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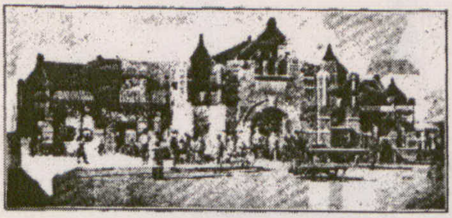

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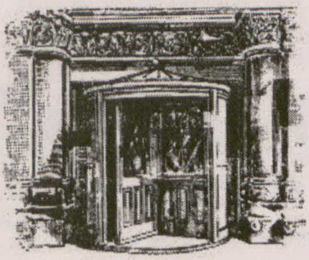

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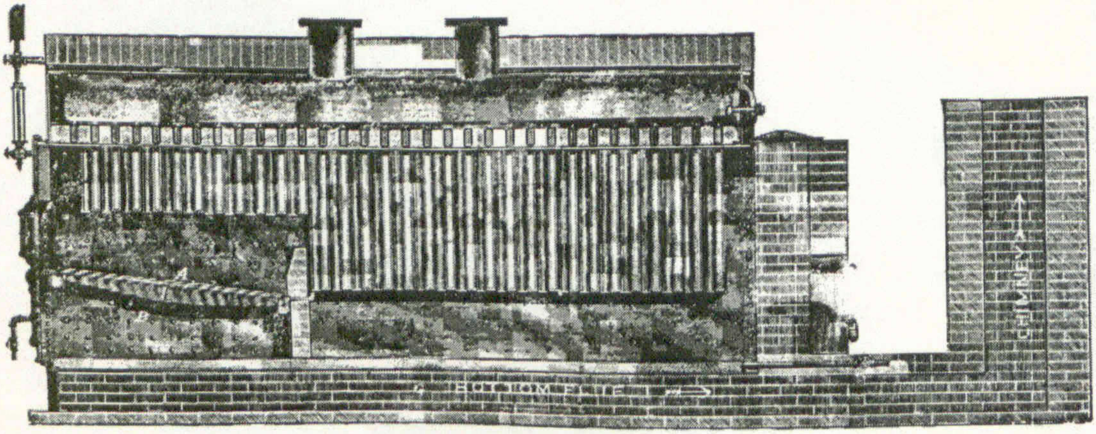

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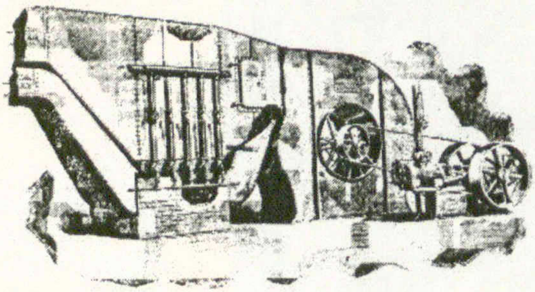

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CANADIAN ARCHITECT AND BUILDER.

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A Monthly Journal of Modern Constructive Methods,

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Safe Building.

EVEN the terrible calamity at London has not taught the average man common sense. From the papers we find that in several instances the advice of incompetent parties has been asked as to the safety of public buildings. Every man who calls himself a builder or an architect is not a safe or reliable authority upon construction. The Ontario Association of Architects have been doing their utmost to obtain from the Ontario Legislature such changes in their Act as would to some extent protect the public against the possibility of such accidents as the London disaster. The infrequency of accidents was quoted to prove that there was no necessity to protect the public against incompetency and recklessness. Those who had not been directly affected by the results of an accident could not remember that there had ever been any accidents. Accidents do occur, however, but unless they are accompanied by a great loss of life, they are very soon forgotten. An accident which could have been prevented by ordinary intelligence or care is nothing more or less than a crime. The London disaster was from all appearances due to an extreme lack of constructional knowledge, or criminal carelessness or neglect.

The Engineers' Strike.

To those who have closely watched the course of events it has long been apparent that the ever-increasing demands of organized labor would some day bring about a gigantic struggle, which would once for all decide the resources of employers and employees. The battle has just been fought in Great Britain, and has proved a Waterloo for trades unionism. The right of employers to regulate the conduct of their own business has been established. The cost of the prolonged struggle is enormous. The direct loss to the strikers is placed at upwards of $5,000,000. When to this is added loss of employment due to the transfer of orders from British to foreign manufacturers, it will be seen that the struggle has proven disastrous to those who were instrumental in bringing it about. The trade of the nation has been seriously disturbed, and it is feared that a portion of it has been driven into the hands of other nations, never to return. It is to be hoped that the hard feelings engendered by this great struggle will now be allowed to die out, and that a spirit of chivalry will characterize the victors in their dealings with the vanquished. The interests of employers and employees are identical. When capital on the one hand or labor on the other becomes unreasonable in its demands, and refuses to be guided by principles of justice, mutual injury is the result.

A Market for Roofing Slates. APPLICATION was recently made to the American Consul at Frankfort, Germany, for advice as to how best to form connections with manufacturers of roofing slates in the United States. The German production of roofing slates being much below the requirements, there is said to be a good market in that country for American slates. Several shipments are reported to have been made recently to this market. The attention of Canadian slate manufacturers is called to this matter.

British Columbia Lien Laws. THE lien laws of British Columbia provide that unless there is an agreement to the contrary, every contractor, subcontractor and laborer has a lien for work and labor, limited in amount to the sum actually owing to the person entitled to the lien. Lien expires unless registered within twenty-one days after completion of work. If lien is on mortgaged premises, it is prior to mortgage against increase of value of mortgaged premises by reason of such work or improvement, but not further, unless work is done at request of mortgagee in writing.

Tests of Canadian Building Materials. THE Ontario Association of Architects have decided to petition the Ontario government to grant a sum of money to defray the cost of making scientific tests at the School of Practical Science, Toronto, of the various native woods adapted to building requirements. The series of tests of Canadian building stones made a few years ago under the direction and at the expense of the association, have proven to be highly valuable, so much so that they have taken the place of reference tables and books formerly employed by architects in their practice. The authorities of the School of Science have also conducted tests of native brick, concrete and cement, so that the qualities of these materials are in a measure understood. No adequate tests have yet been made, however, of native building timber. In view of the extent to which wood is employed for supports in buildings, it is most important that the strength and physical characteristics of the various woods employed should be well understood, in order that the requisite factor of safety may be used. Prof. Fernow, chief of the department of forestry of the United States has for several years been engaged on a series of highly scientific timber tests. It is not expected that anything approaching in exhaustiveness these tests can be attempted in Canada, but there is great need that something be done in this direction on a modest scale in the manner proposed.

The Ontario Association of Architects. WE publish in this number several interesting papers presented at the recent annual convention of the O. A. A., with the discussions thereupon. Notwithstanding that the attendance was small, the proceedings were of a most interesting and instructive character and lacked nothing but the enthusiasm of numbers. It is to be regretted that a larger number of the members of the profession residing in towns and cities outside Toronto do not participate in the proceedings of these annual conventions. No doubt the prevailing hard times have induced many members to remain at home, who under more favorable conditions would have been pleased to have contributed by their presence and counsel to the interest of the occasion. We would again remind members of the profession and of the association throughout the province that if they cannot make it convenient to attend the meetings and personally take part in the deliberations thereat, these pages are always at their disposal for an expression of opinion regarding the objects which the O. A. A. is endeavoring to promote, or any other matters relating to the advancement of architecture. So far as the O. A. A. is concerned we have no doubt the executive will welcome from any member of the profession suggestions as to the means by which the organization can be made most helpful to the profession in this province, and the interests of architecture promoted. In order to avoid a division of interest and effort the Toronto Architectural Guild has been disbanded and the energy of its members transferred to the Toronto Chapter of Architects. This step should have the desired effect not only of strengthening the Chapter, but also the O. A. A., with which it is in affiliation. In our Montreal correspondence is printed in full the bill passed at the last session of the Quebec legislature amending the Act of Incorporation of the Province of Quebec Association of Architects. This bill restricts the use of the title "architect" to persons who shall register under the act. After a period of six months no person will be permitted to call himself an architect who shall not thus be registered. This legislation exactly corresponds to that which the O. A. A. have endeavored to have placed on the statute books of this province, as well as to the act recently passed by the legislature of Illinois. In view of the precedents thus established, and the apparent necessity for a standard of qualification for the practice of architecture, as exemplified by the recent terrible disaster at London, Ont., it is difficult to understand on what ground the legislature of Ontario can longer refuse to grant the desired amendments to the Ontario Architects' Act. We trust the O. A. A. will feel encouraged by the success which has been achieved by their confreres of Quebec, to renew their efforts to obtain at the next session of the legislature amendments to the existing act corresponding to those which have been granted elsewhere, under which the public will have the assurance that persons engaged in the practice of architecture are possessed of the requisite knowledge to enable them to erect buildings which will not by reason of insufficient strength or imperfect sanitary arrangement endanger the health and lives of those who may occupy them.

MONTREAL.

(Correspondence of the CANADIAN ARCHITECT AND BUILDER.)

MONTREAL BUILDERS' EXCHANGE.

THE Montreal Builders' Exchange has been pleased to appoint the CANADIAN ARCHITECT AND BUILDER its official paper. This is an honor which which we highly esteem. It is gratifying to learn that the membership of the Exchange is increasing rapidly, and has already reached the hundred mark.

AMENDMENTS TO THE QUEBEC ARCHITECTS' ACT.

AT the recent session of the Legislature of the Province of Quebec a Bill, No. 87, was passed, making several amendments to the Act of Incorporation of the Province of Quebec Association of Architects, chief among which is one which restricts the use of the title Architect to persons who shall register under the Act.

The following are the provisions of the Bill which was assented to on January 15th:—

1. Section 5 of the act 54 Victoria, chapter 59, is amended by

replacing the words : "a secretary-treasurer," in the third line, by the words : "a secretary and a treasurer."

2. The second clause of section 7 of the said act is replaced by the following :

"Any person who had attended an architect's office during four years, at the time of the coming into force of this act shall be entitled to be registered as a member of the association by observing the above formalities."

3. The notice that the organization of the council of the association of architects of the Province of Quebec is completed shall be published without delay after the sanctioning of this act, in the Quebec Official Gazette, and the delay of six months, mentioned in section 7 of the 54 Victoria, chapter 59, shall be computed from such publication.

4. Section 13 of the said act is replaced by the following :

"13. After the expiration of six months from the publication of the notice of the organization of the council of the said association, no person can take or make use of the name of architect, either singly or in connection with any other word, name, title or designation, giving it to be understood that he is an architect under this act, unless he is registered under this act as a member of the said association.

Any person who, after the time above mentioned, not being registered as a member of the said association, takes or makes use of any such name, title or designation, as above mentioned, shall be liable, upon summary conviction, to a fine not exceeding twenty-five dollars for the first offence, and not exceeding one hundred dollars for every subsequent offence."

3. This act shall come into force on the day of its sanction.

THE LONDON BUILDING DISASTER.

To the Editor of the CANADIAN ARCHITECT AND BUILDER.

SIR,—Without the least idea of placing the responsibility of the London, Ont., accident at the City Hall on anyone, which might be as unjust as to saddle a surgeon or physician or dentist with killing his patient, or an apothecary for giving poison by mistake, it behooves me, as a member and past-president of the P. Q. Association of Architects, or as a member of the Can. Soc. C.E., to reduce the thing to calculation and let the result be a most instructive lesson to both professions and to builders in general, so that, if possible, present structures be examined and strengthened where necessary, or the components of new structures made such that similar accidents be impossible or improbable in the future.

From the data I possess and some of which you were kind enough to hand me, and from a plan of the room where the accident happened, giving lengths, breadths, depths and distances apart of joists, beams, etc., I compute the dead weight of the whole to have been .... 13,845 lbs.
including joists, flooring, ceiling, deafening, mortar and supporting sheet iron.

Taking the greatest assumed number of persons in the room to have been 300, at 150 lbs................. 45,000 lbs.

Together.. 58,845 lbs.
At centre—say ½ ... . 29,422 lbs.
or 14.7 tons.

Thus the incriminated beam broke under this weight.

Now the strength of beam, made up though it was of four beams 3″ × 14″ spiked together, may be assured, if well bound together, equal to that of a solid beam of same size, or of 12″ x 14″. Taking Trautwine's 450 lbs. as the breaking weight of an average pine bar of 1″ x 1″ x 1′, we have for the breaking weight of our beam

$$450 \text{ lbs. x } \frac{\text{b x d}^2}{\text{b}} \text{ or } 450 \text{ lbs. x } \frac{12 \text{ x } 14^2}{21} \text{ or } 450 \text{ x } \frac{12 \text{ x } 196}{21}$$

or $450 \text{ x } \frac{2352}{21} = 450$ lbs. x 112 times = 50,406 lbs., say 25 tons.

Therefore, had the beam been sound it probably would have stood the test, but there were knots in two of the four component pieces, and the beam broke at one of these knots; and that the knot was a bad one is evidenced by the fact of it being a dry one, since it was found fallen out of the beam. Witness Broadbent thinks these knots weakened the beam one-third, and this is a pretty shrewd guess—unless arrived at by calculation of size, or, rather, depth or height, of knot, and taking into consideration its position in the beam as to whether at centre of depth thereof or at or near top or bottom of beam.

County Engineer Talbot estimates the weakening of beam by knots at only $\frac{1}{10}$, and I am not in a position, not knowing size or position of knots, to judge between these gentlemen. But if Talbot be correct, then the difference of stress must have been due, as he assumes, to the vibration caused by the stamping and jumping he alludes to. If there was no stamping or jumping adequate to much of an increase in the stress, tben Broadbent's assumption of a ⅓ weakening by the knots must be reliable.

Taking then from 25 tons, strength of beam, one-third of it, to allow for weakening, we get 14⅔ tons, or just the weight under which the beam broke.

It will be noticed that no strength or resistance or support is attributed to the flooring beams, which there of course would have been had the joists been, all of them or even half of them, of a single length or stretch ; but on the contrary they are all, so I am informed, or were, in half lengths, meeting or lapping a few inches on the bearing beam, and in such case, not only do they not add to the strength, but they aggravate the weight.

Now even had this beam been sound, it is seen that its total strength was but 25 tons, not 50, as Mr. Talbot says, from, evidently, forgetting to divide his distributed weight by 2 to get weight at centre. Thus, at 25 tons breaking weight, supposing it to be sound, it had only a factor of safety of 1⅔ instead of from 3 to 5, which such factor should have been, and had it been made 20″ high it would then have had a factor of safety of about 3½, thus guarding against any probable eventuality ; while, as it was, a column under it would have made it all right.

Without being an alarmist, but seeing the comparative frequency of such accidents here, as in the United States, it would not be amiss for municipal and other authorities to put a few dollars in the way of architects and engineers by causing them to examine and report on structures where a column or two or the strengthening of a beam might be essential.

CHAS. BAILLAIRGE,
City Engineer, Quebec.

MONTREAL, Jan. 27th, 1898.

To the Editor of the CANADIAN ARCHITECT AND BUILDER.

SIR,—Having calculated the strength of the beam and the estimated actual weight on the beam at the time of the collapse, I send you the figures which (if you find correct) may be of interest to your readers :

It has been calculated, according to your article on the subject in the January number, that there were 250 persons on the floor at the time of the disaster—which seems to be on the high side, but I have taken this figure for my estimates, which are as follows ;

WEIGHT (LBS.) OF BEAM.

250 persons at 130 lbs. each = 32,500 lbs.
600 sq. ft. of floor, plaster, etc., at 20 lbs. = 12,000 ″
44,500 ″

Half this amount will have been borne by the beam, viz., 22,250 lbs. or nearly 75 lbs. to the sq. foot.

22,250 lbs.

CARRYING POWER OF BEAM.

$$\frac{\text{b.d}^2}{\text{l}} \times 3 = \text{breaking weight at middle in cwts.}$$

$$\text{that is } \frac{12 \times 14^2}{21} \times 3 = 336 \text{ cwts. or } 37{,}632 \text{ lbs.}$$

$$\text{or } \frac{336 \times 2}{5} = \frac{672}{5} \text{ or about } 134 \text{ cwts.}$$

that is, 15,008 lbs. safe load distributed with a factor of safety of 5. With 4 as a factor of safety we get 18,800 lbs.

