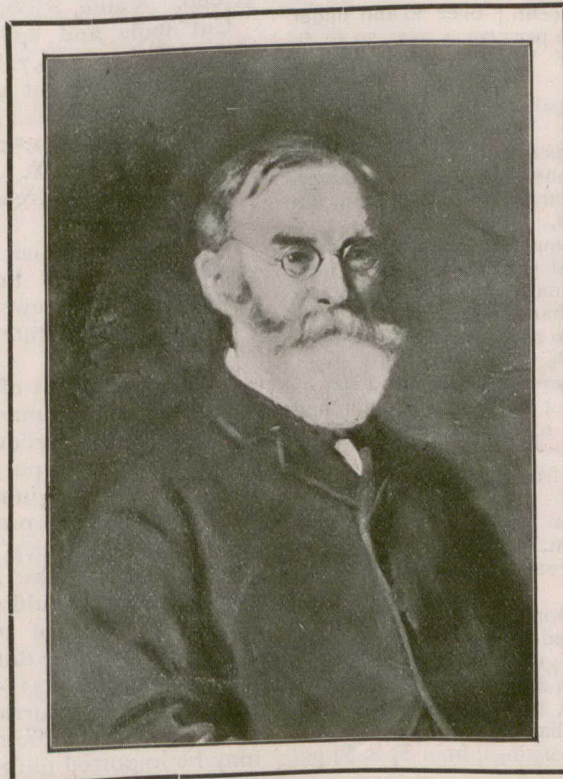
It is reported that the firm of J. & C. Hodgson will shortly resume operations at their pipe foundry at St. Henri, Que.

A valuable deposit of asbestos is said to have been discovered at Fish Creek, about twenty-five miles from Calgary, N. W. T.

It is reported that Haigh, Son & Co., the large Liverpool glass manufacturers, are about to establish extensive glass works at River du Loup, Que.

The plant of the Safe Lock, Metal, Shingle and Siding Company, of Smithville, Ont., has been purchased by a new company at Preston, Ont., formed under the name of the Metal Shingle and Siding Company. Cyrus Dolph, J. N. Clare, and H. D. Walker, all of Preston, are the first directors, and the capital of the company is \$10,000. The new company started operations last month.

The following patents have been granted for Canada: Peter Fraser, Hamilton, device for heating and lighting; F. L. Decarie, Montreal, hose coupling; Philip Nicolle, Toronto, water closet; Adolphe Vervort, Montreal, fire-proof flooring and ceiling; P. C. Ogilvie, Montreal, radiator section couplings; Carl Rubel, Louth, Ont., art of making lime; E. S. Manny, Montreal, hot water and steam boiler; I. and J. W. Crichton, Halifax, N. S., sash lock; Jas. D. Murphy, New York, fire-proof floor arch,



THE LATE MR. ALAN MACDOUGALL.

THE DUTY ON BUILDING MATERIALS.

By the new Canadian tariff, which took effect on April 23rd, several changes are made in the import duties on building and construction materials, but taken as a whole they are of a moderate character, and are not likely to seriously affect many industries. A feature of the new tariff is the double schedule, framed with the object of giving Great Britain a preference in our markets, and of compelling other countries to adopt reciprocal tariffs. This double schedule provides for reducing the import duty whenever any country gives certain concessions to the products of Canada.

Below are shown some of the changes affecting the building trade :

- Portland or Roman cement, from 40 cents per barrel to 12½ cents per 100 lbs.
- Fire brick, from free to 20 per cent. duty.
- Copper wire, from 15 to 20 per cent.
- Builders' hardware, from 32½ to 30 per cent.
- Cotton, linen or rubber fire hose, from 32 to 35 per cent.
- Sawn or dressed flagstones, from 30 to 25 per cent.
- Floor earthenware tiles, from 35 to 30 per cent.
- Glass, ornamented and colored, painted and vitrified, and rough plate glass, from 25 to 30 per cent.
- Plate glass, not colored, in panes not over 12 feet, from 4 cents per sq. ft. to 30 per cent.; over 12 feet and not over 30 feet, from 6 cents per sq. ft. to 30 per cent.; over 30 and under 70 sq. ft., from 8 cents per sq. ft. to 30 per cent.; over 70 sq. ft. from 9 cents per sq. ft. to 30 per cent. When beveled the duty on all sizes is placed at 35 per cent.
- Iron hydrants, valves and watergates, from 27½ to 25 per cent.
- India rubber hose, from 32½ to 35 per cent.
- Rolled iron or steel angles, channels and special sections, weighing less than 35 lbs. per lineal yard, from 35 per cent., but not less than \$10 per ton to \$7 per ton.
- Rolled iron and steel angles, channels and special castings weighing less than 35 lbs. per lineal yard, rolled iron or steel beams, joists, girders, column sections and other building or bridge structural sections not less than 25 lbs. per lineal yard, and rolled iron or steel bridge plate not less than ⅜ in. thick nor less than 15 inches wide, from 12½ to 15 per cent.
- Bar iron, rolled or hammered, squares and bars and shapes of rolled iron or steel, not more than 4 inches in diameter, and flats not thinner than No. 16 gauge, n.e.s., from \$10 to \$7 per ton.
- Iron and structural iron bridges, from 30 per cent., but not less than 1c. per lb., to 30 per cent.
- Bridge plate, not less than ⅜ of an inch thick, nor less than 15 inches wide, from 12½ to 15 per cent.
- Wrought iron pipe, from 30 per cent. and ½ cent per lb. to 35 per cent.
- Cast or wrought iron, hollowware, from 27½ to 30 per cent.
- Iron or steel plates or sheets, sheared or unsheared, and skelp iron or steel, sheared or rolled in grooves, and of all widths thicker than No. 17 gauge, n.e.s., from \$10 to \$7 per ton.
- Iron or steel ingots, cogged ingots, billets and puddled bars, loops and other forms less finished than iron or steel bars, but more advanced than pig iron, except castings, from \$5 to \$4 per ton.
- Cut nails and spikes of iron and steel, from ¾ cents per lb. to 30 per cent.
- Pig iron, iron kentledge and scrap iron, from \$4 to \$2.50 per ton.
- Cast iron pipes, from \$10 per ton, but not less than 35 per cent. to \$8 per ton.
- Manufactures of steel and iron, or parts of iron and steel, from 27½ to 30 per cent.
- Lead pipe, from 4/10c. lb. and 25 per cent. to 35 per cent.
- Manufactures of marble, from 30 to 35 per cent.
- Plaster of Paris, calcined or manufactured, from 40 cents per barrel of 300 lbs. to 12½ cents per 100 lbs.
- Steam pumps, from 30 to 25 per cent.
- Granite, flagstones and freestones, dressed, and all other building stone dressed, except marble, and n.e.s., from 30 to 25 per cent.
- Lincrusta Walton wall decorations, from 1½c. per roll of 8 yards and 25 per cent. to 35 per cent.
- Wire cloth of brass or copper, from 20 to 30 per cent.
- Iron or steel wire, n.e.s., from 25 to 20 per cent.
- Wire nails, from 1c. per lb. to 35 per cent.

In view of the above changes, we give some figures, compiled from the Trade and Navigation returns of the Dominion, showing the import of several lines of building materials from the different countries, together with value thereof :

Cement, hydraulic or water lime, from Great Britain, 2,810 barrels; Belgium, 310; United States, 2,680; value \$8,727. Portland or Roman, Great Britain, 93,307 barrels; Belgium, 79,674; France, 11,112; Ger-

many, 12,814; United States, 8,279; value \$240,-388.

Plate glass, Great Britain, 262,562 sq. ft.; Belgium, 155,675; France, 87,855; Germany, 32,265; United States, 1,226; Austria, 7,798. Total value, \$149,409.

Lime, Great Britain, 10 barrels; United States, 10,-229. Value \$7,331.

Roofing slate, United States, 2,421 squares. Value \$8,274.

Granite, flagstone, rough freestone and other building stone, rough, Great Britain, 854 tons; United States, 13,904. Value \$43,034. Dressed granite and freestone, Great Britain, 439 tons; United States, 370. Value \$11,442.

Cast iron pipe, from Great Britain and the United States, 43,778 cwt. Value \$47,415.

Bar iron, 67,546 cwt. Value \$121,096.

Fittings of wrought iron or steel pipe, Great Britain, 33,126 lbs.; Germany, 5,839; United States, 1,304,376 lbs. Value \$68,951.

Iron bridges and structural iron work, Great Britain, 77,785 lbs.; United States, 1,121,188 lbs. Value \$48,-318.

Pig iron, Great Britain, 6,525 tons. United States, 31,680. Value, \$406,916.

Cut nails and spikes, Great Britain, 44,442 lbs.; United States, 710,726. Value \$15,932. Other nails and spikes, wrought and pressed, Great Britain, 133,499 lbs.; United States, 441,322. Value \$20,262. Wire nails, Great Britain, 27,024 lbs.; United States, 241,-512. Value \$9,008.

Steam pumps, Great Britain, 10; United States, 203. Value \$39,237.

Rolled iron or steel angles, channels, beams, joists, girders and other bridge structural sections, Great Britain, 93,655 cwt.; Belgium, 5,195; Germany, 80,239; United States, 58,863; France, 212. Value \$270,261.

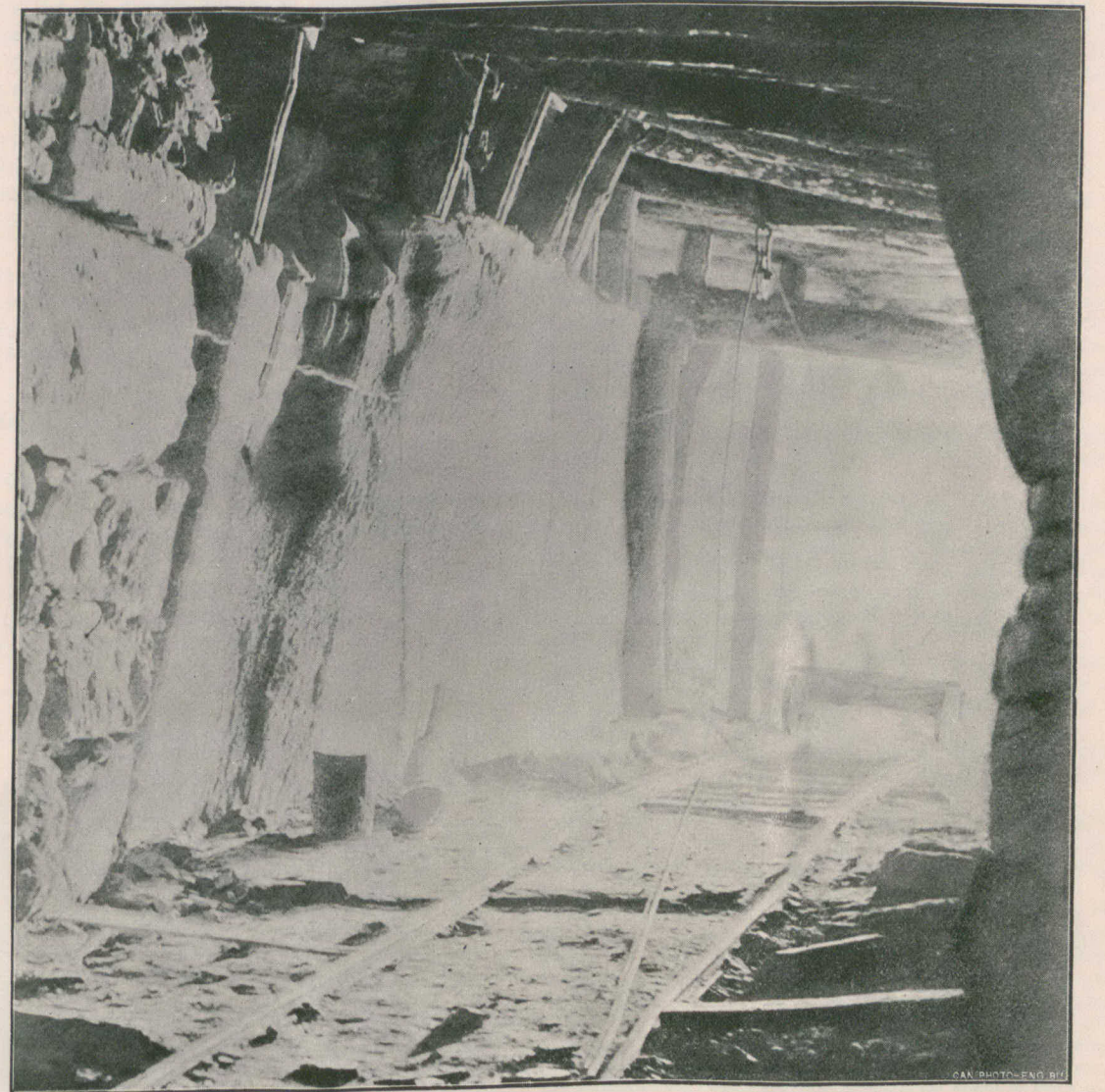
The arrangement of the duties on cement is rather in favor of Canadian manufacturers, but not to the extent that is generally believed. Under the former tariff the duty was 40 cents per barrel of 375 pounds. The standard barrel of Belgium cement is 350 pounds, therefore the duty under the present tariff of 12½ cents per 100 pounds would be 43¾ cents per barrel, or an increase of 3¾ cents. The standard English barrel is 375 pounds, which would make the present duty 47¾ cents less a discount of one-eighth under the preferential clause, leaving the duty to be paid on English cement this year at about 41½ cents. But after the first of January, 1898, a further reduction of one-eighth is to be given to Great Britain, in which case English cement may be imported under a duty of slightly over 36 cents per barrel, or four cents less than the former duty. It would appear from the above that the increased duty required to be paid on importations from other foreign countries may result in the use of greater quantities of cement of English and Canadian manufacture.

The present tariff does not entirely meet the views of Canadian bridge manufacturers. The duty on imported bridges is slightly reduced, while an increase of 2½ per cent. is made on bridge plate, which constitutes the chief imported raw material of the manufacturers. This increase, however, is not sufficient to seriously affect the Canadian firms.