The result of these figures shows that the beam when broken had about 22,250 lbs. weight upon it—if only persons were in the room and no other weight—and that this beam should not have had more than 18,800 lbs. upon it. However, the point is whether the beam would not have stood this weight of 22,250 lbs. if the beam had been built and set properly. There seems to have been a good deal made out of a knot in the wood, but in a built beam of 4 pieces 14 x 3 inches it seems to me as highly improbable that the knot would come in the same portion of the beam when built up and therefore should not have been weakened as much as argued. Another point, however, may be argued, whether a built up beam nailed together is as strong as a solid one of the same dimensions and what proportion one bears to the other. I should like to hear this point discussed by architects and engineers.

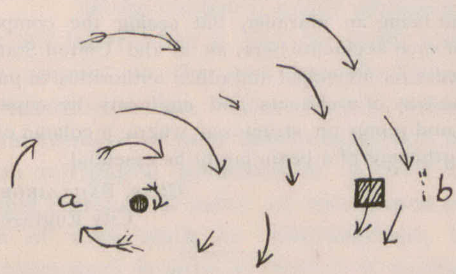
Yours very truly,
J. RAWSON GARDINER.

The contractor's ad should make a strong bid for favor.—Printer's Ink.

ELECTRICITY IN MODERN BUILDINGS.

In the construction of a certain class of building a steel framework, filled in with stone or other material, is being very largely used, and as electricity is rapidly becoming the means of distributing light and power, and to some extent, even heat, throughout the halls, corridors, offices, etc., of any building which proposes to offer all the best modern conveniences, it may be worth while to consider whether there will take place any interaction between the steel framework, considered as a conducting network of comparatively low resistance, and the electrical circuits which distribute the lighting and power currents. It is, of course, evident that such a steel framework will offer a path of comparatively low resistance to any current that may be set up in it, and it is the purpose of this article to formulate those conditions which will tend to the setting up of such currents, and their physical effect on the building materials.

Regarded as a conducting network, currents may be set up in the steel framework by either induction or by direct contact (leakage being included as a contact). The diagram shows in section an electric light wire "a" through which a current is flow-



ing, and a conductor "b" of some kind of conducting material—"a" and "b" being fairly close to each other, and more or less parallel during their length. At the instant of starting a current through "a" the whole space around "a" becomes an inductive field of rapidly increasing intensity, which will include the space surrounding "b," and this is a necessary and sufficient condition for the setting up of a current in "b," so that it will appear that actual contact is not required in order that a current may flow in "b". Similarly at the moment of stopping the current flowing through "a," a current will be induced in "b". If the current in "a" be stopped and started, or reversed in direction rapidly, or even made to wax and wane—that is, to merely fluctuate without actual reversal—currents will under all these conditions be induced in "b," and their strength will be proportional to: The conductivity of "b"; the strength of current in "a"; the rate of variation or fluctuation of the inductive field; the length of the conductor "b" that is in the inductive field—their distance apart. It is therefore conceivable that very considerable currents can be made to flow in "b" without any contact with "a." They will probably be currents of low voltage, but still capable of effecting considerable electrolytic damage. It is sufficiently obvious that contact between a conductor carrying current and a steel beam, whether it be direct mechanical contact or indirectly through a leak caused by damp, etc., will result similarly.

Suppose we have a steel frame building with a complete system of electrical distribution—for lighting, elevators, fans, heaters, etc.—it can easily be imagined that there may be set up inductively a most complicated and interlinked system of active currents in the various uprights and horizontals forming the frame, and that they may be of quite considerable magnitude. This can occur not only in the steel frame itself, but in the piping for the heating or auxiliary gas lighting services. With a direct current distribution for lighting only, these induced currents would probably have a negligible effect, as it is only at the moment of make and break that inductive action would take place, although even in such a case a direct current, though continuous in direction, will have sufficient very small fluctuations in strength (owing to the fact that the number of coils in the armature is not infinity) to keep up a continual alternating current in all the pipes and beams parallel to it and within the sphere of its influence. But in very many cases current is distributed for elevator and motor purposes, and here we find not only the small fluctuations due (as mentioned above) to the armature construction, but also that fluctuation due to the varying demands of the elevator and motor services, which, while not so rapid, will have an enormously greater amplitude, and so a much greater inductive influence. There are very many buildings, moreover, that employ an alternating current for lighting, the influence of which requires no pointing out. So that it appears that there will always be some circuits induced in such buildings, whether in the frame or the piping.

An electric current flowing in a circuit must produce one effect and may produce more. It must heat the conductor and may decompose it. The heat generated in the conductor depends on the amount of current flowing, and on the resistance offered to it, and in a circuit of varying conductivity the greatest heat will be generated at the point of greatest resistance. In a circuit composed of beams the points of junction will be those of highest resistance, and will therefore be the heating points. Just how far the expansion and contraction due to heating and cooling may be expected to work with the natural vibration to loosen the joints, is a matter that affords a very interesting field for discussion and experiment. But if it be granted that it does have the effect of so loosening them, then such loosening will tend to promote the decomposing action of the current flowing, with the assistance of whatever slight amount of moisture has condensed out of the atmosphere (or elsewhere) on the opposing faces of the loose joint. This latter action of the current is probably of greater importance than the former, as its tendency is to loosen by decomposition, and just where the utmost rigidity and permanence is desired, viz., in the foundations. The electrolytic injury would take place just at the base of a steel pillar, where the current was able to escape to earth, and the effect would be to eat away the metal, as the iron of water pipes is eaten away by the passage of railway currents. The electrolysis of gas and water pipes might be even a serious matter unless precautions be taken to minimize its effect.

While it seems impossible to so arrange as that there shall be no induced currents in framework or piping, still it is possible, and in most cases would be well, to adopt such precautions as will confine them within such small limits that they may become negligible. It would be well to thoroughly ground the entire steel structure by copper wires of large section leading from various points to the earth, and making good contact there with permanently moist soil. It would also be advisable in laying out circuits to so arrange that all those wires carrying the main current shall be as far removed as possible from any part of the structure, and as close together as insurance regulations will permit. If it be necessary for the main wires to be close to a pipe or pillar, and to run parallel to it, then they should be placed one on each side of it so as to neutralize each other's effect.

PERSONAL.

Mr. F. F. Foley, of the Stratford Bridge & Iron Co., died at Stratford, Ont., on January 24th.

Mr. George W. Gouinlock, architect, has recently removed his offices from 53 King street east to the seventh floor of the Temple building, corner Bay and Richmond streets, Toronto.

We very much regret to announce the death since our last issue of Mr. D. G. Baxter, of Stratford, Ont. For at least two years previous to his death Mr. Baxter was in such a precarious condition of health as to be unable to devote the required attention to his profession. His death was due to consumption. The late Mr. Baxter was one of the best known and most talented of the younger architects of the province. He was the first architectural student to pass the examinations of the Ontario Association of Architects, and was ever ready to declare the advantage derived from the necessary course of study.

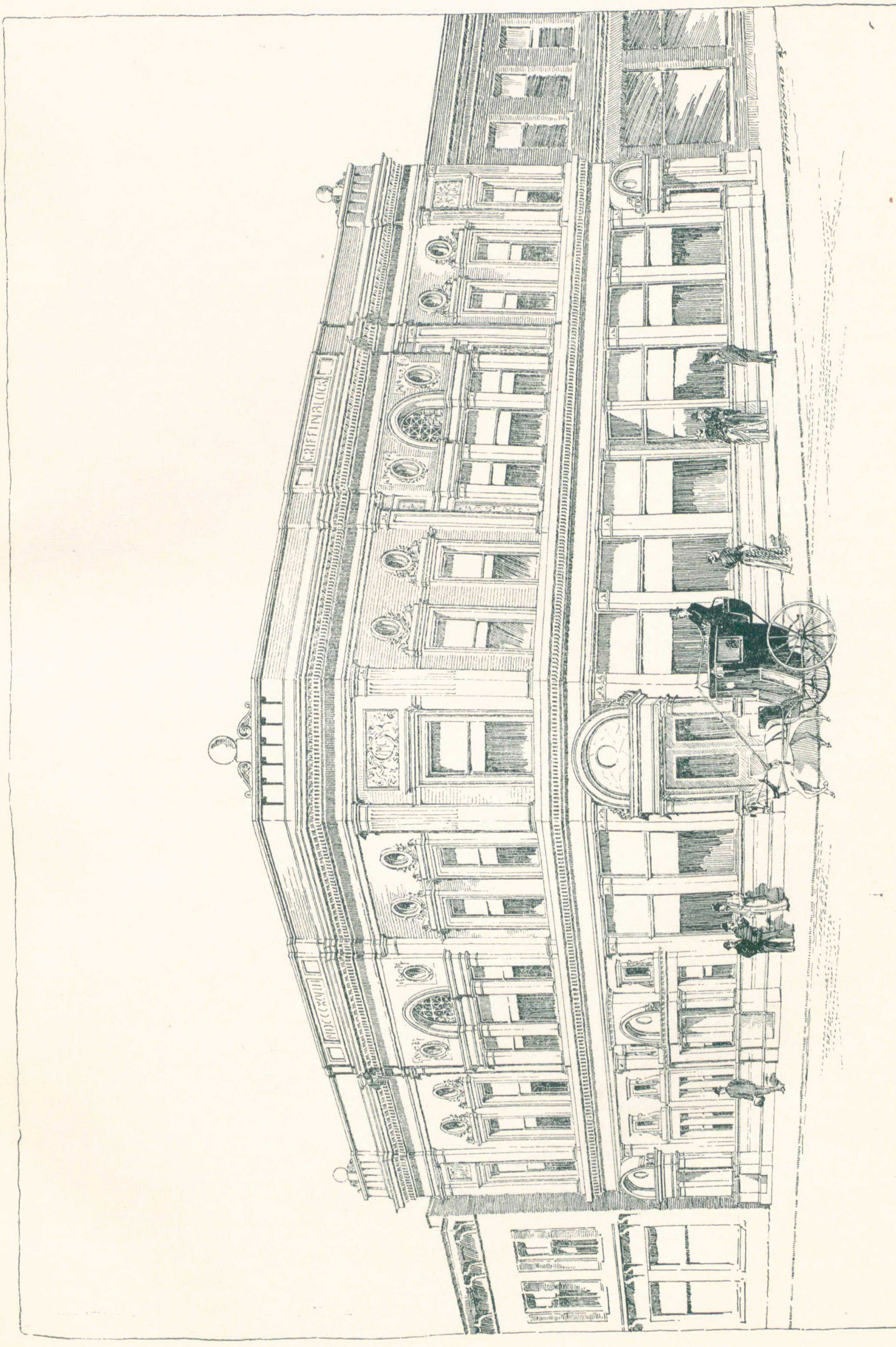
THE "DUPLEX" BATH.

In the advertisement of the Toronto Steel Clad Bath Company appearing on back cover of our January number, the list price of the "Duplex" bath should have been given as $17, instead of $18. This price includes ash or cherry finish rim and combined overflow and waste. The Duplex is a sheet metal bath, lined with sheet copper, which is deposited directly on to the steel by the electrolytic process, by which method the electric current acts as a refining agent, this being a guarantee of purity.

A business man of Portland, Oregon, is said to have invented a paper house that should find a ready market for camping expeditions, etc., as it weighs complete but 400 lbs., and is 9 by 12 feet in size. The material of which it is built is spruce, covered by heavy building paper. It goes together in sections or panels, each being tongued and grooved so that, when put up, each part fits so closely as to be absolutely air-tight and rain-proof.

RESIDENCE OF J. AULD. ESQ.
MACGREGOR ST. MONTREAL

A. P. DUNLOP
ARCHITECT



EVAN T. MACDONALD, ARCHITECT.

OFFICE BUILDING FOR F. M. GRIFFIN ESQ.
COR TALBOT & RAILWAY STS ST THOMAS

BUILDING OPERATIONS IN 1897.

THE building trade of the year 1897 was not characterized by special activity. In comparison with the previous year there was but a slight gain in the value of buildings erected. Early in the season the outlook was hopeful, but it soon became evident that many new buildings which had been talked of would not be proceeded with. During the latter half of the year the general commercial improvement seemed to wield an influence upon capitalists, and as a result there were a number of buildings commenced late in the fall which are not yet completed. In Toronto some advancement was made, while in Montreal the total expenditure shows a falling off, notwithstanding that the buildings erected were greater in number. One feature of the year was the extent of building in the vicinity of mining operations. At Rat Portage alone it is estimated that there was an outlay on new buildings of three-quarters of a million dollars. The conditions prevailing in British Columbia in the west and the maritime provinces in the east call for no special comment.

Without being considered too optimistic we believe it can safely be said that the outlook for the building trades in 1898 is decidedly better than for several years past. There is a general belief that we have entered upon more prosperous times, this belief being backed up by the high price of agricultural products and the attention that is now being paid to Canada by foreign capitalists. The number of projected buildings in Toronto and other cities stands as a further evidence of this improvement. Some disastrous fires during last year will also assist in swelling the volume of building to the credit of 1898. The most noted of these were at Windsor, N. S., and Casselman, Ont. The loss in the first instance was over one million dollars.

MONTREAL.

In 1896, according to figures furnished by the Building Inspector, there were erected in Montreal 315 buildings, at an estimated value of $1,983,750. Last year, although 408 buildings were erected, the total valuation is placed at $1,414,300, showing a decrease of $569,450. Several projected buildings of considerable importance were not proceeded with. There was an increase in the number of dwellings erected and buildings remodelled, while in the suburbs of the city the season was quite active. In Westmount the total cost of new buildings was $757,950.

During the year the chemical and mining building of McGill University, the gift of Mr. W. C. McDonald, was carried to completion. It is of Italian Renaissance style, and built of limestone. The Jubilee Nurses' Home, corner Dorchester and Cadieux streets, is of pressed brick and stone, of Florentine Renaissance architecture. The architect of the above buildings is Mr. A. T. Taylor, F. R. I. B. A. St. John's Baptist church on Rachel street was remodelled and extended, at a cost of $50,000, the architect being Mr. Joseph Venne. This church has since been completely destroyed by fire. Mr. Venne also erected the church of St. Eusebe. Mr. Edward Maxwell, architect, built a large building near Phillips Square for Mr. Joyce, of brick, with bath stone trimmings; also a block on Beaver Hall Hill for Mr. McIntyre. A large school is now being completed at the corner of Rachel and Parthenon streets for the parish of St. Gregoire le Thaumaturge, of which Mr. A. Raza is architect. This building is three stories in height, with Laprairie pressed brick front. From the plans of Mr. A. Prefontaine a convent building was erected for the Sisters of Jesus and Mary, at a cost of $22,000. Several important dwellings were erected by Mr. A. C. Hutchison, architect. These include a residence on Edgehill avenue for Mr. C. Coughlin; four houses on Dorchester street, for William Rutherford & Sons, and a dwelling on Oliver avenue, Westmount, for Mr. W. K. Grafftey. A factory was also built for the Dominion Oil Cloth Company. Messrs. Wright & Son, architects, completed the Carslake Hotel for the Pallascio Estate, of stone and Don Valley pressed brick, cost $50,000. Two houses were built at Westmount for Mr. W. McDonald, cost $10,000 each. Mr. Robert Findlay, architect, built a residence on Prince Albert avenue, Westmount, for Thomas Fraser; a residence on Dorchester street, Westmount, for Mr. Henry Fry; the Sun Life Jubilee Memorial, and other buildings. The convent of the Rev. Sisters of St. Anne at St. Henri was built from the plans of Macduff & Lemieux, architects, who also designed the Moseley shoe factory at same place. The reconstruction of the east end abattoirs and the erection of Lamb's block, corner Victoria and Sherbrooke streets, were executed by Mr. W. E. Doran, architect. A fine building was erected on St. Catharines street for Mr. F. Fairman, including three stores and a music hall. The architect was Mr. A. F. Dunlop, who also erected several good dwellings.