Manufacturers of heating apparatus view the new regulations favorably. The manufactured goods are now protected from foreign competition by a duty of 30 per cent., an increase of 2½ per cent., while pig iron, scrap iron, iron pipe, and such materials, which constitute the bulk of the raw material used in the construction of furnaces and radiators, are admitted more liberally than heretofore. Pig iron, formerly subject to a duty of \$4 per ton, is now imported for \$2.50, and wrought iron pipe at 35 per cent., whereas the old tariff on iron pipe was 30 per cent. and ½ cent per lb., which was equal per cent. As an offset to the above reduction, the government have increased the bounty to be paid to Canadian manufacturers of iron and steel. Notwithstanding the above reduction in cost of raw material, it is im-



CHURCH AT QUEBEC.
MESSRS. VALLÉE & TANGUAY, ARCHITECTS.



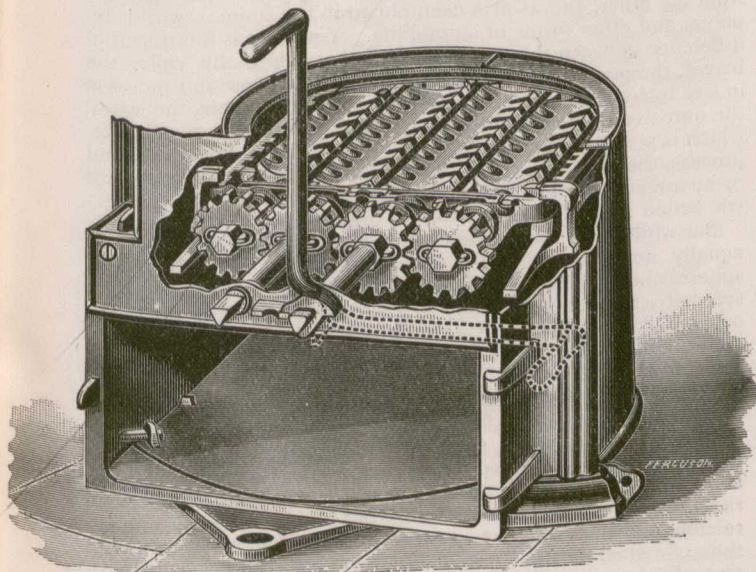
EXTERIOR AND INTERIOR VIEWS OF THE CREDIT FORKS MINING AND MANUFACTURING CO.'S
SANDSTONE QUARRIES, CREDIT FORKS, ONTARIO.

probable that the price of heating apparatus, especially furnaces, will be lowered. The competition in this line has been so keen of late years as to produce very inadequate returns for the capital invested, and the public are now purchasing furnaces at the lowest possible cost of production consistent with efficient apparatus. One effect of the revised duty on pig iron will probably be to enable Great Britain to supply a greater quantity, as under the preferential clause she will be given an advantage over the United States. It is well known that, where in earlier years Great Britain supplied the bulk of the iron used in Canada, to-day the United States practically controls the market, as will be seen by reference to the figures of imports given above. The cost of production has evidently been greatly reduced in the latter country, while the cost of shipping is also in favor of the United States.

CANADIAN HEATING APPARATUS AND METHODS.

In connection with the article which appeared under the above caption in the April ARCHITECT AND BUILDER, the following particulars reached us too late to be embodied in the review :

Messrs. H. R. Ives & Co., of Montreal, have undertaken some changes looking in the direction of making the patterns and plant more perfect, so as to give the



McCLARY TRIANGULAR GRATE.

greatest uniformity in thickness of metal, and in perfect fitting of all the parts. Their "Buffalo" boiler has met with a favorable reception, as indicated by the fact that a shipment was recently made to South Africa.

Practical experience is continually suggesting improvements in the furnace manufacturers' plant, and each year some steps in this direction become necessary. As manufacturers of coal and wood furnaces the McClary Mfg. Co., of London, are among the leaders. They advise us that their "Famous Magnet" wood furnace was first introduced four years ago, and that their sales each year have been nearly doubled. For the coming season they are now making two new sizes, Nos. 12 and 112, of a cheaper and lighter line, and without ash pit. They also now make furnaces with four radiators taking 38½ and 50 inch wood. For their two larger sizes they have just completed a set of patterns for the burning of soft coal in addition to wood, to be used in territories where both fuels abound.

The "Famous Florida" coal furnace for this year, shown in the above cut, is so arranged that either flat or triangular grates can be fitted, as required, but in all cases they advise the use of flat grates.

The Clare Bros. Co., of Preston, Ont., are about to introduce a new hot water boiler and also a new steel radiator. The company have been experimenting for some time past with these new heating appliances, and have now brought them to what they regard as being a satisfactory standard of perfection. As already stated,

this new radiator, which is about 16 inches in height, is constructed of steel, having cast directly to it an ornamental cast iron top and base. The manufacturers claim that this steel radiator will radiate much more quickly than if made of cast iron, and as a proof that they are working on right lines, point to the fact that the tendency in the manufacture of hot air furnaces, cooking ranges, etc., of late years, has been in the direction of steel.

MONTREAL.

[Correspondence of the CANADIAN ARCHITECT AND BUILDER.]

PROVINCE OF QUEBEC ASSOCIATION OF ARCHITECTS.

THE competition of the P. Q. A. A. for a "Letter Heading and Seal," open to architects and draughtsmen, has been decided by the committee of architects appointed for that purpose, as follows: The design marked with the motto of "Velos" was awarded first position, thus winning the premium prize of \$20.00. The author of this suitable design, Mr. C. B. Patterson, has well handled the subject. Mr. Andrew Lindsay was awarded second place, and will receive \$5.00.

It is to be hoped that if similar competitions should be inaugurated in the future, students will see it to be to their interest to respond more generously.

The course of lectures delivered during the last four months in the Art Gallery under the auspices of the P. Q. A. A. terminated on the 20th ult. with the lecture on "The Story of an Illustrious Abbey," by Mr. A. T. Taylor, F.R.I.B.A., president of the Association. The lecture, which is published elsewhere in this number, was illustrated by stereopticon views, and proved to be most interesting and instructive.

The Association are to be congratulated on the success which has attended this series of lectures. Should another series be arranged next year, they would be certain to attract a larger attendance and deeper interest.

At a special general meeting of the Association held on the 14th April last, in Montreal, the following resolutions were passed unanimously :

The Province of Quebec Association of Architects have learned with gratitude that His Excellency Lord Aberdeen, Governor General of Canada had consented to be nominated as patron of the Association.

Resolved : "That His Excellency Lord Aberdeen, Governor General of Canada, be Patron of the Province of Quebec Association of Architects, and that the said Association offer to His Excellency their hearty thanks for the honor thus conferred." On proposition of Mr. A. C. Hutchison, seconded by Mr. A. Raza it was also resolved : "That considering the generosity manifested of Mr. William C. McDonald by the creation, donation and equipment of a Chair of Architecture at the McGill University, the Association desires to express its approbation and gratitude for the benefaction bestowed upon the whole profession throughout the Dominion, and think that they cannot in a better manner convey their thankfulness than by electing him an honorary member of the Association."

PUBLICATIONS.

The Review of Reviews for May devotes its entire department of "Current History in Caricature" to the reproduction of cartoons illustrating various phases of the Turkish question.

The Canadian Manufacturer will shortly publish a special edition which will contain the new Canadian and American tariffs as well as the present British tariff and British Merchandise Act.

The proceedings of the Engineering Society of the School of Practical Science for the academic year 1896-97, a copy of which we acknowledge receipt of, contains many interesting and valuable papers on engineering subjects. Among those of interest to architects and builders are the following : "The High Building Problem," by W. B. Mundie ; "Concrete on Trent Valley Canal," by H. F. Greenwood, C. E. ; "Foundations for a Twenty-one Story Building," by T. K. Thomson, C. E., and "Crushing Strength of White Pine," by A. H. Harkness.

A useful book has just made its appearance from the press of Messrs. John Wiley & Sons, New York and London, entitled "Hydraulic Cement, its Properties, Testing and Use." The author is Mr. Frederick P. Spalding, M. Am. Soc. C. E., Assistant Professor of Civil Engineering, Cornell University. This book contains the results of a careful study by the author of the nature and properties of hydraulic cement, methods of testing, and the limitations within which they may be accepted as reliable indications of value. A chapter is devoted to the use of cement in concrete, and mortar. The price of the book is \$2.00.

One of the neatest productions of the printer's art which has reached our desk is catalogue "M" of the Metallic Roofing Company, of Canada, which contains numerous half-tone illustrations of artistic designs of ceiling and side-wall plates, wainscoting, borders and friezes, cornices, mouldings and other like manufactures. Some striking effects are shown in the full-page illustrations of ceilings composed of several designs, with mouldings, crosses, etc., to match. A partial list of buildings in which "Hayes" patent lathing, Eastlake shingles and embossed ceilings have been used is given, and show a wide distribution of these goods.

CORRESPONDENCE.

[Letters are invited for this department on subjects relating to the building interests. To secure insertion, communications must be accompanied by the name and address of the author, but not necessarily for publication. The publisher will not assume responsibility for the opinions of correspondents.]

GRANITE AS A BUILDING AND PAVING MATERIAL.

To the Editor of the CANADIAN ARCHITECT AND BUILDER.

SIR,—There are indications in many of our large cities to-day that we are soon to see granite more in use for both building and paving purposes than it has been for some time past. A granite house—be it mansion or cottage—is the desire of most hearts; and were the means of acquisition as plentiful as the desire is common we should soon see in our towns and cities a large increase in the number of residences built of this handsome stone. No other class of buildings gives the same impression of solid, abiding, civic health and of faith in the future as the stone residences of all classes of the population. Indeed, the greater proportion of stone buildings in a city the greater is the assurance of that city's stability, for they are but the evidences of the faith of those most deeply interested in its welfare. But stone buildings are costly in the first place compared with buildings of a more transient nature, and this first cost often forbids their erection, to the great loss of the community both in civic and moral health. This forbidding item of first cost does not, however, operate to the same extent in the matter of paving our streets when granite is compared with other and less enduring materials. The difference in cost between granite blocks and asphalt is not to be considered beside the great difference in wear in favor of the granite. A little more than a decade ago asphalt was being spoken of so highly by parties interested in its sale and others interested in experimenting that it succeeded in gaining a hold in most of the large cities of Britain and Europe. But its hold was brief. In Berlin during the heat of summer it was no uncommon sight to see an officer stuck in its deceitful crust. In consequence of this undue adhesiveness, it was voted a nuisance, and Berlin went back to the use of granite blocks for many of her most important streets. In London and other great British cities the failure of asphalt has been equally apparent, and the granite block is now more in demand than at any previous time. In America, from New York to Denver, a similar experience has followed the use of asphalt, and it is giving way before the enduring stone. Now, in some cities another fad is being exploited. Brick is the cry; and the support of the cycling public is asked because it is said to make a dainty road for cycling. Still, cyclists have to consider the question of expense, and the dainty brick track and civic economy do not go hand in hand. Only the other day two Toronto aldermen found it necessary to refer to the bricks of Egypt and Babylonia to strengthen their case in support of their hobby, but it is not recorded that they brought to notice the preservative conditions which saved these bricks, and in this connection it might be mentioned that the same record of endurance follows the Egyptian granite under much more trying conditions; and even human bodies of the same date have come down to us in an excellent state of preservation. But such references are aside from the question. Experience in the cities of Europe has given granite paving blocks the highest award as an enduring and economical street pavement, and as already said, indications are not wanting that experience in American cities is following in the same direction, though perhaps with a tardier step.

EXPERIENCE.

GROWTH OF CRYSTALLINE BODIES.

QUEBEC, May 12, 1897.

To the Editor of the CANADIAN ARCHITECT AND BUILDER.

SIR,—In the issue of the *New York World* of the 6th inst., under the heading:—"Wonderful Discovery of Prof. Von Schroen, Scientist, Naples!—Baby Crystals Fatal Fights!—A New Truth which will revolutionize Philosophy and influence all Science!—Is all Matter Organic?—Dr. Von Hoist tells of Photographs showing the Birth and the Growth of Stones."—I read that Dr. Von Hoist, of the Chicago University, has returned

from Naples with the startling news that Von Schroen has discovered life in crystals.

I may not be sufficient of a scientist to enter into a consideration or discussion of this alleged vitality, this pretention that stones are of organic origin, neither do I believe anything of the kind. Still, the mode of formation of all crystalline substances may be considered a species of vitality; nor is the microscope indispensable in establishing this, for it can be abundantly witnessed by the naked eye in the formation of maple or loaf sugar from the syrup when sufficiently boiled, in that of rock candy around a string for the crystals to adhere to, in the formation of ice on the surface of water, where, under the influence of cold, needle-like crystals shoot out in all directions at the surface, until a film of ice, at first no thicker than paper, thus spreads over the surface and becomes gradually thicker by the addition to it of other crystals from below.

Nor can snow be called organic, though made up of crystals which arrange themselves symmetrically in hexagonal forms around a central nucleus, this being, apart from squares, the only area-filling figure, as with basalt in the Giants' Causeway and elsewhere, as also in the cell of honey bee and wasp, where the economic processes of nature are so intelligently thrust on man's attention; since the circular form would just as well have suited the size and shape of the insect's body, but would have left a useless space between the contiguous circles and have required 50 per cent. more wax or other material for the same number of cells.

Again, I say, the shooting out of crystals, the formation of the hexagonal column of "trap" from the fixed material thrown up by eruptive action, may be considered a species of vitality, as with protoplasmic cells while budding or rending off new cells from the parent nucleus or stem, and as imitated in the process by the cactus, which throws out its unaesthetic leaves, not only from the main stem or stalk, but the one leaf from the other, and as also exemplified in the animal world by polypi and other forms of animal life. Yet there is this essential difference between the two processes, that while the cells, the leaves, the polypi buds actually and gradually grow and increase in size by assimilating from the earth, the atmosphere, the water, the nutritive elements which go to make up their increase in size, which is actual vegetation, or an organic vegetable or animal process, the crystals, on the contrary, only grow by aggregative or by a mechanical addition to them under the influence of electric action and by the attraction of cohesion.