Of the buildings erected at outside points by Montreal architects, mention might be made of the following: Gymnasium and head-master's dwelling at Bishop's College, Lennoxville, Que., Taylor & Gordon, architects; hospital at Cornwall, Ont., of brick and stone, cost $20,000, Robert Findlay, architect; General Protestant hospital at Ottawa, cost $50,000, A. C. Hutchison, architect; House of Refuge at Varennes, Que., for the Grey Sisters, cost $40,000, Joseph Venne, architect; C. P. R. station at Vancouver, B.C., now in course of erection, cost $50,000, Edward Maxwell, architect.

TORONTO, ONT.

The building permits issued by the City Commissioner of Toronto last year represent a total value of $951,130, showing a gain over 1896 of $293,962. A summary follows:

113 brick dwellings	$340,100
32 brick-front dwellings	23,550
141 alterations to dwellings	75,355
10 stores and offices	123,300
19 factories and alterations	80,770
16 warehouses and additions	71,700
Alterations to stores	46,710
8 churches and additions	85,050
1 printing office	35,000
1 brewery	10,000
1 music hall	12,000
1 abattoir	8,000
1 rink	5,000
Miscellaneous	34,595
Total, 1897	$951,130

These figures, in comparison with those of the previous year, show that there were erected last year a larger number of dwellings, factories and warehouses. Some of the best dwellings were erected on St. George street. The first permit of importance taken out last spring was for the brick warehouse of the T. Eaton Company, corner Albert and Louisa streets, which cost $19,000. The new store and office building of W. & D. Dineen followed. This was erected by Mr. F. H. Herbert, architect, at a cost of $30,000, and is a four-story white brick structure, corner Yonge and Temperance streets. Under the superintendence of Messrs. Langley & Langley alterations were made at 112-118 King street west, for the North American Life Assurance Company; these cost $15,000. On the north-west corner of King and Yonge streets, one of the most valuable sites in the city, the Lawlor Estate erected a five-story office building, which will cost, when completed, about $50,000. The architects are Messrs. Darling & Pearson, who are also bringing to completion a three-story brick office building, corner Church and King streets, for the Toronto Railway Company, cost $19,000. Mr. E. B. Jarvis, architect, had charge of extensive improvements at the Loretto Abbey, Wellington street. These include a three-story and attic brick addition and a two-story chapel and concert hall, the whole costing upwards of $65,000. Mr. Jarvis also erected a warehouse on York street for S. F. McKinnon. Another important building which figures in the permits of 1897, but which is now under construction, is the new Telegram building, corner Bay and Melinda streets. It is a four-story brick and cut stone building, to cost $35,000, of which Mr. M. Sheard is the architect. The above list includes the buildings costing upwards of $15,000.

Since the first of this year permits have been granted for several large buildings, including an addition to the Grand Union Hotel, to cost $30,000, a brick addition to the factory of The W. Davies Co., and the new Havergal Ladies College. The School Board have also asked the City Council for an appropriation of $106,000 with which to provide increased school accommodation.

OTTAWA, ONT.

The value of the building operations in Ottawa last year is estimated at more than $600,000. The chief buildings include the Russell Theatre, cost $60,000; the C. Ross Company's building, cost $75,000; and the Sun Life Insurance Company's building, cost $35,000. Many persons availed themselves of the low price of building materials to erect dwellings for private use, for which purpose brick was used almost exclusively. A number of new buildings are in sight for 1898, and the outlook is considered good.

HAMILTON, ONT.

The list of building permits for the city of Hamilton, as furnished by Mr. John Anderson, Building Inspector, is as follows:

Description.	Value.
109 brick dwellings	$163,910
9 frame dwellings	6,600
77 alterations	41,127
35 buildings other than dwellings	151,285
225	$362,922

The total value shows a decrease of $50,000 as compared with the previous year. The principal buildings were Sun Life building, Wm. & Walter Stewart, architects, cost $40,000; Spectator building, W. P. Witton, architect, cost $35,000; Wesleyan Ladies' College, W. A. Edwards, architect, cost $15,000; sewage interception works, Wm. & Walter Stewart, architects, cost $11,000; Sawyer-Massey building, W. A. Edwards, architect, cost $7,000. Improvements are now under way at the Royal Hotel, under the supervision of W. P. Witton, architect, which will cost $30,000. The buildings erected were generally of a substantial character, the absence of speculative work being a feature of the year.

LONDON, ONT.

London experienced a quiet year in 1897, the buildings erected only representing an outlay of $260,000, which is little more than half that of the previous year. Following is a statement of permits issued:

Class.	Value.
Cottages, brick	$13,050
Other residences, brick	79,650
Stores, brick	9,327
Brick veneer buildings	44,225
Cottages, frame	7,520
Other residences, frame	2,700
Alterations and additions	20,735
1 rink	3,000
3 churches	10,200
Addition to city buildings	2,000
Matrons' home	800

There were erected more than an average number of two-story dwellings.

Architects report a good outlook for 1898. In all probability several large buildings, ranging from $50,000 to $100,000 in cost, will be erected.

GUELPH, ONT.

The sum of $100,000 represents the value of new buildings erected in Guelph. Of this amount fully $70,000 was spent on new dwellings. No important buildings enter into the year's calculations. As a result of the building of the street railway, more dwellings are being erected in the outlying districts.

KINGSTON, ONT.

In Kingston residences were erected to the value of $82,000, business places, $86,000, and convents, $40,000. A new chapel for the House of Providence, additions to Notre Dame Convent and Hotel Dieu hospital, and an elevator were among the most important structures. There are in prospect for this year a drill hall, rolling mills, and another elevator.

QUEBEC.

Building in Quebec last year shows an increase of about 25 per cent. in comparison with the previous year. There was erected for the Quebec Railway Company large car stables and offices, 175 x 115 ft., and 65 ft. high, of which H. Staveley was architect. The other buildings included 37 residences and 7 factories, hotels, etc. In the towns and villages adjacent to Quebec building was quite active. Building materials were slightly higher than in 1896, but labor was about 10 per cent. cheaper.

HALIFAX, N. S.

In Halifax there were erected a larger number of buildings of small cost, the total value being given as $650,000. This includes 140 residential and 24 business buildings. Of these 159 were wood and 5 brick. The principal were: Exhibition building, Elliott & Hopson, architects, cost $100,000; Clayton & Son's business house, J. C. Dumaresq, architect, cost $12,000; Outhit & Hamilton's business premises, Henry Birch, architect, cost $12,000. Several new blocks are talked of.

WINNIPEG, MAN.

Notwithstanding the bright prospects in the spring of 1897, the total value of buildings erected in Winnipeg did not exceed $250,000. On street improvements there were spent several hundred thousand dollars, which created a large demand for unskilled labor. Frame buildings on stone foundations predominated. Mention might be made of the remodelling of the Winnipeg theatre, cost $20,000; Ashdown's residence, cost $15,000; Joseph Maw & Co.'s warehouse, cost $15,000; and N. Bawlf's residence, cost $14,000. Building materials were from 5 to 15 per cent. lower in price. Present indications show a marked improvement. Plans for a number of new buildings of a substantial character are being prepared by the various city architects. Capitalists are showing more confidence, and there is a strong likelihood of a prosperous season. It is hoped that as times improve the policy of taking contracts below cost which has been followed in the past by contractors, will be superseded by more businesslike methods.

BRITISH COLUMBIA CITIES.

At Victoria the operations of the year included the competion and occupation of the new Parliament Buildings; the practical completion of the new Post Office; the erection of the new Bank of Montreal, Colonist office and St. Joseph's hospital. Smaller buildings bring the total up to $334,800 as compared with $500,000 for the previous year.

The provincial hospital was the largest building erected at New Westminster, cost $20,000. Two salmon canneries represent an outlay of $26,000, which, with residences, brings the total up to $150,000, this being a slight gain.

OTHER PLACES.

In the vicinity of Rat Portage, Ont., it is estimated that the improvements carried out reach in value $750,000. At Berlin the expenditure was $160,000, including G.T.R. station, $11,000; at Smith's Falls, Ont., $100,000; Portage la Prairie, Man., $100,000, including Home for Incurables, Mr. Silverthorne, architect, cost $14,000, and Presbyterian church, H. Griffith, architect, cost $18,000; Brantford, Ont., $75,000; Goderich, Ont., $100,000; Charlottetown, P.E.I., $223,000, including pork packing establishment, $100,000 and R. C. cathedral, $93,000; Collingwood, Ont., $20,000; St. Catharines, Ont., $25,000; Barrie, Ont., $37,000; St. Thomas, Ont., $75,000; Peterboro', Ont., $50,000; Newmarket, Ont., $10,000; Leamington, Ont., $50,000; Waterloo, Ont., $53,000; Moose Jaw, N.W.T., $53,000; Brandon, Man., $20,000. At many of the above points the year has commenced well, there being more prospective building than for several seasons past.

Mr. H. G. Phillips, architect, of Sarnia, died in that city a fortnight ago. His death occurred in the new hospital recently erected from his designs.

ILLUSTRATIONS.

OFFICE BUILDING, ST. THOMAS—EVAN T. MACDONALD, ARCHITECT.

RESIDENCE FOR MR. J. AULD, MAGREGOR STREET, MONTREAL, QUE. —A. F. DUNLOP, ARCHITECT.

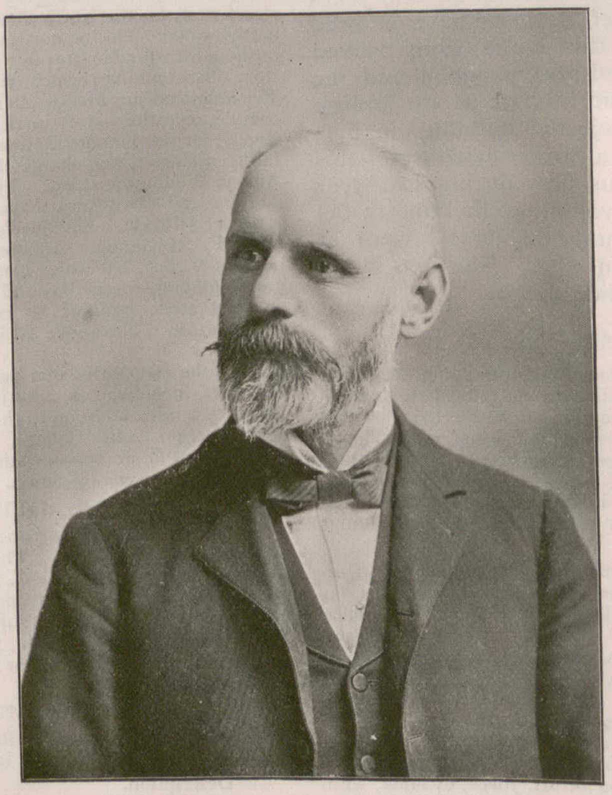
ILLUSTRATIONS ACCOMPANYING PAPER BY MR. EDMUND BURKE, ON "TWO QUESTIONS IN CONNECTION WITH STEEL CONSTRUCTIONS IN BUILDINGS," IN THIS NUMBER.

MAIN DOORWAY OF NEW BUILDING FOR THE MERCHANTS' BANK OF CANADA, AT TRURO, NOVA SCOTIA—ELLIOTT & HOPSON, ARCHITECTS.

RESIDENCES FOR T. N. AND S. B. JAMIESON, CHICAGO, ILL.—DWEN & WHITE, ARCHITECTS.

Fronts of grey granite, with gables, verandah and tower roofs of red tiles; verandah and vestibule floors of mosaic; metal work of copper, and brick walls of red pressed bricks; hot water heating with natural gas furnace; electric lights, gas and nickel-plated plumbing throughout. Finish in large house: Parlor, sitting room and den of cherry; reception hall and dining room in quarter sawed oak; bedrooms in bird's eye maple, curly birch and quarter sawed oak. Finish in smaller house: Parlors in selected curly birch; dining room in mahogany; bedrooms in sycamore, birch and quarter sawed oak; floors throughout of quarter sawed oak; mantels, hall-trees, consoles, etc. Each closet is so arranged that opening the door lights an incandescent bulb inside automatically, and which goes out when door is closed.

MR. S. H. TOWNSEND.



Mr. S. H. Townsend,
President Ontario Association of Architects.

THE portrait appearing on this page is an excellent likeness of Mr. S. H. Townsend, the new president of the Ontario Association of Architects. Mr. Townsend was one of the founders and original promoters of the O. A. A. For several years immediately following the formation of the Association he discharged the duties of secretary and treasurer in a capable manner. When on the passing of the Ontario Architects' Act the office of Registrar was established and became a salaried position, Mr. Townsend resigned and took a seat on the Council, in which capacity also he gave valuable aid to the organization. It will thus be seen that he is deserving of the honor which has just been conferred upon him, and is well qualified by education, experience and energy to occupy the office with credit to himself and advantage to the Association.

FITTINGS OF OLD ST. ANDREW'S CHURCH.

ENQUIRY was recently made through the Toronto Telegram for the whereabouts of the interior fittings of Old St. Andrew's church, which, until twenty years ago stood at the south-west corner of Church and Adelaide streets. The enquiry states that when the building was demolished the internal fittings were sold with the building. The fine walnut pulpit, with its sounding board, the quaint colonial handrail of the curved staircase leading to the pulpit, the unique sounding board, surmounted by its Scotch thistle in brass, the pretty communion table were all, it is believed, either sold by the contractor to other purchasers, or broken up for kindling wood. A history of the old church, with a compilation of the records of St. Andrew's church, King street west, is to be written, and with a desire to give in connection therewith some picture recollections of the old church, enquiry is made for any one who knows where the old pulpit went.

Successful advertising is the art of telling the public the truth about your business.

THE LONDON BUILDING DISASTER.

In the London disaster there was a terrible loss of life, and it is our purpose to determine as nearly as possible the cause or causes resulting in the disaster. We have in this case a large public hall crowded with people who are in a somewhat excited condition, and as a result inclined to crowd together around a central point, which was, in this instance, the platform. The hall was 45'.0 wide by 72'.0 long, with the platform placed nearly in the centre of one of the end walls. A portion of the floor of the hall in one of the corners gave way and precipitated those upon it onto the floor below. The size of the floor which gave way was 22'. 0" × 28'.0", and extended across the hall from one of the side walls. The platform was 16'.0" wide by 7'.0" deep, and 14'.9" × 7'.0" of it was over the portion which gave way. A beam having a span of 21'.0" supported the centre of the space which gave way. The load which was on the beam was that due to the weight of the material in the floor and platform and the weight of the people upon the floor and platform of a space 21'.0" × 14'.0", of which the platform occupied 7'.9" × 6'.6". The total area of floor bearing upon the beam is 294 sq. ft., of which the platform takes up 50 sq. ft. The weight of the floor is close upon 25 lbs. per sq. foot, and of the platform 10 lbs., which would give a dead load, including the weight of beam, of 8,425 lbs. If we allow that the floor should be calculated to carry 100 lbs. per sq. foot, we have a live load of 29,400 lbs., or a total load of 37,825 lbs., upon the 12" × 14" beam.

It is somewhat difficult to arrive with any certainty at the live load. The statement has been made that there were 250 persons upon the portion of the floor which gave way. If we allow the average weight per person to be 135 lbs., we have a total live load of 33,750 lbs. over the entire space which gave way, or a live load of 16,875 lbs. thrown upon the beam. Two hundred and fifty persons on a floor span of 22'.0" × 28'.0" would be equal to one person to every 2.46 sq. ft., which cannot be considered as close crowding if all were standing. From all accounts the crowding was in front of the platform and over the beam which gave way, and it is probable that at least one hundred and fifty of the two hundred and fifty were standing on the portion of the floor supported by the beam. If such should have been the case the load upon the beam would have been 8,425 lbs. dead load and 20,250 lbs. live load, or a total load of 28,675 lbs.