But while snow and stone crystals grow from central nuclei equally and symmetrically in planes all around, and even in spheres and polyhedra, it appears more difficult to explain the unsymmetrical process alluded to by Schroen, where the truly organic-like mode of vegetable growth or life is the more thoroughly exemplified, as in the formation of the exquisitely beautiful leaf-like, branch-like, tree-like tracery which everyone must have witnessed, and which may be detected in the process by the naked eye when, during frosty weather, the humidity or water from an overcharged or saturated inner or outer atmosphere, deposited or as condensed by window glass, is seen to crystallize and shoot out, not as in snow or basalt in equal and symmetrical radiation around a common centre, but in one or nearly one direction, and this, whether upward, downward or sideward, with the main stock or trunk originating from a sash bar or some portion of the surrounding framework as a starting point or base, and in absolute imitation of the growth of vegetable, fern-like forms, though different in this respect, that while vegetable life grows upwards or seeks the sun, the ice crystals grow or shoot out indifferently in all directions.

This is the tendency I would like to see explained, and where crystallizing seems actually to partake of organic life, as exemplified to Schroen's astounded vision by the use of his microscope, and the fights and struggles he alluded to between baby-crystals from different parental stocks, and the death or destruction of one of them by the other, illustrating, mayhap, Darwin's theory of "the survival of the fittest"—though in all this I cannot detect any absolutely vegetable, animal or organic life, but merely a most life-like process.

C. BAILLAIRGÉ.

Mr. T. Wooster, of Aylmer, states that he finds the ARCHITECT AND BUILDER very interesting and instructive reading.

Mr. James Lydiatt, formerly of the Wallaceburg Glass Company, will probably establish glass works at London, Ont.

About 1,200 plumbers went on strike in Chicago recently. The main point of difference was over the employment of helpers, the union insisting that not more than one helper be employed in each shop.

Messrs. Cadman & Williams, plumbers, of St. Thomas, report that prospects for a good season's business are very bright. As an up-to-date business firm, they believe that the plumbers' association now forming in St. Thomas will be beneficial to all.

Messrs. M. & N. K. Connolly, who are now at work on a large dredging contract at Philadelphia, have secured a vast contract sixteen miles in length. The contract price is said to be over \$10,000,000. They will start work almost at once, and the probability is that some Canadian workmen will be employed by them.

THE STORY OF AN ILLUSTRIOUS ABBEY.*

By A. T. TAYLOR, F.R.I.B.A.

There is a community of thought and sentiment linking, as with a golden chain, the architectural expression of all ages and all races.

The same spirit worked amongst earth's earliest builders in brick and mortar on the plains of Shinar when they essayed to rear the tower of Babel; it seized on the boulders on the banks of the Nile, and the Sphinx speaks to us still of eternal silence and peace; it carved human headed winged bulls to stand on the marble pedestals of Ninevah, it raised the Parthenon on the hill of Athens—still exquisitely beautiful even in its ruins; it inspired the chisel of Phideas to give shape and embodiment to those splendid processional figures, fit necklace for the goddess Athena; it bade the Moors build their gorgeous Mosques and Alhambras, and in the gloomy north rose at its command abbey and cathedral, with their fretted cloisters, lofty groined roofs, flying buttresses, spire and pinnacle.

Conspicuous amongst these stands a venerable pile, the story of which, it will be my endeavor, however imperfectly, to bring before you this evening.

There is perhaps no spot of ground in the British Empire which ought to be so dear to every Englishman as that acre contained within the precincts of the Abbey church of St. Peter's, Westminster.

It would be difficult for the most prosaic, callous, or ignorant of mortals to visit this shrine, even if he knew nothing of its history, without a feeling of awe coming over him as he stepped from the sunshine and busy life of the outer world to the religious gloom and silence of the interior; but to one who knew something of its history, traditions, associations and architecture, it would be impossible to do so without the keenest emotion and the intensest interest.

Architecturally it has no tall graceful spire like Salisbury, no magnificent central tower like Canterbury, it has not the richness nor loftiness of Beauvais, nor the storied wealth of sculpture of Wells or Amiens, it is not glowing with splendid color of marble and mosaic like the Lily Cathedral of Florence or the old Doge's church of St. Marks at Venice; but it is solemn, noble, venerable—in perfect keeping with the genius of the English people; it is woven into warp and wool of the texture of English history, and may almost be said to be part of the English Constitution.

Seventeen centuries clasp hands and encircle the Abbey. The mists of antiquity shroud its earliest history, but it is said that somewhere before the year 200 A. D., a small rude Christian church was built on Thorney Island on possibly the site of a temple to Apollo, just as tradition credits St. Pauls with being built on the site of a temple to Diana.

There is no doubt that there must have been a Roman station here, for a Roman sarcophagus was found on the site, and in digging more recently a Roman mosaic pavement was discovered in good condition, and also other remains. This is not to be wondered at, for there was a ford across the River Thames at this point, and the famous Walking Street led directly to this ford until it was diverted eastward on the building of London bridge, and from the opposite side of the river the Dover Road was a great highway, so that it was not the secluded marshy impenetrable spot that some have described it to be, but full of life and pageantry.

In course of time, however, the flow of the tide of Roman supremacy had to ebb and the Saxons surged over the country again, bringing ruin and desolation everywhere. Thorney island shared the fate of many other places, and what had once been the scene of so much life, fell back into its original desolation.

The next glimpse we have of its history is when Sebert, King of the East Saxons, a convert to the Christian religion, after having built a church to St. Paul near by, on the site of the present St. Pauls cathedral, proceeded to restore the ruins of the old church or build a new one on Thorney Island, Westminster, to St. Peter. The legend of its supernatural consecration is repeated by all chroniclers—how at midnight on the eve of its consecration by Miletus, the Bishop of London, one Etric, a fisherman, was dismounted up to row over the river a venerable person who, on disembarking, entered the sacred edifice and suddenly it was lit up by a thousand tapers and the amazed fisherman heard heavenly words and music that ravished his soul; then all was still. On the reappearance of the mysterious visitant, he announced himself as St. Peter, and enjoined Etric to tell the Bishop on the morn what he had seen and heard, and as a token he was to have a miraculous catch of fish.

Any doubts the good Bishop had on the morn were set at rest by the lingering fragrance of unearthly incense, and the very palpable drippings on the altar of the wax candles of heaven!

The earliest document referring to the Abbey, dated 785 A. D., was a conveyance by Offa, King of Morcia, of some land to St. Peter and the "people of the Lord dwelling in Thorney"

And now the Danes overwhelmed the Saxons as the Saxons had overwhelmed the British, and desolation again reigned. After the lapse of a century King Edgar, urged by St. Dunstan, restored or rebuilt the church, and brought, we are told, twelve monks from Glastonbury. He also about this time began the Benedictine monastery, and gave a grant of the lands lying adjacent.

We now begin to emerge from the mists of antiquity and feel on surer ground when we come to the notable personality of Edward the Confessor whose palace was contiguous to the Abbey. A Saxon by birth, he was a Norman in heart and sympathies. He was a great builder, and coming fresh from the massive structures of Normandy he set his heart on rearing a noble monument to himself on this Isle of Thorns, and his name will ever be

indissolubly connected with the Abbey. About 1050 he destroyed the old church and built a new one from the very foundation, which was completed and consecrated in the year 1065. We are told that its fame lingered in the minds of men for generations. It was the first cruciform church in England; its massive roof and walls and pillars were a marked contrast to the Saxon wooden rafters and beams, and was a herald and symbol of the mightier race who were soon entirely to dominate the enervated Saxon people.

It must have been a magnificent conception for the age in which it was built, and was a triumph of faith and devotion, combined with wonderful constructive ability. We gather from somewhat meagre accounts that its size was enormous, covering nearly the whole area of the present Abbey. A high tower rose in the centre, the stones were richly carved and the church was raised high and vaulted; the windows were filled with stained glass and the roof was covered with lead. The monastery, consisting of the refectory, dormitory and infirmary with its special chapel, and the cloister and chapel house were all begun by Edward the Confessor, if they were not finished by him.

The whole building must have been on a similar scale to the Abbaye aux Hommes at Caen. We have an interesting representation of the church in the well-known Bayeaux Tapestry, wrought by Queen Matilda, which allowing for even a Queen's ideas of architectural rendition, must have had some resemblance to the original, and is therefore most precious.

In it there is a quaint figure of a man on a slight bridge connecting the palace with the Abbey and holding by one hand the tower of the palace, and grasping with the other the weather-cock on the east end of the Abbey, indicating without doubt the close connection and contiguity of the two.

Dean Stanley in his memorials of the Abbey says: "This is the architectural expression of a truth dear to Englishmen; the close incorporation of the palace and Abbey from its earliest days is a likeness of the English constitution, a combination of things sacred and things common. The Abbey is secular because it is sacred, and sacred because it is secular. The vast political pageants of which it has been the theatre, the dust of the most worldly laid side by side with the dust of the most saintly, the wrangles of divines or statesmen which have disturbed its sacred peace, the clash of arms which has pursued fugitive warriors and princes into the shades of its sanctuary, even the traces of Westminster boys, who have played in its cloisters and inscribed their names on its walls, belong to the story of the Abbey no less than its venerable beauty, its solemn services and its lofty aspirations.

Go elsewhere for your smooth polished buildings, your purely ecclesiastical places of worship—go to the creations of yesterday, the modern basilica, the restored church the non-conformist tabernacle, but it is this union of secular with ecclesiastical grandeur in Westminster Abbey that constitutes its special delight. It is this union which has made the Abbey the seat of the imperial throne, the sepulchre of kings and kinglike men, the home of the English nation, where for the moment all Englishmen may forget their differences, finding underneath its roof echoes of some memories dear to each."

Of Edward the Confessor's church very little remains, possibly one venerable arch in the south transept, certainly the huge pillars and portion of the wall underneath the dormitory, the low passage leading from the cloister to Little Dean's yard, and a small portion of the refectory, and of the infirmary chapel—these fragments have come down the centuries to us eloquent of the simple faith and devotion of this Saxon-Norman king. We may also add the rough bases of two of the piers of this choir which are now buried under the beautiful pavement on the north side of the choir.

There is something fitting in the thought that the temple he built to the glory of God became also his mausoleum; he was buried in front of the high altar, where his body rested until Henry III, desiring to do honour to his memory erected the magnificent tomb in the chapel of the kings, and removed his remains to that spot. Thus as it were, in the very heart of Westminster Abbey lies the dust of Edward the Confessor.

"The King is dead, long live the King." As the curtain falls on one great royal builder, it rises on another royal builder even greater than Edward the Confessor, viz., Henry III.

Henry's reign was an epoch not only for the Abbey but for England. The beginning of the 13th century was notable theologically for the immense stimulus, given chiefly by the preaching of St. Bernard, to the worship of the Virgin Mary. In architecture it was shown by the erection of a Lady Chapel at the east end behind the high altar of very many of the great cathedrals.

The first of Henry III's efforts in building was the addition to the Confessor's church of a Lady Chapel, which was dedicated by the young king at his coronation.

Like King James he was a "sore saint for the Crown," and he was a passionate devotee of religious observances. It is told of him that on his tour through France with Louis the King, he stopped so long to hear mass at every church he came to, that Louis caused all the rest of the churches on the route to be shut up until they had passed.

Fortunately with this he combined a passion for architecture; he was familiar with the glories of the cathedrals of Amiens, Rheims, Beauvais and Notre Dame, Paris, and his marriage with Eleanor of Provence introduced into England in her train many foreign artists and literateurs.

He was not content with erecting a Lady Chapel—his great dream of building an entirely new Abbey far more splendid than the simple one of Edward the Confessor began to take shape. We are told it was to be incomparable for beauty, even in that great age of art. This introduction of foreign ideas can readily be seen in the plan of the east end of the Abbey with its French

* Paper presented before the Province of Quebec Association of Architects, in the Art Gallery, Montreal, April 20, 1897.

chevet or apsidal arrangement and polygonal chapels. The English cathedrals have nearly always square east ends, the French cathedrals almost always the chevet or apsidal east end. On the gorgeous shrine of the Confessor, however, was lavished all the skill of Peter the Roman citizen. The mosaic pavement was brought from Rome. The enamelled and mosaic encrusted twisted columns surrounding it are suggestions from the Romanesque churches of Italy and the details are largely classical. We read that the Jews wept when they saw the second temple at Jerusalem so inferior, as they thought, to the glories of the first one. The 13th century English citizens must have rejoiced when they saw this new Abbey so infinitely grander than the previous one, and the old was forgotten in the glories of the new. The Societies for the Preservation of Ancient Buildings in England had they existed at that time, would have been horrified at the vandalism of Henry III, but they seem to have had no qualms of conscience in such matters in these good old days. They believed in the "know thyself" of Carlyle, and conscious of their power they had no hesitation in pulling down the work of their predecessors and building more nobly and grandly. To us there has been distinct loss and there has been gain: loss, in that many splendid buildings have disappeared forever; gain, in that oftentimes finer ones remain to us in their place.

It is when we come down to comparatively modern times that we "tremble for the ark" and stay impious hands from meddling with those notable cathedrals and abbeys that have come down to us as a precious heritage from the past, for alas we know we have nothing worthy enough wherewith to replace them.

The centre of the new Abbey was the magnificent shrine of the Confessor, and if the good king knew, perhaps this was some compensation to him for the destruction of his church that he had built as well as he knew how in the dawn of the art in England.

Henry III lived to complete the choir and the east end of the Abbey with the ambulatory and chapels, the Chapter house, and at least the east-most bay of the nave, all which still exist, the date of this work being from about the year 1245 to 1260. The next four bays of the nave are credited to Edward the I., date about 1269 to 1300, and the remaining six bays were added in the following reigns of Edward the II and Edward the III. About the end of the 14th century and early part of the 15th century Abbot Litlington built the lower portion of the western towers forming the west-most bay, but unfortunately left the west front incomplete, also built the refectory on the ancient walls of the Confessor's work, as well as the Abbot's house, the Jerusalem chamber, the west and most of the south cloister. In 1498 Abbot Estney, we are told, put in the great west window. In 1502 King Henry the VII began his magnificent chapel on the site of the Lady Chapel built by Henry the III. The present western towers and gable were added by Sir Christopher Wren about the years 1730 to 1740, some say by his pupil Hawksmoor, but the weight of evidence is in favor of the great master. With the exception of the restoration of the chapter house by Sir Gilbert Scott, and a small portion of the facade of the north transept by the same architect, completed entirely within the last few years by Mr. Pearson, nothing since has been done to the main structure of the Abbey to alter it materially, and thus we are brought down to the present time. Such are the bare bones of chronology; it will be my aim now in the remaining part of this lecture to clothe these with as vivid particulars and interest as I am able, and I trust gradually to unfold the beauty of this grand old Abbey.

No description of the Abbey would be complete without a reference to the great Benedictine monastery of which this church was a part, and before describing the Abbey in detail, a glimpse of these buildings will not be out of place. It can only, however, be a mere glimpse, as a satisfactory account would require at least a whole lecture and as this subject has been so well treated recently elsewhere by Prof. Capper, it is the less necessary.

The general arrangement of Benedictine monasteries was always the same. We have a most interesting plan and description of St. Gall's in Switzerland built about the year 820; and also a bird's eye view of the one at Canterbury taken in the 12th century, preserved in the great Psalter in the Library of Trinity College, Cambridge, and on which Prof. Willis has written such an excellent monograph; so that we are in no doubt as to the arrangement, and are therefore able to trace out the remains at Westminster.

The buildings at Westminster are, as they were in nearly all cases, on the south side of the church, and surround the cloisters, although singularly enough in the two examples referred to above, they are on the north side of the church. On the eastern side of the cloisters was the dormitory, built on the old walls of Edward the Confessor, which communicated with the south transept so that the monks could get comfortably to early prayers. Below this was the common room of the monks. From this east walk entrance is obtained to the beautiful chapter house.

On the south side of the cloister was the refectory, kitchens, etc., and on the west side was the Abbot's house, in which is the famous Jerusalem chamber.

To the east of this group of buildings lay the infirmary, with smaller cloisters and an infirmary chapel and outbuildings. The north walk of the cloister next the Abbey was the Scriptorium, where the monks patiently elaborated their beautiful missals and manuscripts.

To students of architecture it is interesting to notice the great irregularity of the cloisters, the north and east sides being divided each into six bays, and the elevations emphasize the differences still more. Also the east wall of the cloister being co-ordinate with that of the Confessor's work takes the place of a west aisle to the south transept, differing thus from the north transept which has aisles on both sides. At Salisbury and in most other examples we find the cloisters regular and a unit in design.

The cloisters are amongst the most charming bits of the old monasteries and cathedrals, and I must confess that to me they have often formed the most attractive spots where I have lingered longest, and returned again and again with ever fresh pleasure. Here, away from the noise of the outer world, guarded by the venerable buildings that look down on them, lie these simple grass plots of hallowed ground surrounded by the open traceried and moulded arcades, where the changing shadows flit in and out, and the sunshine lights up ever and anon the old inscriptions on the pavements, gradually being obliterated by the feet of successive generations of men. Here quiet lives have been spent and ended, and their memorials are preserved perchance only by the illustrated missals and manuscripts now in museums and libraries, and to which they dedicated their strength and talents. Despise them not! By their laborious and loving industry they kept the lamp of knowledge and devotion bright and shining in those ages before the era of printing, and handed down to us living thought of inestimable value.

When one thinks of the lovely double arcaded cloisters perched like an eagle's eyrie on the top of the sea-girt rock of Mount St. Michel in Normandy; on that famous Campo Santa cloister at Pisa glowing with the brightest work from the brush of Benozzo Gozzoli, Andrea Orcagna, and Spinello Aretino; on the beautiful cloisters of Santa Croce at Florence the work of the great Arnolfo; on the mosaic encrusted arcades at Monreale and Palermo; thoughts arise too deep for utterance. But amid all the splendors of these cloisters one turns with very loving thoughts to the gray, worn and simple, but touchingly pathetic cloisters of our own English Salisbury, Lincoln and Canterbury, and not least to those of Westminster.

It may be interesting to those who like definite figures to know that the Abbey, including Henry the Seventh's chapel is 530 feet long externally, and the width across the transepts is 203 feet; that the nave is 38 ft. 7 in. wide, and 101 ft. 8 in. high inside; and that the height of the western towers is 225 feet; I may add that of the English cathedrals York covers the greatest area, Winchester is the longest and Westminster comes fourth in point of length and area.

We make the confession at once that the least interesting portion of the Abbey is its exterior. It has been ruined by so-called "restorers" who would have been better named "destroyers." It is far less effective than many a smaller church. As we have already pointed out it has no central tower and therefore no main feature to dominate the whole structure as at Lincoln, Canterbury, Salisbury or Norwich. This is much to be regretted, as the ordinate western towers or spires is always felt to be eminently satisfactory. Sir Christopher Wren adopted the same idea in St. Pauls with its magnificent central dome and the two beautiful western campanili towers.

The Continental builders gave more prominence to their western towers and made their central feature of lighter design—more of the character of the fleche, and less important, and I cannot but think that many of their compositions suffer thereby. If it were possible to rear a lofty massive tower and spire at the crossing of the nave and transepts of Amiens or Rheims, or Notre Dame of the fleches now existing, we would have splendid buildings that would be almost unrivalled amongst all other mediaeval creations.

As we found a strong French influence at work shaping the plan of Westminster, possibly nothing more was contemplated at the crossing than a fleche, after the Continental manner, more especially as the four piers of the crossing do not appear strong enough to carry a heavy tower.

We learn from a report made by Wren on the condition of the Abbey that he contemplated a central tower at the time he erected the two western towers. He says: "The original intention was plainly to have had a spire, the beginnings of which appear on the corners of the cross but left off before it rose so high as the ridge of the roof. In my opinion the tower should give a proper grace to the whole fabric, and the west end of the city which seems to want it. I have made a design which will not be very expensive and light, but still in the Gothic form and of a style with the rest of the structure. To deviate from the old would be taste could relish. I have varied a little from the usual form in giving 12 sides to the spire instead of 8 for reasons to be discerned in the model. The angles of pyramids in the Gothic architecture were usually enriched with what the flower botanists call "Calceolus" which is a proper form to help workmen to ascend scaffolds. I have done the same as being of so good use as well as agreeable ornament."

However much one might have desired to see what Wren would have made of it, yet considering his imperfect knowledge of Gothic, and the semi-classic detail of his so-called Gothic western towers, I am unfeignedly thankful that his wishes were not carried out and that nothing was done.

Undoubtedly a central tower of good design would add enormously to the appearance of the Abbey, and I feel sure that if Mr. Pearson, its present architect, was intrusted with the work the result would be worthy of the best traditions of mediaeval times.

Wren was permitted, however, to build the two western towers and complete the west gable. In the same report, referring to these towers, he says: "I have prepared perfect draughts and models, such as I conceive may agree with the original scheme of the old architect without any modern mixtures to show my own inventions."

In spite of this declaration there was very much of "modern mixtures" which are to be deplored. The lines of the towers are

good, and also their mass and proportion, but the details are poor and mixed and strike a jarring note in the harmonies of the exterior of the Abbey.

We turn, however, with unmixed pleasure to the splendid restoration of the north transept, the finest work that has been done on the exterior of the Abbey for the last 300 years. Begun by Sir Gilbert Scott and carried on and completed by Mr. Pearson, it stands almost unrivalled as a perfect piece of restoration, showing an insight into the spirit of the best Gothic work, and a knowledge of detail with a mastery of workmanship not surpassed by any old work that has come down to us. In the hands of ignorant men who are credited as having been pupils of Sir Christopher Wren, this great north transept had been utterly spoiled and vulgarized and it is a matter for rejoicing to see it now. I hope to be able to show you presently on the screen the two fronts so that you can compare them. Mr. Pearson has also done some good restoration work to the south transept and part of the south aisle and cloisters.

At the east end of the Abbey, challenging notice from its utter dissimilarity to the rest of the fabric, is the famous Henry the Seventh's chapel. Like the Abbey, however, its glory is in its interior and not in its exterior. Outwardly it is a tour de force in architecture—a stone framework for immense mullioned bay windows, and covered with rest-ful panelling and pinnacles that tease the eye and worry the mind, and give no rest to body or soul.

There is no good point of view from which a complete and comprehensive view of the Abbey can be obtained; on the south side it is hemmed in with houses; at the east end it was similarly shut in, but recently some old houses have been pulled down, so that the chapter house and Henry Seventh's chapel can now be seen.

On the north side it is more open, and the tide of busy human life and traffic flows past it day and night, surging up almost to the portals. Here stands the parish church of St. Margaret's close under its shadow. Some have urged its removal, but its presence is so time-honored and it gives such scale and perspective to the Abbey that it were better left.

But we must not linger longer outside. Let us cross the threshold and enter it.

It is pleasant to lay aside the cloak of criticism and don the robes of praise and admiration. If the exterior lends itself to disparaging comparisons, the interior disarms and overwhelms us by its unique beauty, tender grace and lofty magnificence. The nave and choir soar up as if into illimitable space, and are unusually high for their width, reminding one again of French influences, although in detail they are thoroughly English. The superb arching and piers lead us up to the magnificent triforium, with its beautiful fenestration, which has been said to be unequalled elsewhere, and then still upwards to the great clerestory windows, and above that to the groined stone arched roof.

We cannot be too thankful that the builders of the western portion of the nave had the great good sense and magnanimity to sink their individuality and complete the nave on the lines and with close similarity to the four eastern bays of the nave built a century before. The whole nave has thus a unity and harmony which it would not have had if they had built it in a later style, as was usual and commonly done in so many other places.

The only difference is in the details of mouldings, in the shafting of the nave piers, and in the absence of the beautiful surface diaper work of the earlier time, differences which do not affect the general appearance, and are most interesting as serving to maintain a distinct yet harmonious personality.

The transepts are as fine as the nave, and have special features distinguishing them, such as the great rose window and the carved angels in the spandrels of the triforium, reminding one of the beautiful angel in choir at Lincoln. The triforium space is unusually ample and large in the Abbey, and forms in reality a continuous gallery round the church, from which large concourses of people could view ceremonials below.

The ritual choir is brought down four bays of the nave, and is divided off by a modern screen erected by Blore. On the top of this screen the organ used to stand, but was removed, divided up, and placed at the sides some years ago.

At the east end of the ritual choir is the grand screen, a noble piece of work, the eastern side of which dates from the 15th century and has carvings illustrating incidents in the life of the Confessor. In front of this, and also behind it, is a very precious and unique piece of mosaic pavement called Opus Alexandrinum, formed of rare marbles. There is but one other piece of pavement of this kind in England, namely, at Canterbury.

A series of chapels cluster around the east end, culminating in the Chapel of the Kings, lying immediately behind the high altar. Here is the famous Coronation Chair and stone on which all the Kings and Queens of England have been crowned since the time of Edward the First. This "Hammer of the Scots" brought the famous stone from Scone, the old Scottish capital. The chair enclosing this stone was originally intended to be of bronze, and we are told the workmen had actually begun it, but for some reason or other it was made of English oak and decorated by one Walter, a famous painter at that time.

A nimbus of legendary fame encircles this stone. The legend runs that it is the stone which Jacob took for his pillow at Bethel, and was transported by his descendants to Egypt. The son of the King of Athens who had married the daughter of Pharaoh, alarmed at the fate of Moses, fled to Sicily or Spain with it. From thence it was carried to Ireland, and on the sacred hill of Tara became the stone of Destiny, and on it the Kings of Ireland were crowned. Fergus bore it from Ireland to Dunstaffnage, and as the Scots went eastward Kenneth II. in 840 removed it and set it on a raised mound in Scone. There, incased in a chair of wood, the Kings of Scotland were crowned. Such is the legend—I cannot vouch for its truth.

The other Coronation Chair which stands beside it is much more modern, and was made for the Queen at the time of the accession of William and Mary.

Addison, in one of the numbers of his "Spectator," gives an amusing account of a visit of Sir Roger de Coverly to the Abbey. He says, "When they came to the chair, having heard that the stone underneath the more ancient of them which was brought from Scotland was called

Jacob's pillow, sat himself down on the chair and, looking like the figure of an old gothic king, asked the interpreter what authority they had to say that Jacob had ever been in Scotland. The fellow, instead of returning him an answer, told him that he hoped his Honor would pay the forfeit. I could observe Sir Roger a little ruffled on being thus trepanned, but our guide not insisting on his demand, the knight soon recovered his good humor, and whispered in my ear that if Will Wimble were with us and saw these two chairs it would go hard but he would get a tobacco stopper out of one or t'other of them."

This cutting and scribbling mania seems to be a disease not confined to the present day, and the Coronation Chair is almost covered with names cut and scribbled on the back and arms, many of them of some antiquity.

One cannot take the most cursory view of the Abbey without being impressed by the monuments that obtrude themselves at every point, but as I desire to give you some idea of the architecture of the Abbey first, permit me to complete our round before taking up the monuments.

Between the chapels of St. Nicholas and St. Paul you enter by a flight of steps under a frowning arch and through beautiful brazen gates into the famous Henry the Seventh's Chapel. It has been called a "miracle in stone," and in spite of its debased Gothic it fascinates you by its bold daring, its reckless exuberance of ornament and detail, its triumph over what are generally considered the limitations of stone.

This chapel is almost itself a miniature cathedral, for it has a nave, two aisles and five apsidal chapels, and is considered the finest perpendicular or ecclesiastical Tudor building in England. Its chief wonder and glory is its fan tracery roof. Washington Irving speaking of it says: "Stone seems by the cunning labors of the chisel to have been robbed of its weight and density, suspended aloft as by magic, and the fretted roof achieved with the wonderful minuteness and airy security of a cobweb." We have somewhat similar roofs in King's College Chapel, Cambridge, St. George's, Windsor, and a few places elsewhere. It is difficult to describe this roof, but I hope to show you on the screen the construction of it. In the meantime I may just say that the main groining ribs spring from the caps of the columns and form flat, slightly pointed arches; studded all over are stalactite pendants, through which the ribs seem to go, and these spread like the branches of a tree until they meet each other in bewildering panelled and cusped reticulations. They appear most puzzling, but they follow certain well-defined lines of construction which when mastered give the key to the puzzle. To strengthen the haunches of the springing arches the space is filled in with cusped panelling. We have to thank Sir Christopher Wren for the preservation of this roof, as in his time it was threatening disintegration, but owing to the steps he took and his wise care, this disaster was averted, and it still remains, a wonder to each succeeding generation.