The authorities are not agreed as to the probable load upon a floor of a densely packed mass of people. Hatfield, in his work on the "Theory of Transverse Strains," places the average weight of males between 20 and 50 years of age at 137.9 lbs., and that when closely packed they will occupy 15" × 20" = 300 sq. inches each = to 66 lbs. per sq. foot. An allowance of 300 sq. inches per man does not necessitate men standing very close together, for it has been shown by actual tests that two average men can be packed within the same space, which would make a load of 132 lbs. per sq. foot.

A test was made a short time ago at the School of Practical Science by Mr. Wright as to the number of men who could be crowded into a given space. Thirty-two students were crowded into a space 2'.11 13-16" × 11'.2⅝" = 33.46 sq. ft. The total weight of the thirty-two students was 4,656 lbs. = 139 lbs. per sq. foot. The average weight of the students was 145.5 lbs., a very high average. Another student could have been packed into this space, which would have made the weight per sq. foot of surface 143 lbs.

Mr. Binder B. Storey (see American Architect, April 15th, 1893) some years ago packed 58 laborers, weighing in all 8,404 lbs., into a deck house of a ship, the floor of which contained 57 sq. ft., which gave an average load on the floor of 147.4 lbs. per sq. foot. On another occasion he packed 73 men, weighing 10,948 lbs., into a hut containing 73 sq. ft., which gave an average weight of 142 lbs. per sq. foot. Prof. Kernot placed sixteen students of his Engineering class in a space of 18 sq. ft., which gave an average of 134.7 lbs. per sq. foot. The students stated that they were not as closely packed as they could have been, and that there was room for another man. The above tests go to prove that a floor may be loaded to at least 145 lbs. per sq. foot. Some authorities, on the basis of the above tests, claim that a floor should be calculated for a live load of 300 lbs. per sq. foot, to allow for jar through the movement of the crowd; but 200 lbs. should be ample, as a crowd so densely packed as to weigh 145 lbs. per sq. foot would not be able to move very much.

One of the witnesses at the inquest claimed that the failure must have been due to the jar or impact caused by the movement of the crowd, and seemed to be of the opinion that the result of such impact must be very great. There is not much data at hand to determine what this force amounts to in proportion to the actual load. Hatfield made a number of tests to determine the increase in weight due to movement of people on a floor. He used a platform scale 8'.6" × 14'0", which was accurate. Eleven men from a foundry were placed upon the scale, and when standing quietly weighed 1,535 lbs., or an average of 139.55 lbs. per man. The weight when the men were stepping without order was 1,545 lbs., or an increase of 10 lbs.; and when stepping simultaneously or in military order, 1,694 lbs., an increase of 159 lbs., or over 10%. The men were finally directed to use their utmost exertion in jumping, when the weight produced was 2,330 lbs., or an increase of 795 lbs., or about 52% increase.

According to the above experiments, the weight of 11 men standing still was 1,535 lbs., moving about indiscriminately, 1,545 lbs., marching in time 1,694 lbs., and jumping about in the most violent manner 2,330 lbs. To obtain the above result the men had to have considerable space to move about in, which would more than counterbalance the increase in weight owing to their jumping. They had a space of 119 sq. ft. in which to jump about in, which made the total load about 20 lbs. per sq. foot. It is not at all likely that when a number of people are packed as close as possible that they will be able to move about in a manner which would increase their weight more than 10%. We may therefore place the greatest weight which can be exerted upon a floor by a dense mass of people at 160 lbs. per sq. foot, which, with 25 lbs. to the sq. foot for the weight of the floor, would amount to 185 lbs. per sq. foot. As a floor to carry the above load would have to be heavier than an ordinary floor, we may place the weight per sq. foot which should be provided for at 200 lbs. This would be an ample allowance for a crowd of men standing and packed close together as in a dense crowd. Where a hall is fitted with fixed seats 125 lbs. per sq. foot would be an ample allowance, as it would be impossible to get more than half the number of people into such a hall as could be packed into one without seats.

In the London disaster we have a dense crowd around the platform. This crowd was standing practically over the 12" × 14" beam. The width of the floor which gave way was 22'.0", and of the platform 7 ft.; this would give 15 ft. in front of the platform carried by the beam. The actual load thrown upon the beam would be the number of people carried upon a space 21.0 × 14.0, of which the platform occupied 6.6 × 7.9. We will figure that the total load upon the floor of the hall was at the rate of 150 lbs. per sq. foot, and on the platform at 75 lbs. per sq. foot. This would give a total load of 40,350 lbs., as against 28,675 lbs. if we take the estimate that there were 250 people on the floor which gave way aud that 150 of them were over the beam. This load was carried by a 12 in. × 14 in. beam, built up of four pieces (3 in. × 14 in.) spiked together, but not bolted. This beam, according to Kidder, would carry safely, under a factor of safety of 4, 13,440 lbs., provided that it was composed of average material in a sound condition. The breaking load of the beam would be 53,760 lbs. If the beam was weakened by knots or dry rot 33⅓%, as claimed by one witness, the beam would break at 35,840 lbs. Another witness stated that the strength of the beam was not affected by the knots more than 10%, which would place the breaking load at 48,384 lbs. We have figured the possible and likely load upon the beam at 40,350 lbs., which we judge would be sufficient to break a beam of the character of this one.

In this beam we have a number of very indefinite quantities. We have very little knowledge of the quality of the timber, the number, size and position of the knots, amount if any of dry rot, or the manner in which the beam was put together beyond the statement that it was spiked together. A 12 in. × 14 in. beam, composed of four 3 in. × 14 in. pieces so spiked together that the pieces could move one on another could not be as strong as a solid beam of equally good timber. A beam placed in the position of the one which broke should have been thoroughly spiked and bolted together, so that all the pieces would act together as one. It is possible that this beam for some, probably for all, the above causes, was from 30% to 50% weaker than a good sound 12 in. × 14 in. solid beam. We are aware that many consider a built-up beam stronger than a solid beam without for one moment considering the points involved. A beam built up of good, sound, perfect timber will be a stronger beam than an imperfect solid beam; and a good, sound, perfect, solid beam will be a stronger beam than the most perfectly built-up beam where the individual pieces are of inferior timber. A solid beam of perfectly clear timber is a stronger beam than a built-up beam of the same size. The only advantage in a built-up beam is when imperfect material is used, and through the use of a number of pieces the defects can be distributed throughout the beam. One large knot in a solid beam may seriously weaken the beam.

Owing to the fact that the platform prevented the crowd centreing upon the beam, the load was greater near one end than the other, and we consequently find that the beam did not break in the centre, but to one side of the centre, which we may assume was the point of concentration of the load. It may have been that there were knots at this point, but in any case it happens to be about the point where the beam would break under the load which was upon it if it were made of good, sound and perfect material. In calculating the breaking load we have allowed for an equally distributed load upon the beam, although it was not actually the case.

There are authorities which would place the breaking load of the beam much higher than Kidder, but those constants do not make a sufficient allowance for the vast difference between the perfect material with which tests are made and the average material used in building. Hatfield gives the value of white pine at 500 lbs., Hurst at 380 lbs., Trantwine 450 lbs. and Kidder 240 lbs. Kidder's constant is quite high enough for the class of material usually used by the average contractor.

The direct cause of the failure of the beam was due to its not being of sufficient strength to carry the load suddenly placed upon it. Even if the beam had been of the most perfect material and put together in the most perfect manner it was by no means of the size it should have been for the work which it had to do. The load which caused it to fail was possibly an unusual one, but while such may have been the case, it was of such a character that it should have been provided for in the construction of the beam. The factor of ignorance in this case was not by any means large enough to cover the possible load and the quality of the beam, consequently the beam failed.

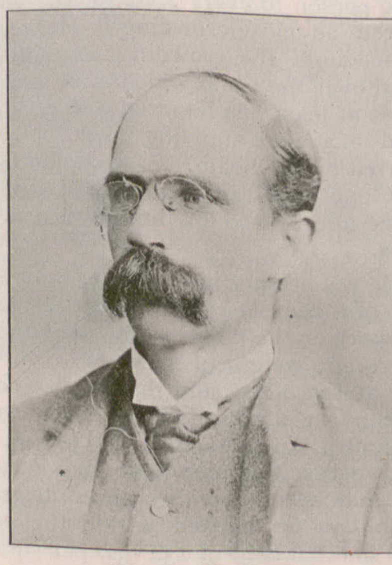
We will look at the strength of this beam in another way, and in a manner which some would call practical. The beam supported a floor area 14 ft. x 21 ft., and was 12 in. wide by 14 in. deep. It actually consisted of four 3 in. x 14 in. joists. If they had been used as joists they would have been placed at 3 ft. 6 in. centres, with a span of 21 ft. in the clear. Would any practical and sane man construct the floor of a public hall having a span of 21 ft. with 3 in. x 14 in. joists at 3 ft. 6 in. centres? The common joists in the floor of the hall were 3 in. x 13 in. at 15 centres, with a span of only 14 ft. 10 in.

The verdict of the jury was "That more than ordinary care was used in its construction and selection of material . . . . and that the sad occurrence was purely accidental." The jury may be perfectly satisfied with the verdict which they gave, but there are very many who would like to have them state the reasons which induced them to arrive at the verdict they did.

What this accident should teach is that it is not safe to trust to the practical knowledge of men who have little or no training in construction and do not understand the simplest problems in mechanics. What right has any man to construct a floor or anything else on which the lives of his fellow men may depend unless he has both the practical and theoretical knowledge which will enable him to do his work intelligently and with the certainty that he has made ample provisions to cover all possibilities? In this case someone makes alterations, and in doing so uses a beam which is only one-third or one-fourth the strength that it should have been; it breaks under the load which it should have been strong enough to carry; many lives are lost, and a supposed intelligent jury calls it an accident. Accidents are bound to occur where ignorance is engaged in place of knowledge. Knowledge may seem high, ignorance may be cheap, but the cheap thing is not by any means the better, nor even the cheaper in the end. Is the loss of twenty-three lives and the suffering of the injured not too great a payment to make for the trivial saving made by the employment of ignorance? A man who knows, as he must know, that he cannot determine the strength of a beam, and yet will not hesitate to construct floors, etc., to carry his fellow men, should be made to suffer for his ignorance and presumption.

MR C. H. RUST.

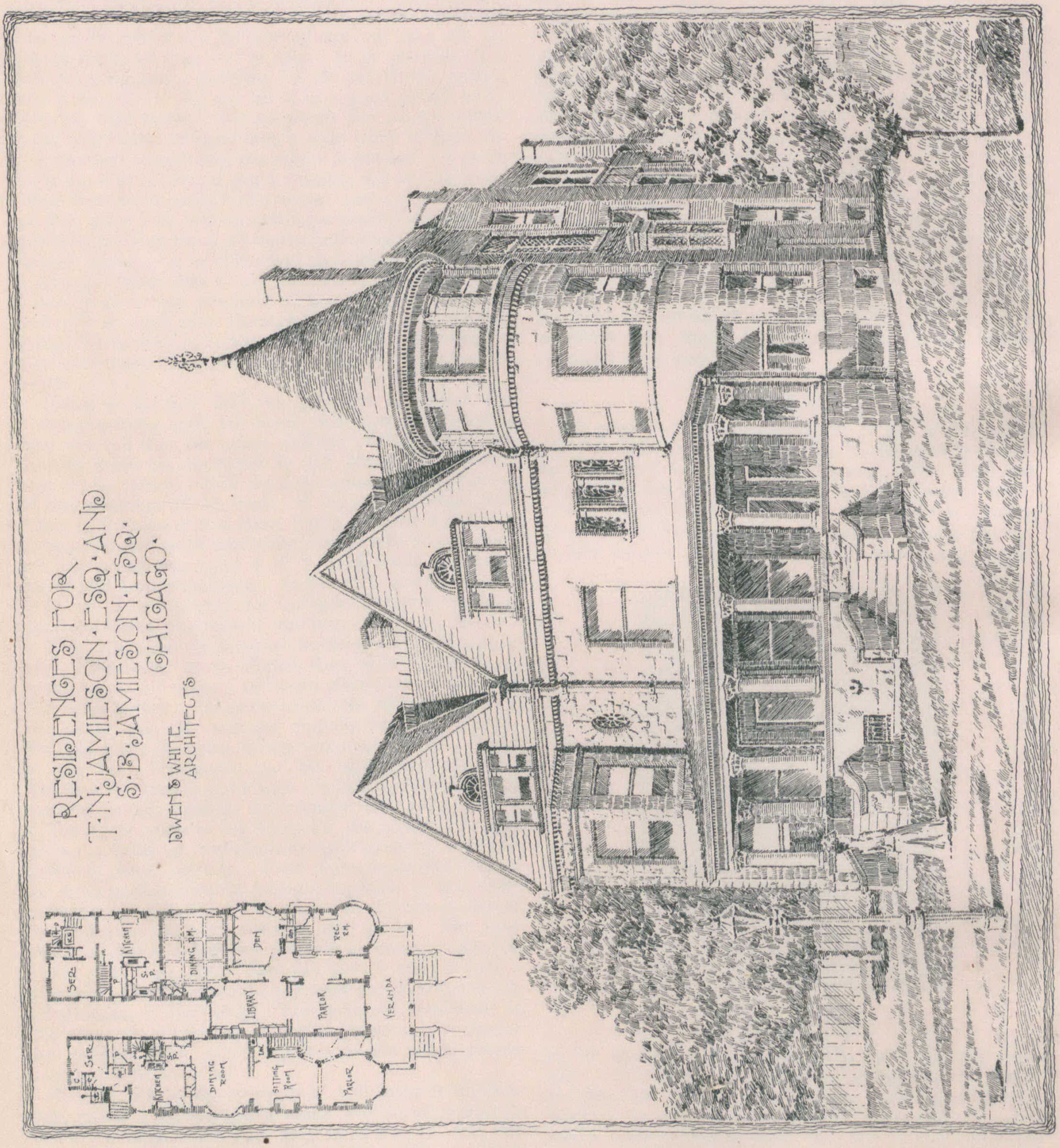
We present herewith a portrait of Mr. C. H. Rust, who was last week appointed City Engineer of Toronto. as successor to Mr. E. H. Keating. Mr. Rust has been in the city's service during the last twenty years, having entered the city engineer's department in December, 1877, as Rodman under the late Mr. Frank Shanly. In 1881 he was appointed assistant and draughtsman

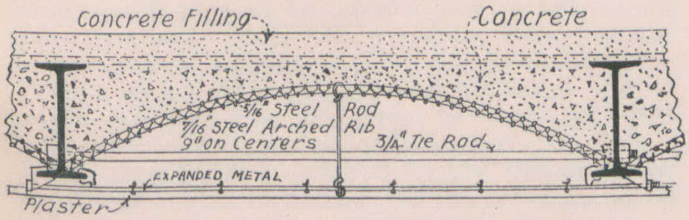


Mr. C. H. Rust,
City Engineer of Toronto.

by Mr. Redmond J. Brough, who was then city engineer. In 1883 he was appointed by Mr. Sproatt assistant engineer in charge of sewers, and whilst in that position constructed 150 miles of sewers at a cost of nearly three million dollars. In 1892 he was appointed deputy city engineer. Mr. Rust was elected a member of the Canadian Society of Civil Engineers in 1887, and last year was appointed a member of Council in place of the late Mr. Alan Macdougall. In view of the excellent service which Mr. Rust has rendered to the city in the past, his promotion is well deserved, while on the other hand, his thorough acquaintance with the work of his department will undoubtedly be of great value to the municipality.

To Take Stains out of Wood.—One ounce oxalic acid, 1 gill of boiling water. Wherever you touch the stain with the liquid it will remove it; if it should happen to fail try a little spirits of salts. If that won't remove it, nothing will.