The abbey, unfortunately, is not rich in old or even good modern stained glass. In the Triforium of the Presbytery there is still a little grisaille of the 14th century. In the east window of Henry 7th's chapel is a figure of the founder. Here and there we find fragments of old glass have been worked in. The great Choir of Amiens seems but a framework for its glorious glass, but Westminster derives no glamour from "storied windows richly dight."

One of the most exquisitely beautiful parts of the abbey is the Chapter House; it was the council chamber of the monastery and is almost peculiar to English cathedrals. It is a detached octagonal building, about 52 ft. in diameter, somewhat similar to those at York, Lincoln and Salisbury, with a slender central clustered pillar of Purbeck marble about 35 feet high, from which the ribs of the vaulted roof spring, branching out like a tree to a height of about 50 feet from the floor, and drooping to the angles of the walls.

The double doorway entering from the cloisters is singularly beautiful. All round the walls under the large windows is a stone seat and arcading, behind which are some old and remarkable paintings of subjects from the Apocalypse found at the time of the restoration by Sir Gilbert Scott, and supposed to have been painted by Brother John in the reign of Edward 4th.

The Chapter House has passed through very trying vicissitudes; it was erected in 1250. The House of Commons came into existence in 1265; they first sat with the Lords in the great hall of the palace adjoining, but in 1282 they parted, and the Commons used this Chapter House until the death of Henry VIII in 1547. Then it became national property and was used for storing the public records, and to obtain more room the groined roof was taken down and galleries erected. It thus remained in this state of humiliation until 1865, when it was restored to its original beauty as it now is.

The Jerusalem Chamber is part of the Dean's house and originally of the Abbot's house, and obtained its name probably from tapestries or pictures depicting the history of Jerusalem, on the walls. This chamber is a Mecca for all good Presbyterians, for here the Directory, the Larger and the Shorter Catechism and the Confession of Faith were drawn up while the famous Westminster Assembly sat from 1643 to 1649, and here also more recently the revisers of the Bible carried on and completed their work.

Retracing our footsteps, and passing on the way the Chapel of the Pyx, or the treasury where the Royal regalia was kept for years, we again enter the abbey to glance at the monuments.

The abbey in its illustrious dead is very cosmopolitan. Here churchmen and nonconformists lie side by side; the dust of the foreigner mingles with that of her own sons. Kings and queens, statesmen, philanthropists, poets, preachers, musicians, warriors, men of science, architects, all are there.

Victory or Westminster Abbey has not alone been Nelson's watchword; it has furnished the incentive for many an heroic struggle against the elements of evil.

In course of time there has grown up a rough classification in the position of the monuments. Thus we have Royalty in the Chapel of the Kings and in the chapel of Henry the 7th; statesmen in the North Transept; poets and literary men in the South Transept, called the "Poet's Corner." Even to these, however, there are exceptions. Our steps instinctively turn first to the heart of the abbey—the Chapel of the Kings, and to the tomb of Edward the Confessor, for whom the abbey was intended by Henry the III as a magnificent mausoleum. It had to be placed to the east of the High Altar, and as the Lady Chapel was

already built here by Henry, to obtain room the High Altar was moved further west to the position it still holds. This magnificent shrine erected in 1260, the work, as we are told from the inscription, of Peter of Rome, was splendid with tabernacle work above, supported on beautiful arches springing from twisted columns and sparkling with glass incrustated mosaic, and even now, in its decadence, is still most beautiful.

Beside him lies good Queen Edith his wife, of whom we are told that being well skilled in needle-work, she embroidered the state robes of her husband. She was the daughter of Earl Goodwin, whose castle once stood on the spot where the fatal Goodwin sands now are.

Near by is the tomb of Henry III, who, after a reign of 56 years, a long reign for those troublous times (now eclipsed by the 60 years' reign of our gracious Queen) was drawing near his end. The Crusaders' Temple church was to have been his sepulchre, but his heart's affections had so entwined themselves round the abbey he had almost entirely rebuilt and loved so well, that no other place seemed so fitting.

In marked contrast is the plain tomb of Edward Longshanks. When the tomb was opened in 1774, nearly 470 years after his death, we are told the embalmed body was found in good preservation. Some one had the curiosity to measure the body, and found it to be 6 ft. 4 in. long.

There are a number of other tombs here, but of lesser importance, and near by are the "Crusaders'" beautiful Gothic tombs of the Decorative period, the one to Aymer de Vallance being specially well known, and whilst we are amongst the super-refined dust of kings and queens, we will maintain the royal succession by passing into Henry the Seventh's chapel. Having previously examined its architecture, we are able now to devote our attention to the Royal Founder's tomb, which is so huge as to defy neglect. Not only in size, but in richness and splendor, it compels notice. Pietro Torregiano, a companion and friend of Michelo Angelo and a Florentine, was brought over to execute it. The tomb is made of a kind of black marble, on which rest recumbent figures of the king and his queen, and is of great richness. Surrounding it is a high screen of brass or bronze perpendicular Gothic work of the most intricate and elaborate design and workmanship. It originally had 36 statues in canopied richness, of which only six remain. So heavy and ornate is this screen that the tomb is almost hidden from sight by it.

Most interesting amongst the other tombs are those of Queen Elizabeth in the north aisle, and Mary, Queen of Scots, in the south aisle. The latter was buried first at Peterboro, and from thence was removed here by James 1st in 1612. Implacable enemies in their lifetime, their dust mingles in neighborly unity.

In the chapel at the east end Cromwell was buried in 1658. With the barbarity of the age, a few years afterwards the great Protector's body was disinterred and hung at Tyburn, whilst his head was placed on Westminster Hall. It is pitiful to think of the petty spite that could prompt such treatment of the body of one whose shoe-latchet in his lifetime these men were not fit to tie.

Dean and Lady Stanley lie buried in one of the small chapels. It may be said of them, "they were lovely in their lives, and in their last resting-place "they were not divided."

Coming back to the abbey proper, in St. Paul's chapel is the monstrous statue of James Watt by Chantry, hideous as his own steam engine, and so heavy, we are told, that in bringing it in, it broke through the pavement into several of the vaults below, disturbing hallowed dust. In the Chapel of St. John "Baptist" is the large monument of Lord Burleigh, with recumbent figures of the Earl and his Countess Dorothy; on his other side is a vacant space which was intended for the effigy of his second countess, but she indignantly refused to divide honors with his first wife, and the space remains vacant to this day.

We must not pass the portion of this chapel called Abbot Islip's Chantry without ascending to the chamber above, to see the curious wax effigies collected here, suggesting to the irreverent reminiscences of Madame Tassands. It was the custom at all burials in the abbey to have a waxen effigy clothed in the garments usually worn by the deceased, carried in the procession and afterwards deposited in the abbey, a custom which had a precedent in ancient Rome.

From time to time some of these have been destroyed, and now but few remain. On my last visit to the abbey, quite a number were there, but all rather dusty, ragged, and unmistakably showing the ravages of time. Amongst them were Queen Elizabeth, Charles the II, Queen Anne, William and Mary, Lord Nelson and others, furnishing an instructive commentary on the vanity of rank and pride.

In the next chapel—that of St. John the Evangelist—is the famous monument to Sir Francis Vere, modelled on the lines of that of Countess Nassau at Breda, where four kneeling knights bear a slab with the arms of the dead hero who lies underneath. The story is well known of Roubilliac the sculptor, who was found standing in rapt admiration of one of the knights, and on being accosted, said, "Hush! he will speak presently."

In St Andrew's chapel is the (perhaps best known and intensely dramatic) Lady Nightingale monument, by the sculptor I have just mentioned, where her husband is vainly trying to arrest Death, who is in the guise of a partially draped skeleton issuing from a tomb, from throwing his dart at her. The monument is in the worst possible taste and most repulsive and horrible, and it is a great pity that this and many others ever found their way into the abbey.

As we have already intimated, the North Transept is the Statesmen's Corner, and here are monuments to Lord Chatham, Fox, Grattan, Palmerston, Pitt the Younger, the two Cannings, and Peel. In the west aisle of the transept are memorials to Blow Burney and Purcell, the musicians and composers, and also to Cobden of Free Trade fame, and the noble-souled high-strung Wilberforce, who gave his best years to the abolition of slavery.

The "Poet's Corner" in the South Transept is classic ground. The founder of this peaceful and quiet dynasty was Chaucer, "that well of pure English undefiled," where so many small authors have had their little pitchers filled whereby they have refreshed their day and generation. The next was Spencer of "Fairy Queen" fame, a book in many volumes which everyone has heard about, but I venture to think few have read. He was followed to the grave by Beaumont and Fletcher,

Ben Jonson, and probably Shakespeare. The latter has the well-known monument here, but he is not buried in the abbey. The Avon rocks him to sleep at Stratford. There was a wish to lay him in the Poet's Corner, and Basse, a poet of that time, quaintly wrote, "Renowned Spencer lies a thought more nigh to learned Chaucer, and rare Beaumont lies a little nearer Spencer, to make room for Shakespeare in your threefold fourfold tomb."

The epitaph "O! Rare Ben Jonson" is familiar to all; his monument is here, but he is buried in the north aisle of the nave. The story is that he asked Charles I to grant him a modest request, viz., 18 inches square of ground. This was readily granted by the king. When he learned it was to be in the abbey, the royal giver hesitated, but a king's word is not to be lightly taken back, and so the story goes, that Ben Jonson was buried upright in his 18 inches of ground. When digging at this spot a skeleton in an upright position was actually found, giving a certain color to this story.

Next come Dryden and Butler, and the monuments of Milton and Gray, memorials only however, for Milton's dust reposes in the fine old church of St. Giles Cripplegate, amid the bustle of city life, and Gray lies in the quiet remote churchyard of Stoke Pogis which he has immortalized in his Elegy.

The monument of Gray attracts notice from its cynical couplet, put on it by his own desire: "Life is a jest and all things show it—I thought it once, but now I know it."

There is also a monument to Addison, but his grave is in Henry the Seventh's chapel.

Southey, Dr. Johnston, Goldsmith and Thompson are not forgotten. Time would fail me even to enumerate the glory roll of those buried in this corner. To mention only a few amongst many: Of musicians we have Handel; of historians, Macauley and Grote; of novelists, Charles Dickens and Thackeray; of actors, Garrick; of architects, Chambers, Wyatt and Sir Robert Taylor. Curiously enough, no painter is buried in the abbey.

Coming now to the nave and aisles. There is one interesting spot in the middle of the nave, the spot where one of the truest and grandest of Scotland's sons is laid—I mean Livingstone. His heart was fittingly left in the great Dark Continent for which he gave his life.

Not far from him lie the engineers, Telford and Stephenson, and here also is the dust of Sir Gilbert Scott, who was architect to the abbey for many years, and his comrade, George Edmund Street, architect of the Law Courts; also Sir Charles Barry, who lies almost under the shadow of his greatest work, the Houses of Parliament.

Amongst naval and military heroes in the aisles are Lord Clyde, Outram and Dundonald. In front of the choir lies Sir Isaac Newton, and amongst the monuments we must not forget the one to John and Charles Wesley, who did so much to quicken the religious life of England; and in the Baptistry near the western door are two sweet singers—Wordsworth and Keble.

The incongruities in the memorials in the abbey must strike everyone. It is truly cosmopolitan in taste, as in creed and nationality. Many names are found of those who reflect little credit on the illustrious edifice, and many names we miss of those who would have added lustre to this National Campo Santa.

For lack of proper and wise oversight, monuments have been admitted which are felt by everyone to be singularly out of place, and out of touch with the genius and spirit of the architecture of the abbey. Some notorious ones I would have no hesitation in removing, but traditions and vested rights are no doubt obstacles.

The abbey and precincts are now so crowded that many more interments cannot take place, nor many more monuments be admitted.

The necessity of maintaining the continuity of the succession of the memorials and remains of the mighty dead, together with the best means of overcoming the lack of space without incongruity, or disturbing the best traditions of the abbey, has for some been exercising the minds of those in charge.

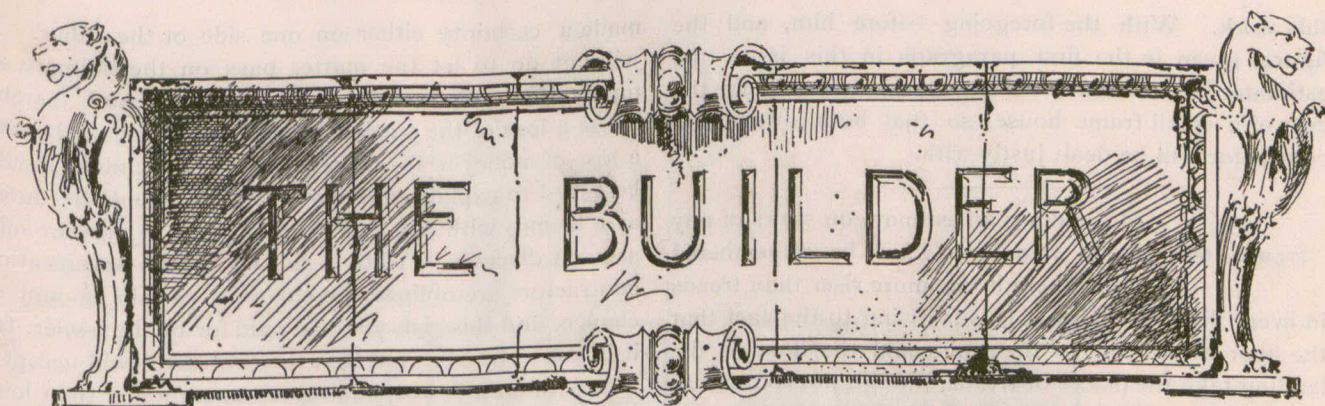
Many designs have been made, embodying such ideas as a second large cloister or Campo Santa, a large crypt or chapel adjoining, etc.; all these schemes have found their ardent advocates and vehement objectors. Something must be, and doubtless something will be, evolved, that will be felt by all to satisfactorily meet the difficulty.

I have referred to the absence of many names we might have expected to find here, and I cannot close better than by quoting a sentence by Dean Stanley in reference to this. He says: "Westminster Abbey is, as Dr. Johnston well said, the national resting-place of those great men, who have no bond elsewhere; its metropolitan position has in this respect powerfully added to its fame. But even London is, or ought to be, insignificant compared with England; even Westminster Abbey must at times yield to the more venerable, more enduring claims of home and race. "These quiet graves far away are the Poets' Corner of a yet vaster temple, or may we take it another way and say that Stratford-on-Avon, and Dryburgh, Stokepogis and Grasmere, are chapels of ease united by invisible cloisters with Westminster Abbey itself."

The largest church edifice in the world is St. Peter's in Rome; the smallest is a church ten feet square in the Isle of Man.

His Excellency Lord Aberdeen has accepted the office of patron of the Province of Quebec Association of Architects, as a mark of his appreciation and good wishes for the association and the profession in general. At a recent meeting of the Association Mr. William C. McDonald was elected an honorary member in recognition of his great generosity in endowing a chair of architecture in McGill University.

Judge Ouimet has given judgment in the long-contested case of A. R. McDonald, ex-superintendent of the Intercolonial Railway, against Charles Riordan of St. Catharines, the estate of the late John Macdonald and Ed. Boswell. The plaintiff claimed a large sum as due him in connection with the Temiscouata Railway, and the court gave judgment for \$197,000 with interest for seven years at 6 per cent. It is probable the defendants will carry the case to a higher court.



[THIS DEPARTMENT IS DESIGNED TO FURNISH INFORMATION SUITED TO THE REQUIREMENTS OF THE BUILDING TRADES. READERS ARE INVITED TO ASSIST IN MAKING IT AS HELPFUL AS POSSIBLE BY CONTRIBUTING OF THEIR EXPERIENCE, AND BY ASKING FOR PARTICULAR INFORMATION WHICH THEY MAY AT ANY TIME REQUIRE.]

Some Guides for Estimators.

THE great difficulty in preparing rules for estimating when prices are involved, is the fluctuation and local differences in cost of labor and materials. Lumber in some places may cost from one to four dollars per thousand feet more than in others, the quality being the same, and labor, while it does not vary so widely as lumber, varies enough to make it impossible to give rules from a central point, that can be relied upon with certainty at points distant from where the estimate is made, so far as the cost of labor is concerned. The local surroundings, too, have something to do with the cost of a building. In some places excavation may be done with ease, the ground being dry and easily handled. In other places the ground may be stony, tough clay, or an inflow of water may prove very troublesome. All these factors should be considered when an estimate for any particular building is being prepared. The following prices at this writing may be taken as a standard where local prices are not obtainable, or difficult to get, but, as has been repeated in these columns over and over again, the estimator should make it a point to arm himself with the actual prices current when the proposed works are to be erected :

Excavation per yard.....	\$ 20
Stone foundation, put in complete, per cord of 100 laid in the wall.....	8 00
Brick laid in the wall, per M.....	12 00
Plastering, two coats, complete, per yard.....	20
Framing timber and lumber, hemlock, per M.....	11 00
Flooring, ready to lay, per M.....	17 00
Siding, second clear, 4, 5 or 6", per M.....	16 00
Sheathing and roofing, second, per M.....	12 00
Pine shingles, per M, best 16-inch sawed.....	3 00
White cedar shingles, per M, best 16-inch sawed.....	2 50
Slate, best, laid per square (100 feet).....	8 00
Finishing lumber, pine per M.....	\$25 00
Painting, per yard, each coat.....	30 00
Carpenter's wages, per day.....	6
Mason's wages, per day.....	2 00
Laborer's wages, per day.....	3 00
Hardwood finish, with hardwood doors, extra over pine per room, about.....	1 25
	20 00

Of course something depends on the size of the room and the character of the work; on an average, however, if the estimator has no other data to work on, he may feel fairly safe in adding \$20.00 extra over pine finish for each room finished in hardwood, if the room is not above ordinary dimensions. It must be kept in mind, however, that this refers only to the bare wood-work in its natural condition, and not after the painter or polisher has gone over it. Three coat work, in paint, according to the figures, would sum up eighteen cents per yard, or 20 at the farthest, but if the work was finished up in hardwood, filled, rubbed and polished, the same surface might cost from thirty cents to one dollar and fifty cents per yard, a condition of importance to the estimator. A careful examination of the specifications

is absolutely necessary when deciding on the cost of wood finishing.

Estimating.

THE frequent enquiries that pour into the office of every architectural or building journal asking for some "short cut to estimating" proves beyond a doubt that many contractors, and would-be contractors are either unable to master a thorough and systematic method of estimating, or are too careless or indolent to enter into all the minutiae of the art—for art it is—and, although the best minds in the building world have endeavored to evolve some quick and easy method of getting at the cost of a building before its erection, nothing satisfactory has been developed. The system of cubing, estimating by comparison, and "jump estimating" have all been tried and found wanting, and the successful contractor has always found it necessary to fall back on his "first love," and estimate his proposed work item by item or by groups of similar items. The following figures, although not correct in every particular or for every locality, may serve in some instances where a hasty estimate may be required. The figures are taken from a number of works on estimating, and are given as "helps in need" where local figures are not to hand:

The price of grates finished and in place, including blower and frame.....	\$ 12 00
Outside cellar stairs, complete with doors, hinges, locks and fastenings.....	10 00
Cost of lower floors in dwellings, including joists, bridging and good quality of pine flooring, per square.....	13 00
Second floors, per square.....	12 00
Upper tier of ceiling joists, including time and all materials, per square.....	2 00
Wood copings, per foot.....	10
Chimney backs, fire clay, each.....	1 00
Flashings, 14" wide, per foot.....	9
Plain cornice, composed of matched stuff and fillet, including time, per foot, square.....	15
Siding, including studding, boarding, papering and time, per square.....	4 00
Partitions, including studding, two coats plastering, lath and time, counting both sides of wall, per square.....	6 15
Box stairs, no rail, each flight, including lumber and time.....	12 00
Stairs with rail, balusters and newel posts.....	20 00
Inside doors, with frames, locks, etc., each.....	6 00
Outside doors, with transoms, good mortise locks, bronze faced butts, each.....	11 00
Average sized windows, with medium weight glass, weights, pulleys, and all complete in place, each.....	7 50
Base in average sized room, in place.....	3 50
Shelves in pantry in ordinary style.....	4 00
Wainscoting per lineal foot, time and material, including cap.....	26
Conductor pipes and gutters per foot.....	11
Verandah, including turned posts, tin roof, foundations of posts, painted joints in floor, brackets, spindle work, three coats of paint, all complete, per running foot....	4 50
Chimneys per foot, from.....	75 to 1 00
Per foot according to size and number of flues in each shaft.	

Wooden mantels vary in price according to style finish and materials used in their construction, from \$8.00 to \$100 each, so that the estimator must have some particular style in his mind's eye when he fixes a price for

this work. With the foregoing before him, and the figures given in the first paragraph in this issue, the estimator should have no trouble in determining the cost of a small frame house, so that both owner and contractor will be dealt justly with.

IN making an estimate on stairs of any kind it must always be remembered that there is one more riser than treads in every flight of stairs. This is owing to the fact that the floor at the foot of the stairs and the floor at the landing take the places of treads, though not counted as such. The width of the tread does not include the nosing or projection; thus a 10 inch tread will measure $11\frac{1}{2}$ inches, as the nosing will project from the face of the riser $1\frac{1}{2}$ inches, or at least the thickness of the stuff which forms the tread. The run of a stair is the distance between the face of the first riser to a line perpendicular to the face of the last riser in the flight. The height of the riser always includes the thickness of the tread, so that the first riser must be made narrower by the thickness of the tread than the other risers that are placed above it. In laying out a stair having a "winder" in it, it is customary to make the centre of the "winder" treads the same width as the "flyers" or regular treads. The cost of ordinary stairs, either open or cased, may be obtained by finding the number of feet in each flyer and riser, and counting the steps and risers and strings adjacent, allowing generally one foot in length of string for each riser. Allow for timbering the carriage underneath the stairs, when such work is done. After ascertaining the number of feet of lumber in one step and riser, with one foot in length of strings included, multiply by the whole number of risers in the flight, allowing three straight steps for each winder or swelled step, where there are such. An allowance of two will be sufficient when there is no furring underneath. Allow four for quarter platforms and six for half platforms. No allowance need be made usually for landings unless large. Double the cost of all dressed lumber. Figure pine at 5 cents per foot, oak at 7 cents per foot, walnut at 12 cents per foot. For ornamental brackets of pine allow 16 cents each, and oak or walnut 30 cents each, or per foot of fascia if the bracket is continuous. For all hand railing put up plain multiply number of square inches on cross section by 3 cents, which will be the price per foot for pine, and multiplied by 4, will give the price of birch, oak or sycamore, while 5 will give the price in walnut. Crooks, ramps and goose-necks should be figured at three times their length. The prices of balusters, plain and ornamental, and of newels in regular or special styles, may be obtained at any woodworking establishment where a wood-turner is employed, or from regular dealers who make a specialty of wood turning and who will gladly send catalogue of design and price list if applied to.

Too much care cannot be taken in reading and studying the specifications for a building of any kind. Often these important documents are very loosely drawn or worded. Ambiguous phrases and misleading expressions find their way into specifications sometimes, that were never intended by the architect to convey the meaning the estimator extracts from them. If the estimator has a "doubt" on any item he is figuring on, he should not send in his tender until that doubt has been

made a certainty either on one side or the other. It will not do to let the matter pass on the estimate as uncertain, as it may be an overcharge, and thereby cause a loss of the work, or an undercharge, and cause a loss of money to the contractor. The architect should be asked to explain, and his rendering should be noted as a memo, with day and date, in order to prevent subsequent disputes. With a loosely drawn specification contractors are obliged to bid on a certain amount of chance, and this risk must be paid for by the owner, for it is not to be expected that the contractor will accept a risk without a corresponding remuneration. In a long experience in matters of this kind, we have always found that the more exact the details were in a specification, and the greater amplitude given them, the closer were the figures of competing contractors, and the nearer to a correct value of the work was presented in each tender. On the other hand, it is frequently the indefiniteness of the specification that proves the cause of such divergence of bids. Plans and specifications drawn up and prepared by country carpenters, who have had little or no experience in works of any magnitude, are dangerous instruments for builders to meddle with, if possessed of honest intentions. The number of "outs" and "omissions" and misplaced and alarming phraseology, often prove such a source of endless dispute and contention, that the specifications become a veritable Pandora's box to everyone concerned. Of course, an experienced contractor will read in a rurally prepared specification, a great deal between the lines and protect himself accordingly, but the new beginner should make it a point to have every "foggy" detail made clear before submitting his tender. It does not follow that because a specification may be "hazy" that the drawer of it up does not know what he wants or intends, for as a mechanic and a builder and draughtsman, he may be quite an expert; but the drawing up of a perfect specification requires a quality of a much higher order, the chances of acquiring which seldom fall to the lot of country builders, though it must be acknowledged that under the circumstances our suburban builders perform their mission fairly well.

Concrete and Cement Work.

In estimating the cost of concrete work much depends upon the cost of the raw materials used, the kind of concrete made, and the use it is to be put to. In building concrete is used for several specific purposes, as follows:

- 1st. Footings and foundations of walls.
- 2nd. For cellar walls.
- 3rd. For the walls of superstructures.
- 4th. For the filling of arches in fire-proof structures.
- 5th. For cellar floors and walks.