RESIDENCES FOR
T.N. JAMIESON. ESQ. AND
S.B. JAMIESON. ESQ.
CHICAGO.
OWEN & WHITE
ARCHITECTS



THE ROEBLING FIG. 1 SYSTEM

FIG. 2 THE MAURER SYSTEM

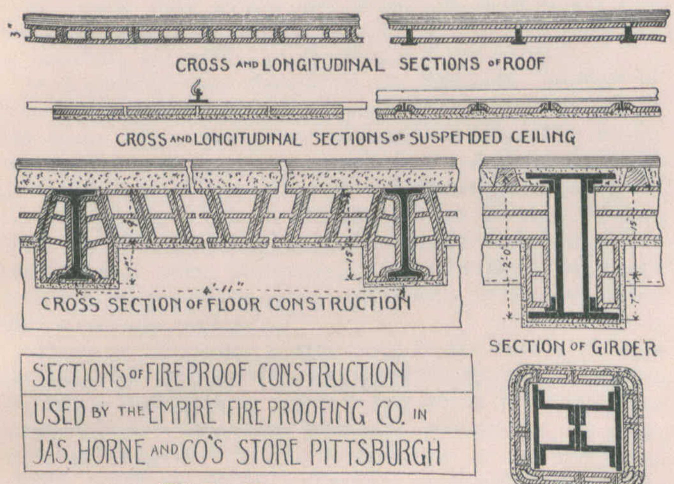


FIG. 3

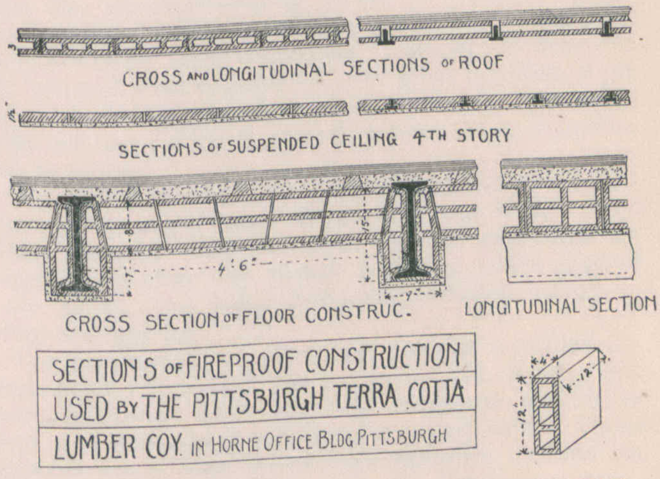
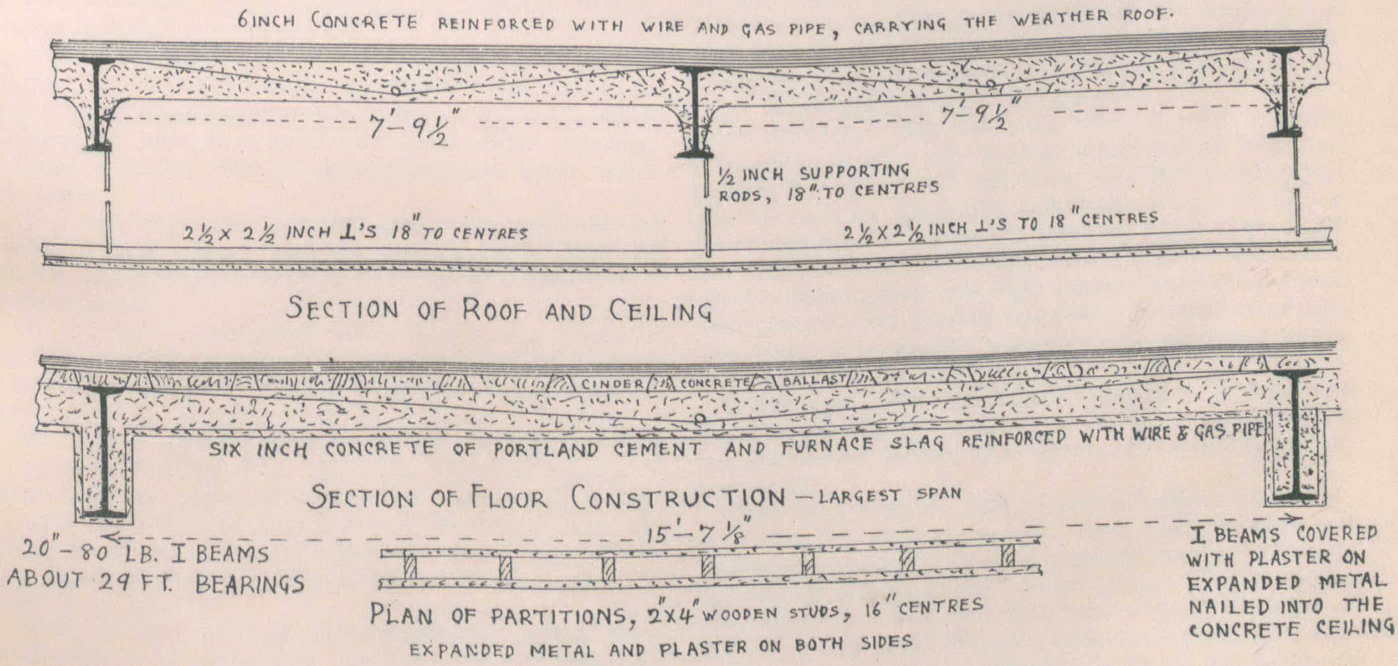


FIG. 4



FLOOR. CEILING, ROOF AND PARTITION CONSTRUCTION IN METHODIST EPISCOPAL BUILD'G. PITTSBURGH

FIG. 5

Illustrations Accompanying Mr. Burke's Paper on "Two Questions in Connection with Steel Constructions in Buildings," in this Number.

TWO QUESTIONS IN CONNECTION WITH STEEL CONSTRUCTION IN BUILDINGS.*

By Edmund Burke.

Having been invited to introduce, by a brief paper, a discussion on steel construction by this convention, I have thought it well to confine my remarks to two points which seem at the present time to call for the most care and study, viz., protection from rust and protection from high temperature, caused by fire.

The question of the protection of structural steel as used in buildings from the action of rust is one which has received too little attention in the past.

Gen. Sooy Smith is authority for the statement that rolled steel subject to moisture will be disintegrated by rust to the depth of about one inch in a century.

At this rate the life of an ordinary high building of steel frame construction exposed to the action of moisture would not exceed thirty years.

Moisture may reach the metal in mysterious and insidious ways, by leaky pipes, bad jointing of masonry or capillary attraction of the material encasing it.

It is claimed that limestone in concrete, applied to iron or steel surfaces will cause deep corrosion wherever the stone comes in contact with the metal. Mr. Buck, the engineer of the Niagara railroad suspension bridge, stated, at a recent meeting of the American Society of Civil Engineers, that in the anchorages of that bridge, the strands of the main cables were embedded in a concrete made with limestone, and wherever the spalls touched the wires the latter were badly eaten and sometimes entirely severed.

There is, of course, a difference in the nature of limestones, and some qualities may have a greater corrosive tendency than others. But in any event it shows how important it is that the greatest care should be exercised in the protection from corrosion of the structural metal work of large buildings, especially where the columns are supported on grillage footings embedded in concrete and also where the connections of columns, girders, &c., are protected from the action of heat with a like material. In such places the detection of corrosion is practically impossible.

It has been suggested, as a precaution, that where it is necessary to use limestone it would be advisable to put a layer of pure cement concrete, or an extra thick coating of asphalt around the metal, thus excluding oxygen whether free or in combination with other elements.

It is very important for the permanent exclusion of moisture from contact with the structural steel and iron of a building that it should be thoroughly coated with a reliable paint.

It is well known that there is a great range of quality in paints designed for the protection of metallic surfaces, some being practically useless as a protection from rust.

In a paper read by Mr. Max Toltz, before the Civil Engineers' Society of St. Paul, he reported results of chemical and practical tests of 22 varieties of paints. The tests discovered that some of the paints were entirely worthless as a permanent protection. One of the so called asphaltic paints when analyzed showed no asphaltum at all.

Besides the chemical examination, the paints were subjected to a systematic practical test, to ascertain their real values as anti-rust paints. For that purpose comparative tests, by painting pieces of sheet iron, tinned iron and galvanized iron, wooden boards and shallow sheet iron dishes, were carried on. The iron dishes were about 12 inches in diameter and about ½ inch deep, having a capacity of about half a pint. The scale of skin was carefully removed before painting so as to have a clean surface of iron exposed next to the paint. Two dishes were painted with each kind of paint—one of them receiving one coat, the other two coats, the first coat having dried thoroughly (for at least a week) before the second coat was applied. After the second coat had completely dried and hardened, these dishes were exposed to the so-called water-and-moisture test, in which a given amount of water is placed in the dishes and allowed to evaporate to dryness at the ordinary temperature of the room. This is repeated a number of times, till the inside of the dishes begin to show more or less rust. All dishes were carefully examined before each refilling. After most of the water has evaporated, there remains, at the junction around the edge, a thin film of water, which, in contact with the air and the carbonic and other acids in the air, acts on the paint in such a way that the iron under the paint begins to rust. The rust thus formed develops more and more after each evaporation, in some cases practically covering the whole dish in a short period. In actual practice and service the same thing will happen, the only difference being that the rust will extend under the paint and will not show as plainly as on the dish. This test is a most important and severe one for the purpose of determining in a relatively short time the weather-resisting power of a paint. If the paint is unable to resist this action of the water or moisture under these conditions, it cannot be desirable for iron and steel structures. But other qualities in the paint have to be taken into consideration in connection with this test before a correct opinion as to its merits can be formed.

The dishes painted with true asphalt varnish and with the carbon paint were refilled fourteen times. The dishes painted with one coat showed very little deterioration, while the dishes with two coats showed none at all, the paint being as elastic and tough as when first applied.

The behavior of the cheap and inferior so-called asphalt paints, applied on the surface of the dishes, was quite different. After the fifth exposure, the dishes with one coat showed considerable rust all over. Those with two coats, after the seventh exposure, showed not much better.

Quite a difference was apparent in the test of the iron-oxide paints. On the average, after the fifth exposure, a good many rust spots or specks appeared on the surfaces of the dishes painted with one coat. The dishes with two coats were refilled six times and on them rust could be easily detected with the naked eye.

The graphite paints so far examined acted much the same in comparison with one another.

All the dishes with one coat were exposed 10 times to the water test: all these graphite paints began to show a few specks of rust after the fifth evaporation, and the number gradually increased after each successive evaporation. After the tenth exposure some slight difference between them was shown, but not very much. All the dishes given two coats were exposed 13 times, and none of them showed any rust or indication of rust. The natural toughness and elasticity remained in the paint after the treatment.

Other tests with reference to exposure to heat and gases of combustion were made but are not pertinent to our discussion, having reference more especially to railroad work.

With regard to the use of red or white lead Mr. A. H. Sabin, an expert chemist, says that the chemical problems involved in the use of paints having white or red lead as pigments, are very obscure. The lead probably combines with the oil to form a soap, the acid of the oil uniting with the lead of the oxide to form a salt.

The addition of lead compounds to oil increases its rate of drying, whether heat be used to combine them or not. He questions whether this lead soap is a better binder than oxidized oil, and deems it to be very improbable that it is so even when red lead is used; white lead, he says, is notoriously converted into a crumbling soap which is washed off.

A New York architect is reported to have solved the difficulty of knowing how many coats of paint the metal work in his buildings has received by specifying the use of two colors—one to be put on before the work leaves the shops, a different color after it has been assembled, and a coat of the original color just before fireproofing is commenced, thus securing a thorough covering of every portion of the work.

Recent fires, both in Europe and America, have

* Paper read at the annual convention of the Ontario Association of Architects, Jan., 1898.

shown that the development of even a moderate amount of heat can be fatal to a structure dependent for its support on unprotected iron.

One of the most remarkable cases occurred at Vienna where the canvas of a panorama caught fire, destroying in the shortest possible space of time the roof of the building. The fire itself was quite an unimportant one, from a fireman's point of view, and yet it demonstrated what a small quantity of inflammable material may wreck and destroy a large piece of unprotected iron-work.

The entire framing of the light iron roof was found after the fire, lying, a not very distorted or dislocated mass, on the floor of the panorama building.

The effect was evidently that of a gradual yielding to the heat, and the entire roof supports appear to have simply turned inside out in their fall like an old-fashioned umbrella, the ring at the apex of the roof finding a resting place on the centre of the floor below.

A series of tests has recently been completed at Hamburg having reference to the behavior of uprights for warehouse purposes when subjected to the action of high temperatures. The conclusions reached are as follows :

1. Wrought-iron uprights, if not protected, show but little resistance at a fire, and, in fact, may be said to collapse in temperatures exceeding that of 1,100 Fah., even if this temperature is of short duration.

2. Wrought-iron uprights, if protected by concrete, in such a manner as, for instance, by filling in the kernel of girder work framing, offer a somewhat greater resistance than if entirely unprotected.

3. Wrought-iron uprights, if surrounded by non-conducting materials, i.e., "protected" in the manner so understood, show a considerably greater power of resistance than did the cases Nos. 1 and 2.

4. Cast-iron columns offer a slightly greater resistance than wrought-iron uprights, assuming that both are entirely unprotected, the collapse only taking place at temperatures above 1,400 Fah.

5. Cast-iron columns require considerable consideration regarding section and maximum load when intended for use in buildings of a dangerous character, as the time of collapse differs very materially according to the weight they are carrying during a fire, and their plan.

6. Cast-iron columns, if protected, as usually understood, by surrounding the shaft with non-conducting materials, show a greater resistance than wrought-iron uprights protected in a similar manner.

7. Wooden uprights, if unprotected, catch fire at temperature under 1100 Fah. but, though well alight, show greater resistance than unprotected wrought-iron or cast-iron uprights.

8. Wood, wrought-iron and cast-iron uprights, whether protected or unprotected, in no case give any sign of an impending collapse.

Another very interesting series of tests has lately been prosecuted in New York with a view to discover the relative value of various methods of floor and beam protection.

These tests were made at the instance of Mr. Constable, Superintendent of the Building Department of New York City. They were very carefully conducted under uniform conditions and included several methods of concrete as well as hard burned and porous tile construction. Accurate readings of temperatures and deflections were taken.

The Engineering Record says, "while this series of tests was especially designed to provide conditions thoroughly comparable with the severest conditions usually realized in actual conflagrations the circumstances governing them did not make it feasible to complete the parallelism by securing an endurance standard that would have been attained if it had been practicable to subject the constructions to repeated fires and quenchings, thus demonstrating how a structure that had endured throughout one cycle could withstand successive reapplications of fire and water after having been subjected to more or less deterioration from the first, a condition that is frequently realized by a fire breaking out anew after the firemen have once quenched it and attacked another part of the building."

The rooms in each instance were specially built, approximately 12 feet square, and a uniform load of 150 pounds to the square foot was placed on the central bay of each. In almost every case the deflection of the beams was proportionate to the completeness and thickness of their protection.

Where the soffits of the beams were protected by metal lathing and plaster or by thin slabs of concrete or tile, the deflection was the greatest and but little of the protecting material remained after the test ; that which was not destroyed by the heat, was washed away or badly broken by the application of cooling water at a pressure of about 60 lbs.

In the concrete constructions the material was damaged or washed out until the embedded rods, bars or wire mesh was exposed. In the tile constructions the lower thickness invariably cracked on the application of water and many of the pieces fell down, especially the portions covering the beams.

The deflection in all but three instances ranged from about two to five inches at the time of maximum heat and in most cases the work returned to nearly its normal position after having cooled. The deflection was less than ½ inch in the best examples of beam covering, and floors having flush ceilings suffered less deflection than those where the beam construction was apparent.

In the Gustavino construction, which was of arched form from wall to wall made up of several layers of flat tiles and without steel beam supports there was a slight elevation (about ¾ inch) of the crown of the arch at the time of the highest temperature, supposed to be due to expansion of the material. The bottom lamination of tiles cracked and fell upon the application of water.

Some months after the above tests were made another was inaugurated arising out of a challenge made by Messrs. Henry Maurer & Sons, manufacturers of fire proof materials of New York to manufacturers of fire proof materials to take part in a 24 hour test. The Roeblings, using a concrete system, (Fig. 1—see illustration pages) accepted the challenge with the proviso that the tests should be conducted under conditions similar to those which governed the former ones, a 5 hour test being assumed to be sufficient to test the value of the two constructions as fire resisting material. It was further stipulated that the hard burned tile should be bought in the open market and not specially burned for the occasion.

As the conditions named by Messrs. Maurer were modified they declined to have anything to do with the test, but it was proceeded with.

The Roebling floor system consists of concrete arches sprung between floor beams on a centreing of wire mesh. The ceiling is formed of wire mesh suspended a couple of inches below the bottom flange of floor beams and heavily plastered. As the arches are of segmental form quite a large air space is formed between them and the ceiling.

This floor occupied nearly one-half the room. A corresponding space was devoted to the hollow tile floor consisting of a flat arch with concrete filling above in the usual manner. (Fig. 2—see illustration pages).

The result is thus described in the Engineering Record : "After firing for three hours, the greatest deflection of the tile arch was 3.65 inches and of the Roebling arch 1.4 inches. At this stage a large portion of the tile floor between the two tierods in the centre, representing an area about 5 x 5 feet, fell away, allowing the superimposed load to drop through into the chamber below. The temperature immediately reduced, and the test was practically at an end. The Roebling arch remained apparently intact, with shreds of the skim coat hanging to the ceiling, the brown coat remaining intact. The temperature from the time of firing rose uniformly until it reached 2,000 degrees, about an hour and a half after the fire was started. From that time on to the end of the test a temperature of 2,000 to 2,300 degrees was maintained."

The Record also remarks that "although the concrete construction came out first in the test, there is not the least indication that hollow tile is an unsuitable material for fireproof construction. On the other hand, this test, as well as others that have heretofore been made, should satisfy the Board of Examiners of New York that its discrimination against concrete construction as a fireproof material is no longer jnstified."

The conflagration which occurred at Pittsburg last May has furnished the latest and most interesting test ot the behavior of large steel framed buildings subjected to the effects of intense heat.

The chief damage to the frame of the Horne department store was caused by the falling of a large water tank which was supported at the top of the building upon unprotected steel beams. In falling it displaced some of the beams and ruptured the fireproofing in proximity to them which allowed the heat to warp and twist the steel work of the sections involved. But elsewhere the steel frame was practically uninjured, although in many places the tile protection of the columns and beams was displaced by heat and water. The tile floor arches, in many places also, were partially destroyed, the lower shell having fallen off. The displacement of the tile protection by the force ot the water, however, did not take place till the worst of the conflagration was over, else the heat would have warped the exposed metal work to the practical destruction of the buildings.

The lessons of the Pittsburg fire are the most valuable of any which have yet occurred in steel frame buildings.

The relative value of fire proofing material was demonstrated in the following order :

1st. Terra cotta lumber or porous terra cotta.

2nd. Hard burned clay of the hollow arch type.

3rd. Concrete.

The use of these materials saved the buildings in which the various constructions were adopted.

The continuous ceiling ot the top storey of the Horne department store was the most effective in preventing damage to the material it protected and suffered the least deterioration in itself.

The weak point in the girder protection of the departmetal store (Fig. 3—see illustration pages) was the method of covering the soffit, viz., a flat solid tile clamped to the web of girder with metal which was only protected by the plastering.

Many of the skewbacks had the lower portion of the outer shell broken off permitting the dovetail soffit covering of beams to drop off.

The bottom shell of the floor arches was broken and dropped off, not impairing the carrying capacity of the floors, however, as the webs were left intact.

The blocks covering columns were not properly attached to the columns and but slight concussion or expansion sufficed to throw them off.

The fire-proofing of the Horne store and office building (Fig. 4—see illustration pages) adjoining the departmental store suffered less damage than that of the store building, even where the heat was quite as intense. The material was terra cotta lumber which is burned with a considerably less admixture of sawdust than is the case with porous terra cotta.

Here, however, the same weakness at the skewbacks and soffit tiles was developed. There was practically no breaking off of the lower shell of the floor arches.

The floors and the strips to which the floors were nailed were completely burned out and the cinder concrete between the strips was reduced to ashes, thought to be on account ot the unburned cinders in the composition.

In the Methodist Episcopal building, which was of concrete floor construction, (Fig. 5—see illustration pages) the test was not as severe as in the store buildings as it was divided into numerous rooms by wire lathed partitions and had not as large an exposure of windows facing the building where the fire started. The most serious damage was done in the stair well where an unprotected beam was badly warped.

The heat caused some sagging in the ceiling of the top flat which was one of suspended metallic lathing and plaster. One or two of the floors also sagged an inch or two where exposed to great heat. Portions of the partitions which were of wooden studs, metallic lath and plaster, were partially destroyed, but proved to be in a measure fire resisting.

Another interesting fire occurred in a Detroit storage warehouse. It was of skeleton construction, but the floors were of the type known as mill construction.

The columns and girders were fire proofed with terra cotta blocks and while the fire developed an intense heat on account of the nature of the contents and the wooden floors, the frame remained in place, but was sufficiently warped to displace some of the outer walls and necessitate practical reconstruction.

Some of the most experienced architects ot New York are strongly of the opinion that in buildings of the office type, divided by numerous partitions, the ordinary method of protecting columns and beams is quite sufficient, while some go so far as to think that sufficient heat cannot be generated in these buildings to make it necessary to more than plaster the soffits of the beams.

The experience of the conflagration at Pittsburg, however, points to the necessity of far greater thoroughness in the case of buildings of large undivided areas filled with inflammable stocks and having large exposed window surfaces.

If such great floor spaces are indispensable, and if some means of protecting the windows is impracticable, the only way to save the steel frame from destruction in a conflagration is to so completely protect it that the enormous heat generated will not have an opportunity of penetrating the envelope till the fire has burned itself out. In other words, to so construct the building that it will resemble an enormous stove—able to withstand the consumption of its inflammable contents without injury. The duration of a fire in a building of this class has been demonstrated to be not more than an hour or two, while the destruction of the inflammable contents is much more thorough than in a building whose floors collapse quickly.

Porous terra cotta floor arches, either of solid material or having an extra thick shell, flush ceilings, and at least 2 inches of terra cotta beneath the bottom flanges of the girders, would seem to be requisite for the protection of the floors, and the substitution of porous blocks for the filling on top of the arches instead of the usual cinder concrete.

For the columns at least a thickness of three inches of porous terra cotta blocks dovetailed and fastened so that the destruction of one will not displace the rest. Casing the blocks with wire lathing well secured would add greatly to the safety of the columns and defy any amount of heat likely to be generated.

A weak point in the Horne departmental store was developed by the behaviour of the steel lintels over the large window openings. Being poorly protected they warped in several instances, destroying a portion of the walls above.

The application of water, save for the protection of adjoining premises, is undesirable after a fire has got beyond control in a fireproof building ; owing to circumstances the firemen were driven from the Pittsburg stores and devoted their attention to saving surrounding property. After the buildings were somewhat cooled water was again applied. It is owing to this that the loss on the terra cotta was comparatively light, being appraised at about 5% of the value of the whole.

A new material for the protection of steel and iron from the effects of heat is being introduced in the shape of asbestic plaster. There are no details at hand with reference to any tests on full sized structures. A test was recently made in Washington on a miniature house about 4 feet high. A fierce fire was kept up for half an hour without damage to the building. Then a heavy stream of water was poured upon it without, it is said, in any way injuring or removing the plaster. It is claimed that it can be heated to red heat (1100 degrees Fahrenheit) without harming its durability, and that nails may be driven into it without causing cracks, also that it will only dinge, not break, when it is struck with a hammer, and that it is elastic, stretching with the shrinkage or settlement of a building. It will be very interesting to observe its behavior under tests similar to those prosecuted by Mr. Constable. If it will accomplish all that is claimed for it, it should revolutionize fireproofing methods.

There are many other interesting questions in connection with steel construction, such as rivetting versus bolting, wind bracing, column and girder connections, and in connection with iron construction such as brackets on columns, column connections, etc., but I have already consumed the time allotted me in the consideration of two questions of the most vital interest in the present state of steel construction.

DISCUSSION.

Mr. Gregg having moved a vote of thanks to Mr. Burke for his very carefully prepared paper asked, have examinations been made of any of those very large steel buildings to see if corrosion has taken place to such an extent that danger is to be apprehended?

Mr. Burke: I do not know of any such examinations.

Mr. Langton: They have recently pulled down the old post office in Chicago, and the examination of the old iron work was satisfactory.

Mr. Aylsworth: That building was put up twenty-five or twenty-six years ago. It was a solid concrete foundation, not piers.

Mr. Curry: In regard to the question of fireproof construction, one great trouble about it is this—a building that may be fireproof under one set of conditions may not be under another set of conditions. An office building divided into small rooms does not require the same protection that an open building does. A storage warehouse, of all buildings, should be built with the greatest care, because one can easily imagine the heat engendered by a fire in such a building, so intense that it would destroy almost anything. Naturally an architect must take into consideration the uses a building is going to be applied to when considering the question of fireproof construction. In regard to this subject much remains to be solved in the future. Many of the tests made are not to my mind satisfactory. One man will test a material aud report that he finds it all right, another may test the same material, under apparently the same conditions, and finds that it is all wrong, so, as far as I can see, the only safe course to pursue is to make a very large allowance unless you know that the test has been made by uninterested parties, and in the most careful manner. I think there is no question that concrete fire-proof construction is by no means satisfactory. The concrete in itself will not stand fire to any great degree; it is a question of how much it will stand. Certainly it will not stand the repeated action of water and fire; although advocates of that construction have put it through tests, and say it has stood the tests, I am not by any means convinced, and it will have to be subjected to more severe and better conducted tests before I am. Many of those who make tests are after all only trying to prove that something they are dealing in is superior to what other people are dealing in. We are governed by so many different conditions that all we can do is to do the best we can under each condition as it arises. In many cases you cannot put in exactly what you would desire, and in that case you must do whatever is done as well as it can possibly be done under the conditions prevailing. There is no question but that in severe fires the beams dropping below the ceilings are damaged, the terra cotta covering, or whatever it may be, generally gives way at that point. With regard to the question of rust, we have had no actual example of what has occurred, and I think it depends very considerably on the cementing material. Some limes seem to be injurious to iron, while others are not; the same with cement. Under some conditions it will deteriorate and under others it will not, so after all it is a very difficult problem. I suppose in the course of years a number of these buildings that have been erected under these conditions will have to become dilapidated and have to be pulled down, and then we will find out something as to the cause of rust and its prevention. So far as the contraction and expansion of the steel or iron that is covered up is concerned, it can not be very great, because there is not any very material change in temperature. I do not think there is anything very serious to be apprehended on that score, although Mr. Smith is trying to convince people there is. I think many of his contentions are well made, but at the same time we have to consider what has been done and govern ourselves by practical results rather than theories that are not apparently borne out by practical work.

Mr. Wickson: An architect with whom I had a conversation, who has had experience in a number of very large buildings, told me that that one thing he was determined after this to do was to have hollow tile under the soffits of all beams. He seemed to think that was a weak point, and he would have sufficient depth to get the soffit covering hollow. Mr. Burke in his paper mentioned a minimum of two inches, which would enable one to have it hollow.

The President: I think the hollow tile is quite largely used in new work now.

Mr. Curry: They have been used and defects found. It is just about the same as covering these columns.

Mr. Duff: I do not know that the question of rust has caused so much difficulty in buildings as in bridges, where the iron work is exposed to the weather. In bridges, especially near salt water, it is found that the girders, no matter how carefully you at first paint them, will rust out in a very short time, and become so thin with the action of scaling and rust that they have to be replaced in some parts. In some places, where exposed to the water dashing against them, the life of an iron bridge is only about ten years, and it is found that the rust continues to go on underneath even after a scale is formed, possibly a little more slowly than at first. As to the paint for iron work there is a difference of opinion now as to the relative merits of asphalt and linseed oil paints. I think Mr. Burke in his paper referred to iron oxide or red lead as the pigment to be used as red lead. If you wish to make beams proof against rust the best way is to specify that as soon as they are rolled they shall receive a coat of linseed oil. A great deal of damage is done before the beams have left the shops at all; the rust begins before they have passed through the mill and been punched and fitted for buildings. The red lead painting is not usually done until the beams have been punched, and in going about rolling mills I have often seen beams badly rusted before they left the shops at all, or had even been painted.

Mr. Dick: I think the most valuable feature of these discussions is the bringing out of personal experiences, and unfortunately, from that point of view, there has not been a fire in any building which I have constructed, which would enable me to know whether the precautions taken have been sufficient or otherwise. I think one of the chief lessons we can gather from Mr. Burke's excellent paper is the necessity for watching every point in fireproof construction. The strength of a chain is said to be only that of its weakest link, and if wrong in only one little point, a structure may be destroyed that was supposed to be fireproof. That applies to the protection of the main beams that come down below the ceiling. One of the greatest difficulties in fireproof construction is to make that point thoroughly safe, and it is undoubtedly safer construction to have a flat ceiling in which there is nothing for the fire to impinge upon.

Mr. Kennedy: Mr. Duff has spoken about painting the girders before they were drilled and punched; I would like to know how it would do to submerge them in paint before placing them in position. I think that is quite as cheap as painting them in the ordinary way, and by that means you are pretty sure that it is all well covered.

Mr. Gordon: I was going to remark that in the Pittsburgh fire the protection formed by the suspended ceiling, although much more lightly constructed and imperfect, seems to point to the great benefit of having air space. The difficult point in all floor construction seems to be to keep the bottom of the large beams from the action of the fire; but if we made a flat ceiling across below the soffit of large beams, even though it were not very fire proof, simply such a ceiling as in one of these buildings, suspended and with flat tiles, it would form such an efficient protection not only to the soffit of the beam, but the whole soffit of the terra cotta on the other beam, that it would seem as if it would be impossible by any fire to cause deterioration of the floor. Then you gain the other point which is emphasized in the paper, of a flat surface, no pockets for the fire, nothing for it to catch upon. I think where extreme precaution is needed it would be the correct thing to have an air space below, forming an independent suspended ceiling below the floor. With regard to immersing instead of painting, we know that the best pipes put down for gas and water are generally dipped in tar. It strikes me that to have our constructional iron work dipped in asphaltum would certainly be more effective than painting.

Mr. Baker: The same thing has occurred to me. I do not see why a beam should not be dropped in a trough and taken out again; it would be much more rapid, and I should think cheaper than painting with a brush.

Mr. Burke: I would like, Mr. President, to make a sketch of the Roebling construction, which seems to be the ideal shape, in following up Mr. Gordon's remarks. If that could be adopted in porous terra cotta construction I think it would fulfil every requirement.

Mr. Gordon: I intended to second Mr. Gregg's motion for a vote of thanks to Mr. Burke for his paper, and beg now to do so.

The President: I am sure we are all very much obliged to Mr. Burke for his very careful paper. In regard to the immersion of beams, while it may be done and is done with cast iron, in the case of ordinary rolled steel I would have much more confidence in their being put into the oil if it could be done immediately they come from the mill. On the other hand, if it is to be done with paint after the drilling and that kind of work has been done, in the time intervening between their coming from the mill and passing through the shops for drilling they may receive more damage by rust than would be compensated for by dipping them in paint. Of course if both precautions could be taken that would perfectly protect them.

The vote of thanks to Mr. Burke was then carried with hearty applause.