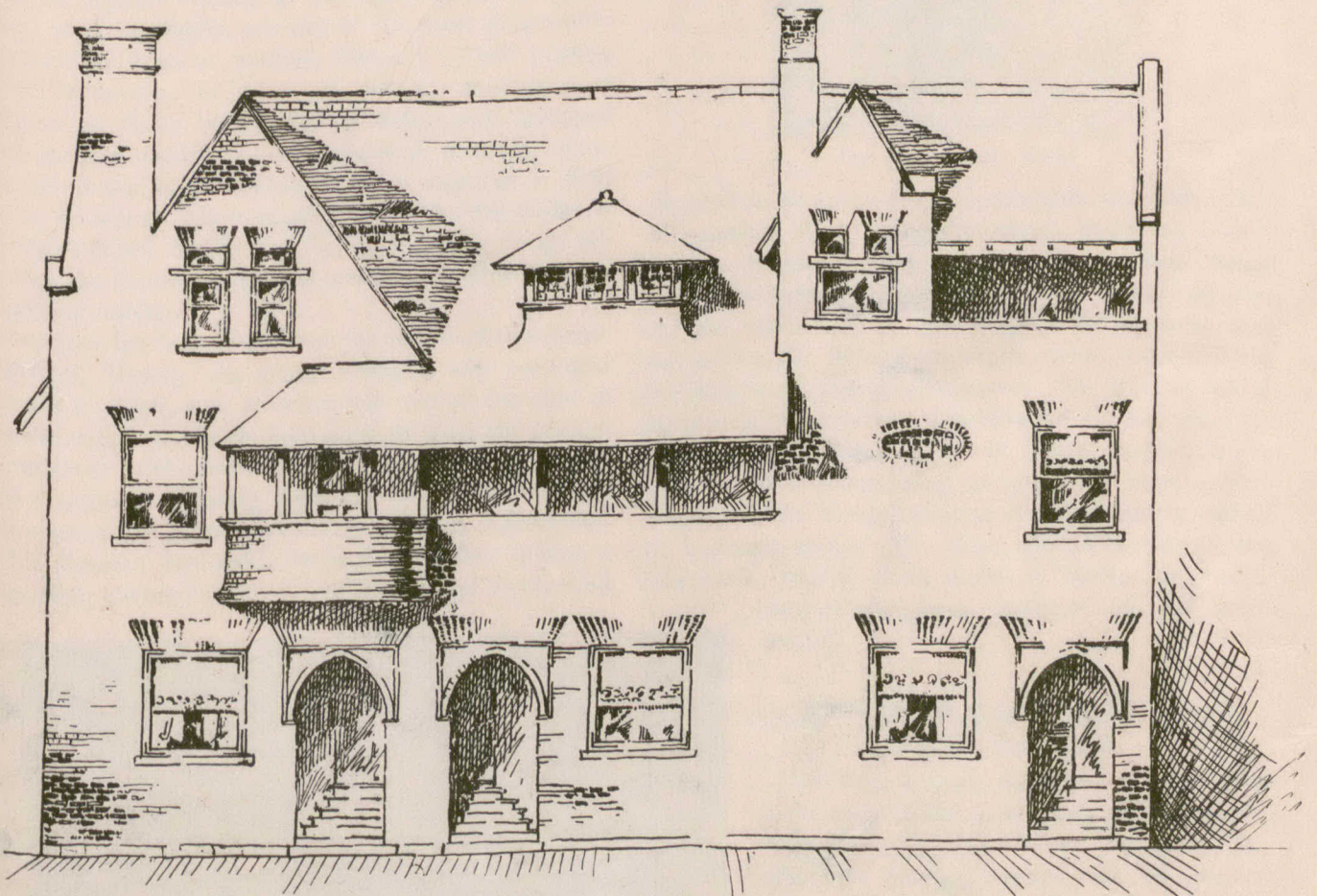
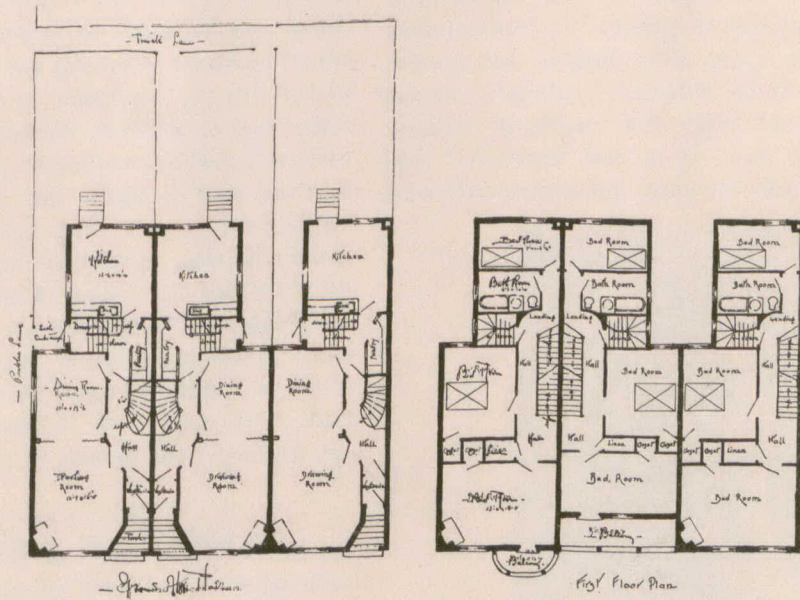
Concrete is prepared in several ways, and of several materials, Portland cement being the base, as follows:

Portland cement used in all cases.

Cement 1 part.	Broken stone 3 parts.	Gravel.. 1 part.	Sand 3 parts.
" 1 "	" bricks 3 "	" .. 1 "	" 3 "
" 1 "	Cinders.... 4 "	" .. 1 "	" 2 "
" 1 "	Pebbles.... 2 "	" .. 2 "	" 3 "
" 1 "	Broken stone 3 "	Cinders.. 2 "	" 2 "
" 1 "	Coarse slag.. 3 "	Fire clay 1 part.	" 3 "

Mixed with clean water.

To the cost of the several ingredients to be worked into the concrete, add the labor of preparing, and the cost of mason's wages in placing in building, as follows: A good laborer will prepare a cubic yard of concrete ready to put into a wall or footing in one and a half hours; a



— Front Elevation —

Three Attached Houses
Scollard St Toronto

April 1894 Dick & Wickson
Architects

1/8" scale

mason will place and ram a cubic yard in half an hour. Concrete is generally measured by the cubic yard or by the superficial yard, according to the kind of work, and the cost is gauged by the cost of material and labor. Cellar bottoms and walks are generally prepared by the use of from 2 to 6 inches of concrete, on the top of which is finished from one-half an inch to two inches of top dressing compound, of one part of best Canadian portland cement, and one and a half or two parts of coarse sharp sand. The cost of this class of work varies from 50 cents to \$1.25 per superficial yard, the latter sum being for the best work made, not less than six inches thick, and built in a good gravel or shale base, rating cement at \$3.50 per barrel, and sharp, clean sand at \$1.00 per cubic yard, mason's wages at \$3.00 per day, and laboring man at \$1.25 per day. Any change in these prices will, of course, affect the cost per yard of the work.

MESSRS. HAWES & MATCHETT.

OUR travelling representative furnishes some particulars of Messrs. Hawes & Matchett, of St. Thomas, Ont., who, he states, are one of the most progressive contracting firms in western Ontario. Their planing mill and factory, of which we give an illustration, is situated on Ross street, and is thoroughly equipped with modern machinery, thus enabling them to manufacture all the woodworking material required in their work, as well as to do a supply trade with other builders. A large lumber business is also done, their yards adjoining the factory being well stocked with the different grades of lumber.

The firm has been organized for about twelve years.

Mr. S. Hawes, the senior member, was born near London in 1846, and after leaving school engaged in several minor mercantile lines until forming the present partnership. Mr. Hawes is held in high esteem by his fellow townsmen, having been elected as alderman for three successive years, then refusing further nomination.

Mr. Edward Matchett, the junior member is also a Canadian, having been born in the county of Haldimand



in the year 1852. After leaving school he learned the carpenter trade, working as journeyman until removing to St. Thomas in 1880, where he engaged in the building business until 1885, when he became a member of the present firm. Mr. Matchett, being a thoroughly practical workman, gives his supervision to all details.

Mr. J. Fenn, contracting plasterer, of London, reports prospects for season's business very promising. He has recently completed the interior of the Congregational church, Horton street.

THE LATE G. W. REED.

READERS of this journal will regret to learn of the death of Mr. Geo. W. Reed, the well-known roofer and manufacturer of roofing materials, of Montreal, who formed the subject of a biographical sketch in our January number. In this issue we reproduce his portrait, together with some particulars of his active life. Deceased was in his 69th year, was a native of New Hampshire, but came to Montreal as far back as



THE LATE G. W. REED.

1852, when he entered into partnership with Mr. Raynor, another New Hampshire citizen, under the title of Reed & Raynor, in the slate-roofing business, being among the first to introduce that industry into that city. On the retirement of Mr. Raynor the business was carried on by Mr. Reed alone, who succeeded in building up an extensive business. He was an active member of the American Presbyterian church, from its establishment at the corner of McGill and St. James streets, and besides being an elder for many years, taught in the Cross mission for over thirty years. In business circles Mr. Reed always stood in the front rank, having done much to elevate the standard of business integrity in the community.

AN AUSTRALIAN ARCHITECT AND BUILDER.

WE have recently been favored with some particulars of Mr. J. H. Garratt, of Sydney, Australia. Mr. Garratt is a brother of ex-alderman Joshua Garratt, the well-known contractor of London, Ont., and holds the position of architect and superintendent of construction for the New South Wales Fresh Food and Ice Company, a concern of large magnitude, who are constantly adding to their many branch houses. Mr. Garratt states in a letter to his brother that the building trade of Australia is very quiet.

He has recently finished a cold storage factory at Grafton, where over \$5,000 per week is paid out for produce, while the factory is only working to one quarter of its capacity. He is about to commence the construction of a \$150,000 plant and buildings at Sydney, where the head offices of the firm are situated.

The oldest wooden building in the world is a church at Bor-gund, Norway. It was erected in the eleventh century, and frequent coats of pitch have preserved the wood from decay.

PROMINENT CANADIAN CONTRACTORS.

III.

B. MOONEY AND SONS.

THE well known and established firm of B. Mooney & Sons is undoubtedly among the largest of those in the contracting line in the Maritime provinces. The subjects of the portraits which are herewith presented are Messrs Patrick and Michael Mooney, the senior members of the firm, of which Mr. Edward Mooney is

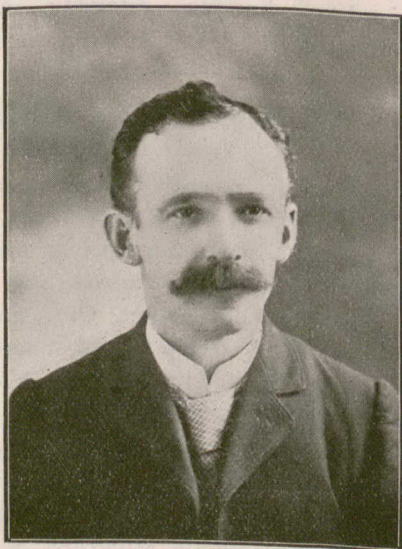


MR. PATRICK MOONEY.

a third partner, all being sons of the lately deceased Bernard Mooney, whose name the firm still bears.

Mr. Bernard Mooney came to Canada from the north of Ireland in 1861, and settled for a short time at Musquash, N. B., where he practiced the trade of stone mason, which he had learned in Ireland. After a short time he moved to Carlton and later to St. John, where he settled permanently in 1877. Shortly after the great St. John fire, he opened a brickyard in Fairville, and engaged in contracting, taking a prominent part in the rebuilding of the ruined city, about two hundred buildings having been erected under his direction. His sons, as they grew up, took an active interest in the work, and since his death, in 1890, have carried on the business alone.

The brickyard of the firm now covers over 10 acres



MR. MICHAEL MOONEY.

and turns out daily 50,000 bricks. A new 100 h.p. boiler and 150 h.p. engine are being added to the plant. An average of 110 men are employed the year round, and for some time last summer the staff of workmen numbered 180.

Among the large buildings which the firm have erected in St. John are the following: Centenary stone church, one of the finest edifices in the Maritime provinces; the churches of St. John the Baptist, Holy

Trinity and St. Peters; Miserecordie hospital, Aberdeen school, St. John high school, St. John electric light station, Pender's nail works, and the new high school building, the latter just completed and costing in the vicinity of \$50,000. Included in the outside work were a stone church at Nelson; the immense Chatham pulp mill on the Miramichi, and a large portion of the town of Marysville, largely owned by Mr. Alexander Gibson. They also built the immense Gibson cotton factory, one of the largest in Canada, which occupies an entire block, with frontage of 418 feet, being 4 stories, with 10 foot basement and requiring 8,000,000 bricks in construction.

Over a quarter of a million dollars worth of business has been secured by this firm in the state of Maine adjoining. They built nearly all the brick portion of the town of Eastport, in that state, and during the summer following the fire of 1887, erected seventeen large brick buildings there.

In civic affairs Messrs. Mooney have taken an active interest and are highly esteemed in the community.

TORONTO MASTER PLUMBERS' ASSOCIATION.

THE Master Plumbers' Association of Toronto met in their rooms in Pythian Hall on Wednesday, the 12th inst., Mr. W. J. Burroughes, president, in the chair. Nine new members were added to the membership. The principal business of the evening was the election of delegates to attend the convention, to be held in this city from July 1st to 3rd inclusive.

The Palmer House has been selected as headquarters for the delegates, and the meetings will be held in Pythian Hall. It is expected that every part of the Dominion, except probably British Columbia, will send representatives.

Messrs. W. J. Burroughes and A. Fiddes, on behalf of the Toronto association, will represent the National Association, and the following the Toronto Association: Geo. McGuire, Alex. Purdy, Jas. B. Fitzsimmons, K. T. Allison, Jas. Wilson, with the following as alternates: C. H. Beavis, Robt. Ross, W. Inwood, J. W. Dram, J. H. Parkes, Geo. Wallis.

THE ARCHITECT IN HIS RELATION TO THE PLUMBER.

BY W. J. BURROUGHES, TORONTO.

IF there is any one thing that we can be said to know better than another, it is the fact that in all ages of the world, and in every state of human development, Man has been subject to the same natural laws—that is, his respiration, assimilation, nutrition and excretion have not been materially changed either by legislation or civilization. True, it does not require a very large amount of knowledge to realize this, but it is always wiser to know a little and know it well than, like a bubble, inflated with too much knowledge, suddenly collapse into ignorance. We are able to assert, therefore, without fear of contradiction, that city ordinances have never been able to control digestion nor change either the quantity or quality of man's excretions, the removal of which must be provided for in some way. We are so certain of this that, while we admire the majestic ruins of ancient cities, and are lost in wonder at their stupendous evidences, not only of the existence of a swarming population, but also of superior mechanical arts, we require no peculiar inspiration to enable us to determine with equal certainty the co-existence of sanitary science; because Nature's laws, in every age and among all people, have required that provision be made for the waste and excretion of the body and a proper supply of food, water and air.

We also know from experience that the larger the number of people collected together in communities, the more imperious becomes the demand. But those ancient people, together with their arts and civilization, have passed away, leaving us only the magnificent remains of their marvelous architecture from which to conjecture the extent of the sanitary science required in order to have cities with the necessary health and supplied their densely populated cities with the necessary water, air and sewage.

We learn of the architects, for many of them put their trademark on their work or had their faces chiseled in the marble, but that history has been repeating itself in its neglect of that worthy class of artisans always? Yet, we are confident that the great architect of the pyramid of Cheops, and the twenty-two architects whose names are preserved in Egypt, Ballbec and Thebes, to say nothing of those who designed the monuments and palaces of Palengue and Uxmal, the hanging gardens of Babylon or the convenient dwellings of Ninevah, must have had the aid of the sanitary plumber. We say must, unless, indeed, those ancient architects were better or differently educated in sanitary science than many of them are now-a-days. Be that as it may, their sani-

tary arts and sciences, together with their first-born children—the plumbers—got lost, so long and badly as to leave no records behind them.