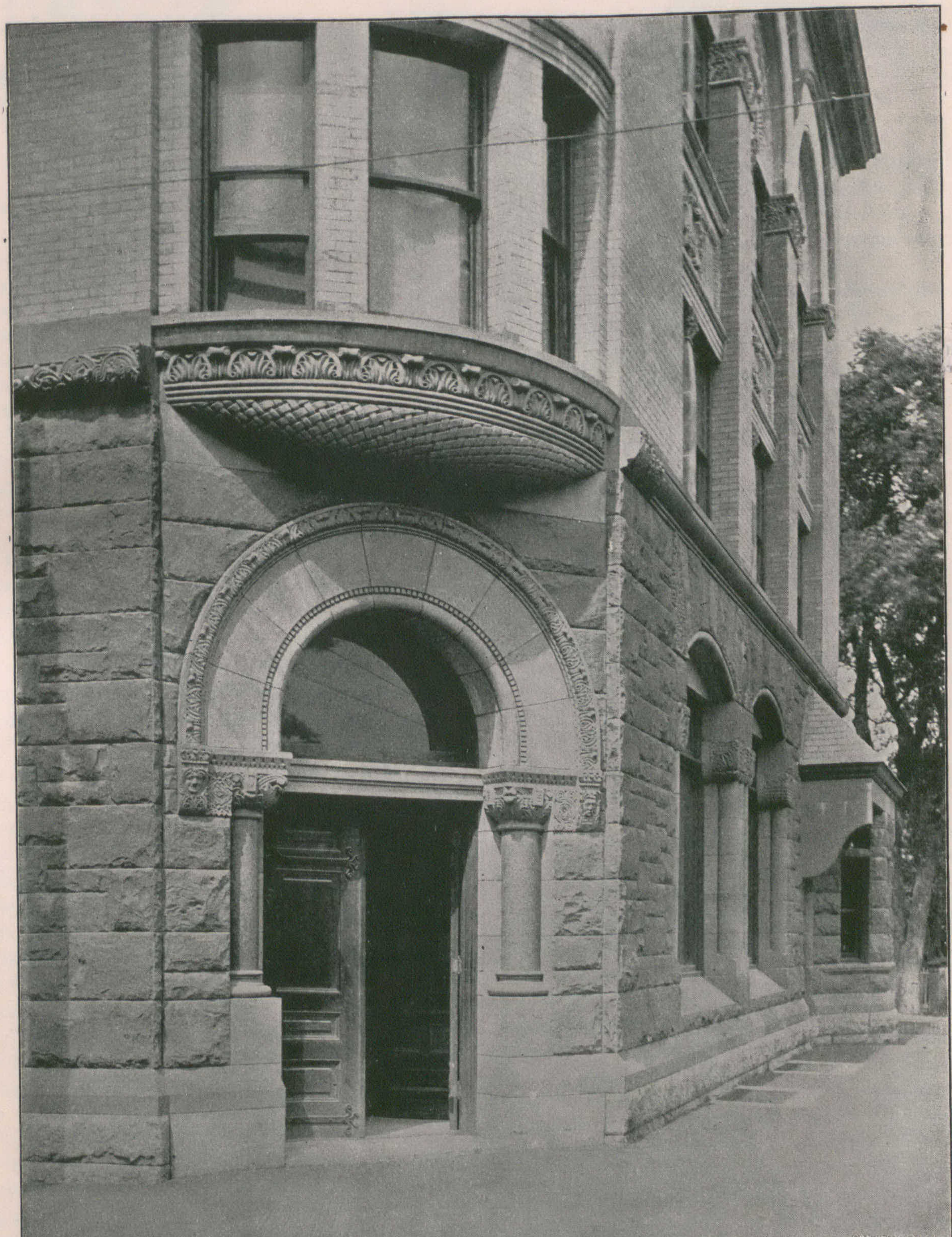
USEFUL HINTS.

To Make Brown Oak Stain.—Four ounces Vandyke brown, 1 pint spirit of ammonia, 1 ounce bichromate of potash.

Ventilation depends on the volume of air that enters a room, but no more can enter than will equal the amount removed.

Red pigments embrace two distinct series of substances, the reds of inorganic origin (minerals) and red lakes, obtained from animal and vegetable colors.

To Make Black Varnish.—Four oz. white shellac, 1 pint methylated spirits, 1 oz. benzine, 1 oz. white resin, 1 oz. gum mastic, ½ oz. gum sandric, 1 oz. gas black or vegetable. Strain before using.



MAIN ENTRANCE FOR NEW BUILDING FOR THE MERCHANTS BANK OF CANADA, TRURO, NOVA SCOTIA.

ELLIOTT & HOPSON, ARCHITECTS.

THE BUILDER

[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.]

Ice at the Eaves.

ONE of the troubles with a flat roof in our Canadian climate is the accumulation of ice at the eaves. This is often very troublesome, as the ice rises above the level of the roof, and the water banks up and rises above the flashings, and runs down the walls on the inside, or finds some seam or leak under the covering and drops on to the ceiling below. A number of devices have been tried to prevent this accumulation, but in most cases the experiments have been failures, for if the roof at the eave can not be kept at the same temperature as the main body of the roof, or at a higher temperature, the water running down from the warmer portion will surely freeze when it reaches the colder projection during the frosty season. The accumulation, therefore, can only be prevented by keeping the whole surface of the roof at one temperature, or by some special device at the eave that will keep the flow of water at the same or a higher temperature than it acquires on the roof. There are several ways by which this result may be accomplished. The first, and in our opinion the best, is to leave a sufficient space between the ceiling joists and the rafters to prevent the heat from below affecting the roof, and having the space well ventilated in order to preserve a uniform temperature between the ceiling and roof from end to end. This prevents any thawing above the eave, and consequently there can be no flow, or if there be a thaw the flowing will be uniform—as much at the eave as elsewhere. Another method is to cut off the roof boards five or six inches short of the inside wall, and build in a good solid trough between the joists or rafters to receive the water from the upper part of the roof, and then continue the roof to the eave the same as usual. The metal forming the covering of the roof passes into the trough, forming a metal gutter, and is taken up on the lower side and continued to the eave, just as it would be if no trough was there. The water flows into this trough from the upper roof, and is conveyed from the trough to the drain by a proper leader, which passes down on the inside of the building, then through the wall to connect with whatever conveniences are provided to take the surplus water away. The theory of this device is, that the trough being placed where the heat from the rooms below can reach it, ice cannot form, and an open avenue will always be provided to admit of the free flowing of water. The theory is correct, but in practice it does not always work as is expected. If the house, shop, store or factory is vacant during a frosty term, some of the conditions are changed and troubles ensue. Another method of getting rid of the ice, and a good one, too, is to connect a steam pipe—when steam is used—with the heating system and carry it up to the underside of the roof boarding at the eve on the outside of the wall (the pipe may be boxed in), and when ice commences to accumulate, to turn a current of steam through the pipe; the result is generally satisfactory. A 1½-inch pipe is sufficiently large for the biggest roofs. The steam pipe should be so arranged that it could be cut off and turned off the heating system at will. The device is not an expensive one either to install or to operate when wanted. From thirty to sixty minutes' application of steam through the pipe will clear any eave of ice, no matter how great the accumulation may be. There are other methods more or less effective, but the three main ones are those mentioned in the foregoing.

Mortar Joints.

MORTAR is used to hold the parts of a wall together, and also to prevent the fracture of the bricks or stones by insuring an even distribution of pressure notwithstanding any irregularities in their beds. Thick joints should be avoided where possible; they not only injure the appearance of the work, but, when the weight of the superincumbent walling comes upon them, the mortar is squeezed out, projects beyond the face of the wall, catches the rain and leads it into the walls, rendering the work liable to injury by frost, and the surface of a building finished with thick, coarse joints of mortar can never be made to look neat or workmanlike. In order to make neat work certain rules must be adhered to, among which are the following: In flat or flush joints the mortar must be pressed flat with the trowel and the surface of the joint made flush with the face of the brickwork. Such walls are not very ornamental, but are suitable for many buildings and for interior walls that are intended to be whitewashed or painted. Struck joints are formed by pressing back the upper portion of the joint while the mortar is moist, so as to form a sloping surface, which throws off the wet; the lower side of the joint is cut off with the trowel to a straight edge. These joints are usually struck along the lower edge. This is the joint usually made by Canadian bricklayers. Keyed joints are formed by drawing a curved iron key or jointer along the centre of the flush joint, pressing it hard, so that the mortar is driven in beyond the face of the wall; a groove of curved section is thus formed, having its surface hardened by the pressure. In some cases the moist key is dipped in ashes, which are thus rubbed into the surface of the joints. Raking and pointing consists in removing the original mortar joints to a depth of about ¾ of an inch in from the face, filling in with good mortar, and finishing the joints in one of the methods described. Pointing is not advisable for new work when it can be avoided, as the joints thus formed are not so lasting as those that are finished as the walls are erected. During a severe frost, however, when the walls are going up, it would be impossible to strike good joints ; then pointing may be resorted to during better weather. Pointing is, moreover, often resorted to when it is intended to give the work a superior appearance, and also to conceal the defects of inferior work. In repairing old work the mortar of which has become decayed, raking out and pointing become necessary. Both in old and new work, before pointing, the original mortar should be raked out with an iron hooked point, and the surface well wetted before the fresh mortar is applied. In flat joint pointing the raked joints are filled in with fine mortar and struck flat with the trowel or jointer. Tuck-pointing is chiefly employed on better-class brickwork ; the joints, having been raked, are "stopped," that is, filled with mortar. This is colored or rubbed over with a soft brick until the joints and bricks are of the same color. A narrow groove is then cut along the centre of each joint, and the mortar is allowed to set. After this the groove is filled with pure white lime putty, which is caused to project so as to form a narrow white ridge, the edges of which are cut off parallel so as to have a raised white line about ⅛ of an inch wide. This work requires considerable care and skill on the part of the workman, but when well executed it causes inferior work to look as if it had been executed in the best of materials, laid in very fine joints ; in carrying it out, any defects in the work, such as irregularity of joints, are corrected by smearing over the face and striking false joints, so that defective work is disguised and made to present a good appearance. Bastard tuck pointing consists in forming a ridge from ¼ to ⅜ of an inch wide on the stopping itself, the edges being cut parallel and clean. There is no white line, the projecting part of the joint being of the same color as the remainder. Blue or black pointing is done with mortar mixed with coal ashes instead of sand. Sometimes colored mortars made for the purpose are used. Masons' or V joints project from the face of the wall with an angular V section. With good mortar they throw off the wet, but when inferior lime is used they soon become saturated and destroyed by the frost. The best joint for general purposes is the "struck joint." It is the easiest made, and is the most lasting.

PLUMBERS' MEETINGS IN MONTREAL.

Representatives of the Plumbers' Supply Association and of the Dominion Master Plumbers' Association met in Montreal at the beginning of the month and satisfactorily adjusted their business relations.

A meeting of the Master Plumbers' Association was subsequently held in the rooms of the Montreal Builders' Exchange, the following executive officers being in attendance : Joseph Wright, Toronto, president ; W. Smith, London, Ont., vice-president ; G. McKinley, Ottawa ; Wm. Stephenson, Winnipeg ; Joseph Lamarche, Montreal, past-president ; P. J. Carroll, W. J. Hughes, representing St. John, N. B., and W. Harris, representing Halifax, N. S.

The relations between the plumbers and the supply firms were considered, as also the sanitary regulations prevailing in the various cities. In this latter connection a deputation was appointed to wait upon the proposed new local Health Board and endeavor to secure improvements in the sanitary regulations of Montreal.

It was decided that the next annual convention of the National Master Plumbers' Association shall be held at Quebec from June 29th to July 2nd. The executive will meet at 9 a. m. on June 29th and the convention will open at 2 p. m. on that date.

ANNUAL BANQUET OF THE MONTREAL ASSOCIATION.

A very pleasant evening was spent by the members and guests of the Master Plumbers Association of Montreal at the annual banquet of the association in the Queen's hotel, Montreal, on Thursday evening, Feb. 3rd, at which Mr. J. W. Harris presided. Occupying places of honor beside him were : Mr. James Wright, president of the National Association ; Mr. Stevenson, of Winnipeg ; Mr. Smith, of London ; Mr. G. McKinley, of Ottawa, and Mr. W. Mansell, of Toronto, secretary of the National Association. There were altogether about one hundred persons present, among whom were the following : Mr. McMichael, of the James Robertson Co. ; Mr. Booth, Toronto Steel Clad Bath Co. ; Mr. J. M. Taylor, of the Toronto Radiator Co. ; Lieut.-Col. Massey, of the Gurney-Massey Co. ; Ald. Gagnon, Ald. Beausoleil, Ald. Laporte, J. P. Lamarche, T. Christie, J. McArthur, Robert J. McLaren, W. J. Wall, Z. St Aubin, E. Hebert, A. J. Martin, A. Paquin, T. Lessard, T. E. Rouillier, D. Dugas, Z. E. Martin, G. C. Denman, P. C. Ogilvie, A. S. Walker, W. Stephenson, James Simpson, J. Lecompte, J. Hoffner, Joseph Mansfield, H. H. Brosseau, Geo. Moffatt, ex-Ald. Germain, Z. Cusson, G. Lecompte, T. O'Connell, A. J. Murray, John Watson, Capt. J. H. Wynne, P. J. Canab, Alex. A. Robertson, J. A. Hughes, W. R. J. Hughes, R. J. Lockhart, Louis A. Payette, G. Pelletier, Alfred Blais, S. E. Crevier, F. Duclos, J. M. H. Robinson, C. E. Thibault, N. Simoneau, F. Hurturbise, H. A. Lamontagne, H. G. McLaren, R. D. Robins, Capt. J. Giroux, Ernest W. Thurber, James A. Sadler, T. Moll, J. M. F. Trembly, W. Skead, Jas. Addison, John Burns, J. P. McEntor, M. Beaupre and others.

Mr. F. Hortan, Secretary of the Banquet Committee, read telegrams and letters of regret from Mr. J. Doodey and Thos. Campbell, of Halifax, N. S., P. Fitzsimmons and Mr. Picard, of Quebec, Messrs. Perrier and Burton, of St. John, N. B., Mr. Foote of Boston (one of the New York delegates), H. R. Ives and Mayor Prefontaine of Montreal. The maritime province delegates were snowbound.

After justice had been done to the excellent menu the president proposed the toast "the National Association of Canada," which was ably responded to by Mr. James Wright, the President of the National Association, who said every member of the local association would find a friend in the National Association, and he had no doubt, as he had said in the afternoon, that if the roofers and steam-fitters would all affiliate with them, and take Canadian goods only, it would be of great benefit to themselves and the supply houses. He would try and do all he could to have Canadian goods used by every member of the Association, and hoped they would all see their way to deal with Canadian firms.

Mr. Smith, of London, the vice-president of the National Association made a few remarks on the same theme, and said as they expected to have a revival of home trade before long they would not require American goods in any form.

Mr. Mansell, of Toronto, Secretary of the National Association, made a few interesting remarks, and Mr. Stevenson of Winnipeg made an excellent and witty speech.

Mr. McKinley of Ottawa, hoped in the near future to see the plumbers buying their supplies from home manufacturers.

The toast "Corporation of Montreal" proposed by ex-President Lamarche, was ably responded to by Aldermen Beausoliel, Laporte and Gagnon.

Mr. Taylor gave a recitation which was received with great applause.

Mr. Dore, sanitary engineer, Montreal, also made a short speech.

The Chairman, commenting on the position of the wholesale manufacturers of Canada, said he did not see why they were not in as good a position to get the Canadian trade as the Americans; they had a good protective tariff, and suggested that the Master Plumbers form a committee to see what could be done.

Mr. J. W. Hughes, in proposing the toast "Our Guests," eulogized the wholesale hardwaremen in Canada, and also the Executive Committee of the National Plumbers Association, some of whom had travelled thousands of miles to attend the meeting.

Mr. James Simpson, President Montreal Builders' Exchange, in reply, expressed the hope that many of the plumbers of the city would see the advantage of connecting themselves with the Exchange. Appropriate replies were also made by Mr. McMichael, of the James Robertson Co., Toronto, and Mr. J. W. Taylor, of the Toronto Radiator Co. A few remarks were also made by Mr. Moore, of Boston, Mr. Saunders, of Goderich, and Mr. Anthes, of the Toronto Foundry Co.