After the fall of the Roman Empire, man drifted into darkness of superstition and ignorance; science was forgotten and the arts abandoned; whole communities neglected the simplest laws of cleanliness and hygiene; pestilence and death stalked hand-in-hand over the earth, sweeping away its millions of appalled and helpless victims with relentless fury and persistence.

As imperfect as our modern sanitation of cities may be, we can scarcely imagine in a civilized city of the first class, a plague like that of Egypt in 1792 or Barbary in 1799, with a death rate of 3,000 a day, or Bassona, in Persia—and all from causes now considered within the easy remedial reach of sanitary science. The great pestilences that nearly depopulated Europe during the sixteenth and seventeenth centuries became the cause of a revival, rather, the creation, of a sanitary science; for when investigation had brought to light the terrible sanitary conditions by which the evils had been produced, and men began to realize the accursed horrors of the situation and the imperative necessity of a remedy, the next step was to formulate the results of experience into science, which was done; and so well was it done that the average health of cities has been vastly improved and the duration of human life prolonged—and we have done it all ourselves, without the aid of the ancients. It is a source of some pride that sanitary science, with its long train of useful arts to ameliorate human conditions, is exclusively of our own invention. It is true, we were forced into it by a necessity which knows no law, excepting the laws of nature, of which self-preservation happens to be the first; but still we have accomplished our duty as well, perhaps, as any other department of science having for its object the advancement of man's physical welfare. By we, I mean the plumber, in contradistinction to the architect.

With a proper regard for the proverbial modesty of a worker in lead, and due deference to the grandeur and dignity of architectural achievements, we humbly submit that the modern improvements in the art of sanitation are due to the labor and experience of the long-suffering plumber rather than the intellectual efforts of the artistic and skilled architect. The inference is, therefore, clear that in the onward march of sanitary science the time has arrived when the plumber should take his place in the procession to which he is by right entitled as minister-in-chief. In the necessary and logical order of things, custom has long since entrusted the sanitary welfare of the community, and held alone responsible for the shortcomings, of the man who does the work. The architect, however learned and skillful, may design palaces, and princes may have them erected, which, but for the aid of the sanitary plumber, would become reeking hot-beds of disease and pestilence. It is to the plumber that all questions arising from defective drainage, sewerage, etc., are referred, and, whether justly or unjustly, he is alone held responsible for the evils of bad plumbing, and too frequently made to bear the sins of others. Now, the grand object of the organized agitation of our Guild is, so far as possible, to remedy the evils and elevate the sanitary art in behalf of the public as well as ourselves. Our desire is to render the plumber competent to meet the varied duties and responsibilities not only supposed, but made necessary by the practice of his art—in brief, to make himself a worthy executor of an honest art and dignified science, and even to invoke the aid of legislation if necessary in order to more effectually insure results. In order to achieve this it is necessary that the working army of reform be properly disciplined and officered, and the duties fairly and wisely assigned. Our relations with the architect, builder and doctor, should be clearly defined, and each class be made to bear their respective burdens. Our present affair is with the architects, and our duty is to examine dispassionately the relations we occupy with them, and decide what changes are necessary, if any. Presupposing that the educated plumber is his own sanitary engineer, it is evident that to him will be referred all questions of drainage, sewerage, light and ventilation, and especially the practical methods whereby the best results are to be attained, all of which are but incidental in the studies of the architect while they constitute the life and business of the plumber.

Let us look into the facts a little. The investigations of science into the causes of pestilence and the search for remedies, from which investigations sprang sanitary science, revealed facts no less curious than important. We recognize the great central fact that all matter is but the different arrangement of a few simple elements into the absolutely innumerable forms of use and beauty, and that from the lowest to the highest form of organized matter. Each is but a laboratory, which changes the material arrangement and hands it on to the organisms above it, each returning the waste to the earth and air to recommence the work in never ending cycles—not that this knowledge was necessary to enable the plumber to fit up a water closet, but to give birth to a new science, whereby the plumber's art is hereafter to be directed and developed. When Moses by Divine command instructed the children of Israel to make the first earth closets on record by covering their excreta with earth by means of a paddle which each was ordered to carry for the purpose when on the march. But when they came to be gathered into cities Moses was confronted with a series of sanitary problems that became more and more difficult of solution as the population increased, and they were precisely the same problems that bring the plumbers to the front to-day. The removal of excreta and waste of cities is not left to the leisure or discretion of anybody, but is absolutely compulsory, and proper supplies of water and air equally so, for reasons too obvious to require mention. The question that we are called upon to answer, therefore, refers to the methods best adapted to promote the public health on the one hand and to counteract the evil results of a false economy on the part of

ignorant plumbers, shoddy-builders and mercenary owners on the other.

Our duty and business interests both demand that we face the situation openly and boldly, neither underrating the difficulties before us nor deferring to vicious customs or traditional authority. It is no secret that one of the disabilities by which the practical sanitary artisan is often hindered is his false relations with the architect, relations which the sanitary experience of modern cities demonstrates should be at least modified if not reversed.

An architect is not necessarily a plumber, and is seldom practically familiar with the laws of sanitary science, and still less with plumbers' devices, methods and materials. It cannot, however, be denied but that many of the architects have given the question of sanitary plumbing a good deal of thought and consideration, some of whom (in our own city) have done more to advance the cause of good plumbing than many of the plumbers themselves. Architects are always careful whom they select to carry out their plans, in order to secure the best possible results. Yet the architect's plans and specifications are generally prepared without consultation with the plumber, who is expected to do the work, and who alone is held responsible for its efficiency, not only by the owner, but by the public.

Let us not be misunderstood here. With the architectural beauty of a building or of the building materials, the plumber has nothing to do, but with its water and air supplies, its many and varied fixtures, its piping and drainage and sewerage, he should have everything to do. In some cities, and forsooth in many of our government buildings it is customary for a builder to undertake a whole or lump contract. The builder sub-lets the plumbing, not to the best, but to the lowest bidder, who, in order to save himself, puts his whole mind on the arts of substitution, and how not to do things and still keep within the letter of the specification. The chief sufferer in the affair is the confiding owner, who, perhaps, finds his costly and magnificent dwelling little better than a whited sepulchre. This is no fancy sketch—it is history enacted in large cities every day, and tends to bring about results which are humiliating to the plumber, and by no means creditable to sanitary savants. That the plumber has too long permitted himself to occupy the position of the humble mechanic, asking leave to carry out the designs of his superiors as cheaply and showily as possible, and is expected submissively to grin and bear the popular abuse heaped upon him and his art by those who feel outraged by somebody, and make the plumber the scape-goat, cannot be denied.

There is no conflict of interest whatever between the architect and plumber, but they both need to be educated to a realizing sense of the situation. The plumber of the future will be required to conjoin his art to science and elevate them both to the dignity of a profession which will command the respect of the architect. Apparently it is too subversive of the long established relations between the intellectual designers of palaces and the heretofore dirty plumbers who have been trained to perform the double duty of drudge and scape-goat. And we do not expect the enmity of cheap people whose evil methods we hope to reform, will be conciliated at once or easily; innovations upon any established customs are always opposed by those whose trade or occupation is hindered by the improvement. This is also history. But the difficulties before us should stimulate more determined effort and encourage us to the inauguration of a more harmonious co-operation between architects and plumbers. By this means public interest in the progress of sanitary science will be inspired, and the confidence of the people gained; it will be easy to secure a wise system of legislation, in order to perpetuate and multiply the sanitary advantages we shall have inaugurated. Fortunately—if I may use the word in a case where the accumulated misfortunes arising from the evil sanitation of cities have been our school-masters—we are in some degree prepared for improvement. For nothing is more certain than the facts we have mentioned concerning the origin of sanitary science. Not only the public generally, but architects, doctors and plumbers have acquired, through misfortune, the rudiments of a sanitary education, whereby our contemplated revolution will be rendered easier. It is also most probable that the real or fancied interests of the trade will interpose vexatious obstacles in the way of any change. But neither architects, doctors or plumbers, or the shrinking public disagree as to the existence of great sanitary abuses that cry aloud for reformation, and none dispute the fact that the proper education of all concerned is the rational course to be pursued. Educate the plumber by force of law if necessary, if it cannot be accomplished otherwise, so as to enable him to execute a wise system of sanitary legislation, and all the rest will follow. To the master plumbers will then be entrusted all matters pertaining to sanitary art, and the plumbing of buildings will not be planned without his counsel. One more point it is well to suggest. As the plumbers' work is subject to especial criticism on all hands, therefore justice and common sense, under the coming dispensation, will demand that no Board of Health, either provincial or municipal, shall be complete without at least one master plumber. We have everything to hope for and nothing to fear; if we are sincere in our intentions and earnest efforts we shall succeed. Let us secure an efficient system of legislation, and the foundation will be laid for our sanitary superstructure. The architects will give us the plans; we will see to it that proper drainage shall carry away all noxious elements, and our friends, the doctors, may stand by and approve.

Glass bricks are made extensively in Germany. They are blown with a hollow center, containing rarified air, and are said to be as strong and durable as clay bricks. They freely admit light. So far the glass bricks has only been used in the construction of conservatories.

WORKS OF CONSTRUCTION.

Mr. J. Whittaker, slate roofer, London, reports good trade in his line, and has a large number of contracts already booked for this season. Mr. Whittaker has been engaged in the roofing business for the past two years, and in that line has built up a very large trade.

The corner stone of a new Methodist church was recently laid at Simcoe, Ont., the erection of which is in the hands of Mr. M. W. Hoyt, of Brantford. It will be 70 x 50 feet, with Sunday school room 60 x 50 feet, and two stories high. The floor and seats will be built in amphitheatre style with a floor elevation of 2 feet 6 inches. A circular gallery will run across one end. The seating capacity will be about 700.

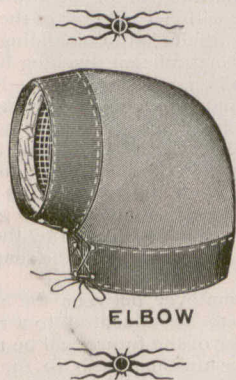
A new opera house has been completed at Rat Portage, Ont., from the plans of Mr. G. A. Mitchell, of Winnipeg. The building is 150 x 50 feet, four stories high. The front part will be used for a hotel, while the opera house proper will be in the rear, 50 x 80 feet, entered through a large corridor panelled in British Columbia cedar. The stage is 24 x 48 feet, and from the floor to the gridiron is 43 feet 4 inches. The roof is a mansard and covered with metallic shingles. The cost was \$22,000.

A large block of stores, covering 100 x 100 feet, is being erected at Fort William, Ont., for Mr. Joseph King. This will be one of the finest blocks in that town, having a most imposing front three stories high by 100 feet wide, which will be entirely constructed of galvanized iron made to details prepared by

Messrs. Arnoldi & Ewart, the architects, of Ottawa, and executed by the Metallic Roofing Company, of Toronto. The exterior will be covered with "Special" single stone rock faced siding in different sized courses while the interior will be furnished with embossed steel ceiling.

The new Southern Congregational Church at London, Ont., was recently opened. The building cost \$4,000, and has a seating capacity for 500 persons, with a large basement. The foundation is of stone and walls of white brick, while a small, slate-covered tower is located in the centre of the front. There is a small gallery at the rear of the auditorium, and a gradual rise of the floor from the altar to the entrance. The architect was Mr. Herbert Mathews, and the contractors: Moran & Ridge, brickwork; Hessel & Davidson, carpenters; McLaren & Parkinson & Co., heating; John Fenn, plastering; George Lewis, painting.

In response to a question of a member of the City Council, Mr. E. J. Lennox, architect for the new municipal buildings in Toronto, stated that the Council might hold a meeting in the chamber by November next. There were now 241 men employed on the work, including 78 plasterers, 45 carpenters, 67 steamfitters and plumbers, 30 bricklayers and 21 excavators. By the end of May the number would be increased to over 300. Work on the tower will be commenced again at the end of the present month, the delay in this part of the work being caused by the lack of stone supply. Thirty feet of stone and fifty feet of wood have yet to be put on the tower.

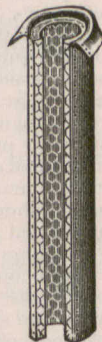


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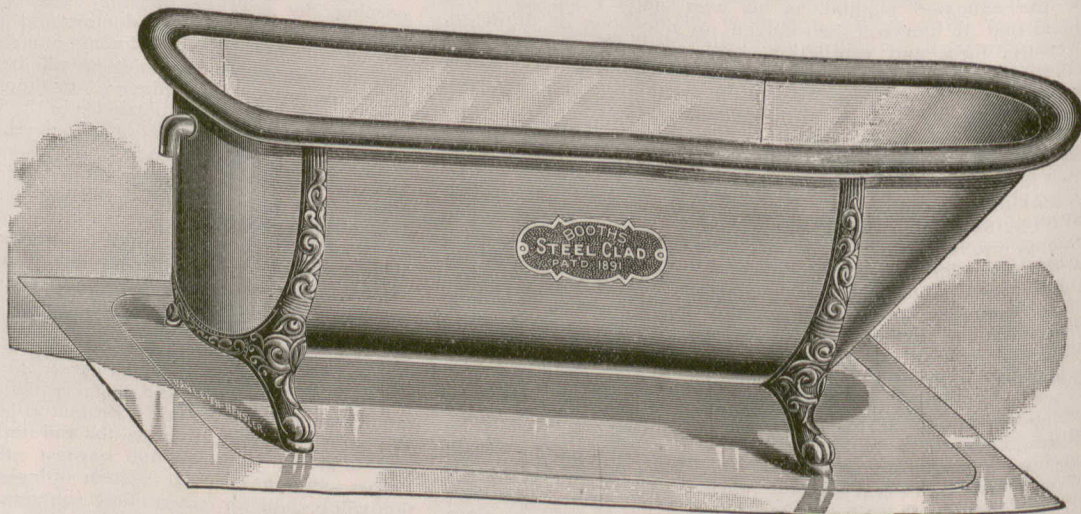
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