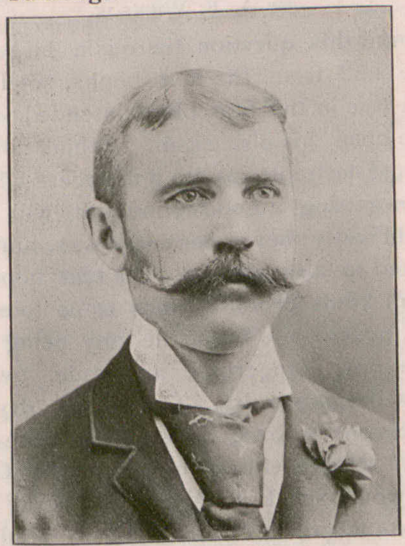
The proceedings closed with the usual toasts to the Ladies and the Press and the singing of the National Anthem.

For the success of the Banquet credit is chiefly due to the following gentlemen comprising the Committee on Arrangements: P. C. Ogilvie, chairman; F. Hartman, secretary; J. Watson, treasurer; P. J. Carroll, Thos. Moll, Alf. Paquin, I. Lamarche.

EXECUTIVE OFFICERS.

MR. J. W. HARRIS.

Mr. J. W. Harris, third president of the Master Plumbers' Association of Montreal, was born in Buffalo, N. Y., but when about seven years of age removed to Montreal, where he has since resided. Previous to starting business on his own account he was for five years manager of the firm of Brodeur & Lessard. On the retirement of Mr. Brodeur he entered the business as a partner with Mr. Lessard. As an evidence that Mr. Hrrris thoroughly understands the plumbing and heating business it may be mentioned that he has satisfactorily conducted the steam heating plant in Laval University and fitted up several of the leading banks and other large buildings.



MR. FREDERICK HORTAN.

Mr. Frederick Horton, 1st vice-president of the Master Plumbers' Association of Montreal, was born in Yorkshire, England, and served an apprenticeship of seven years under indentures to the plumbing and heating business in one of the large contracting shops in England. On completing his term of apprenticeship he travelled for a time in England, Scotland and Wales. He then sailed for New York and lived in that city for about twelve months, thence removing to Montreal, where he considered there was a large field for plumbing and heating. After having been associated with plumbing establishments in Montreal for about three years he decided to build up a business of his own, in which he has been very successful. He was one of the most active promoters of the first plumbing association in 1887, and advocated and formed classes for the education of the apprentices to the plumbing trade held in the Council of Arts building, 96 St. Gabriel street. He was appointed instructor of these classes by the government of Quebec, jointly with the Master Plumbers' Association, and held the position for three years, when the demands of his business compelled him to resign. Mr. Hortan has carried out plumbing contracts in connection with many of the large churches, warehouses and handsome residences of the city.

MR. GEO. C. DENMAN.

Geo. C. Denman, who was by an unanimous vote elected secretary of the Montreal Plumbers' Association, was born in Birmingham, England, in the year 1855, and came with his parents to Montreal in the spring of 1858. He was educated in the British and Canadian school. For fourteen years he was in the employ of the well-known firm of Gordon & Egan, and for the past seven years has been carrying on business with his partner, under the name of Denman & Ogilvie, 279 Bleury street.

REASONABLE SUPPORTING STRENGTH OF DIFFERENT KINDS OF SOIL.*

By A. F. Wickson.

Regarding this question there is a large amount of data to be had from the text books, so I will not do more than was in the first place intended, viz., merely attempt to open this discussion. I think we shall obtain the most desirable results if members who have had difficulty in getting a good foundation will tell us just what the difficulty they experienced was, and the means they adopted to surmount it. The text books speak of the different kinds of foundations to be found, there is rock, clay, gravel and sand, the clay being marked as one of the most dangerous, as a rule, owing to the difficulty of keeping it dry. Good hard, dry clay is, as almost everyone knows, an excellent foundation, but not as good as gravel or compact sand. One thing I thought I would speak of particularly is the practice of making tests wherever one is going to build ; it would almost seem as if tables and data alone were not sufficient in erecting buildings of any magnitude, and that the best thing one can do is to make careful tests. The suggestion of Mr. Kidder, who has recently written a book on this subject, is that a table with four legs, each about six inches square, should be placed on the soil, and gradually loaded with heavy weights until there are signs of settlement, carefully noting them, and having found that it is beginning to make an impression to take from one-fifth to one-half of the load as the safe carrying power. For the Capitol at Albany they erected a mast, holding the top in place by guys, and loaded weights on it, taking, I think, about fourteen inches square at a time. For the congressional library at Washington they had a moveable table with the load already on it, that was moved around the foundations making tests at short intervals, and in that way they found what it would safely carry. The strength of soil as given by Rankin is very low indeed, from 1 to 1.5 tons, but that is a great deal below the average. In Kidder's new book he puts it as follows :

BEARING POWER OF SOILS.

KIND OF MATERIAL.	Bearing Power in tons per square foot *	
	Min.	Max.
Rock, hard	25	30
Rock, soft	5	10
Clay on thick beds, always dry	4	6
Clay on thick beds, moderately dry	2	4
Clay, soft	1	2
Gravel and coarse sand, well cemented	8	10
Sand, compact and well cemented	4	6
Sand, clean dry	2	4
Quicksand, alluvial soils, etc	0.5	1

* Ira O. Baker, C. E., in Treatise on Masonry Construction.

I think if we could get any discussion from members as to how they have overcome the difficulty encountered in quicksand it would be very helpful to many of us. Here in Toronto we are very well off for foundations as most of our soil will carry from two to four tons per square foot pretty safely. One large building put up not long ago was carefully figured for two and a quarter, and in a warehouse building which I put up myself, where it was figured at three and a half there has been no trouble, so far as I have heard. In a recent experiment in France they found that clean sand carried 100 tons to the square foot quite easily. One is liable, even in Toronto, perhaps, to take it for granted that as we have pretty good soil it is not necessary to test it, or take as much pains as in some other places, but we certainly run risks in not doing so. I know of one building erected here not long ago on partially filled in ground, the foundations of which were in some places not taken far enough below the original top surface. While nothing dangerous resulted, it went down sufficiently at one corner to cause a slight crack. A little more careful testing would have prevented that. Quicksand is one of the most difficult soils to build on. I notice that in building the Boston aqueduct they had trouble with it, and tried several methods before they succeeded ; putting in concrete first, it would not work, as there was a sufficient force of water to prevent it properly setting. Then they tried filling a trench quickly with two feet of good coarse gravel, pounded down, and in that way obtained a very good foundation. Made ground is also one of the most difficult bottoms to handle, the only method being, usually, to go right through to the solid earth with the masonry walls—rather an expensive method, it is true, but I see no other way out of it. Not long ago there was an arbitration case here, and I know a great many of those who were on it took the view that the only way of making such ground useful for building purposes was to take piers right through the filling into the hard ground, and that meant going down, I think, between twenty-five and thirty feet, in some cases. There is just one other point that occurred to me in this connection, and that is that in building where there will be tremor one has to allow a good deal less for bearing power than in other buildings, as the shaking and vibration have the effect of causing such a building to continue sinking for a much longer time than a steady building would do.

* Introductory paper read at the annual convention of the Ontario Association of Architects, January, 1898.

DISCUSSION.

Mr. Helliwell : A case came under my notice in the city where there was a deep ravine, the filling in of which was begun about ten years ago, and has been continued up to the present time. The filled-in portion is now quite extensive, and the owners of the land contemplate putting up buildings on it. The site is not such that very costly buildings would be erected, and the question arises, "What would be the best way to overcome the liability to settlement." The depth of the ground would be from forty to sixty feet, and I would like to hear suggestions as to what can be done in a case of that kind to put up buildings at a moderate expense.

Mr. Wickson : The only thing, I should think, would be to have the ground tested as accurately as possible, and then, if it has any bearing qualities at all, by spreading the footings the difficulty might be overcome. The difficulty about spreading the footings is that it is rather expensive, even when composed of concrete with twisted wire (one of the cheapest methods), but I do not know of any other way except to go right down to the original soil. The method I suggest might do if the filled soil had a bearing power of a ton to the foot.

Mr. Pearson : If it had a bearing power of a ton to the foot there might in course of time be a shrinkage, owing to the action of water, and I should think it might be better to pile.

Mr. Wickson : Unless the ground is saturated, it is very little good. Piles will not last in ground that is not wet, one of the fundamental principles of piling being that they must be cut off below the water level to be of any value.

Mr. Gordon : In the case referred to I would suggest building the house somewhere else.

Mr. Paull : In the city of Boston they drove down piling below the water's edge, and on that they put large flat stones across, and on that they have successfully laid their foundations and erected fine mansions.

Mr. Wickson : Mr. Paull's remarks about the houses at Boston simply support what I have just said as to cutting off the piles below the water line. In reply to the statement that a soil not carrying more than a ton to a foot is not strong enough to be built on, if the spread of your footing is only made proportionate to the weight to be carried, a bearing power of even less than a ton to the foot could be used. It is a question whether you could make a brick foundation spread sufficiently to carry the building. There is also this to consider, that filled-in ground is worse than soft ground, because you do not know what may be beneath. I do not think Mr. Helliwell has an easy task before him; to build on top of made ground at all is decidedly inadvisable.

Mr. Gray: I think Mr. Dick had some experience in building the Infants' Home, which might be valuable; it was built on an old reservoir or something of that kind.

Mr. Dick: It was built on the site of an old reservoir that had been filled in with ashes and all kinds of rubbish. It looked tolerably uniform, and was too deep for one to go down to the solid ground, and what appeared to be the cheapest way to get a foundation was to widen the footings so as to get a large bearing surface, and that was done by using two thicknesses of two-inch plank crossed. It was expected that the settlement would probably be uniform, but owing to inequality in the filling, and the the nature of the stuff used for filling, it did settle more in some places than in others. The consequence was that several cracks appeared, not sufficient to interfere with the stability of the building, but still enough to be unsightly. At the back of the main building there was a low annex, used for laundry purposes, that came partly on the filled ground and partly on the solid ground. The same precautions were taken where it extended on the filled ground as had been adopted for the main building; the plank foundation was put down, but notwithstanding that, a crack appeared on each side of the building just where the solid ground and the filled ground connected, which, of course, was just what might have been expected. The building being only one storey high, it did no harm, but it certainly looked bad. I have looked up some data or calculations I made some time ago for a chimney erected down near the Don, on what was supposed to be pretty bad soil. It turned out to be clay, and it was above the water level, and dry. The chimney was 130 feet high, above the ground, and the load was about 3,950 pounds to the square foot. Over the whole site was a bed of concrete two feet thick, then a course of heavy dimension stone, on which was begun the foundation of brick, with large wide footings, diminishing by offsets of a quarter of a brick until the width was reduced to the thickness of the wall proper. The chimney was built very rapidly; in fact, the brickwork was begun the very day the concrete was put in, but there has not been the slightest appearance of cracking, though, looking at it since, I have seen what I think is a slight settlement. There is not the slightest appearance of cracking or being out of plumb, and the settlement, so far as we could judge, was not more than half an inch.

Mr. Wickson: In building near a bank on clay, one needs to be very careful, as the water runs through the edge of the bank. Although it is rather against the reasoning in my former remarks, I might say that a row of houses was put up in Toronto a good many years ago on piles, and they are there yet; whether they have had any trouble from the piles decaying I do not know, but I know that the walls of the main houses were built on piles and the wings were built on earth, with the result that they were almost detached buildings before many months. I suppose it depends entirely on the life of the piles how long they will stand plumb.

The President: I had a case, a chimney I had to build on made ground. It was not very high, only 95 feet, and quite a large one. I made a test by driving just a few piles around it. I might say the chimney was intended to be incorporated in the building. In driving the piles I found that on one side the ground was softer than on the other. The piles drove fairly hard, and sufficient of them could have been put in to carry the chimney, but I did not want to put them in, because I thought it might not always be damp ground. I therefore extended my foundation on the soft side and made it consideraly larger than had been intended, and put in large flags. You know we generally have stone foundations in our city, and we put in a large flag foundation, and on top of the second tier of flag I put in concrete, and on that built my chimney to the height of about sixty feet without connecting the building, aud let it stand for a time, five days, I think, at sixty feet. At the end of that time I found that it had not moved perceptibly, so I connected my building with it at once and went right on. I watched it very closely, and the building and chimney are almost as one. While it is not a good foundation it came out all right.

Mr. Burke: If there is danger of piles decaying in dry ground is there not equal danger of plank put in as Mr. Dick described decaying? And if the plank should decay there would be a more dangerous settlement than in the other case. I remember when I was a student with Mr. Langley he built two or three warehouses at the corner of Scott street on piles. I never noticed any cracking, but there the soil was somewhat damp, because it was down below the level of the water line.

Mr. Langton: I used paving stones three or four feet wide to carry an addition to a house resting on quicksand. The main portion of the house had a plank foundation under water, which, though it had been down twenty years was as good as ever. I cut it with a knife and it was like a new plank. I wanted, however, to carry my floor above the wet and found these 4 inch slabs of stone cost but little.

Mr. Aylsworth: Seventeen years ago I put up a block of stores three-storeys high, and the end wall on the side street happened to go right over a stream, and we did not go down any deeper than was required for ordinary foundations. The rest of the ground was pretty good sand. We put two thicknesses of plank to bear it. There was no sign of cracking about it, I suppose it has always been under water. I have not heard anything in this discussion about the effect of frost on sand foundation, as to heaving it. In the town where I put up the stores I speak of I put up a twelve-room school house, and I did not go more than eighteen inches below the surface at any part, because it was intended to terrace it high enough to counteract the influence of frost. That was on a sand foundation, and the terracing has never been done yet, although it is sixteen years ago, and yet there has never been any sign of heaving or cracking.

Mr. Wickson: It is wonderful what can be done in sandy soils in that way, but very great care has to be exercised in others. Mr. Kidder recommends very strongly in his book to batter the foundation a little bit when building on clay soil to counteract the effect of the clay heaving as it will invariably do. As to Mr. Aylsworth's experience, I would not like myself to take the chances of eighteen inches, even in sand.

Mr. Aylsworth: It seems to prove, bowever, that sand does no heave.

MANUFACTURES AND MATERIALS

The Owen Sound Portland Cement Co. have recently added to their manufacturing plant a Raymond Vacuum Separator.

At the works of the Ontario Sewer Pipe Co., at Mimico, a new kiln has recently been constructed which is said to be 36 feet 7 inches in diameter.

A factory is to be erected at Halifax, Nova Scotia, by J. P. Carritte, of that city, and J. W. Patterson, of Montreal, for the manufacture of tarred roofing and building paper.

A charter of incorporation has lately been granted to the R. McDougall Co., Limited, of Galt, Ont., capital $30,000, to do a general foundry business and manufacture heating and ventilating apparatus.

Germany produces annually about 13,500,000 barrels of Portland cement. About 3,000,000 barrels are exported, the remainder finding a market at home. The price at the works runs from $1.25 to $1.50 per barrel.

Messrs. Geo. W. Reed & Co., of Montreal, have published an attractive illustrated catalogue, descriptive of the advantages for heating large buildings of the Boston Hot Blast System, for which they are the sole Canadian agents.

The Odorless Crematory Closet & General Heating Co. of Hamilton, Limited, has recently been incorporated, with a capital of $24,000. The names of the promoters are: H. S. Griffin, M. D., T. J. Stewart, W. Trusdale, Hamilton, Ont.; J. Dickenson, Glanford, and W. M. German, Welland, Ont.

The suggestion has been made by Stone that quarry owners would find it profitable to add to their plant a stone crusher, and thus put themselves in a position to supply crushed stone to neighboring municipalities for use in road-making. In many parts of Canada the municipalities are taking the initiative by purchasing their own plant.

If there is one fact about advertising that is well established, it is that its effect is cumulative.

WOODEN POSTS AND BEAMS.*

By H. B. Gordon.

Owing to the lateness of the hour I shall not occupy any time in speaking on the subject I was to have spoken on, "Wooden Posts and Beams," but there is a matter I wish to bring to your notice. For years past when making calculations in regard to the strains and loads upon posts and beams we have been using Kidder and other books, written by men whose ideas have been formed upon very imperfect data. The tests made in 1882 and other tests with regard to the various woods have been very imperfect tests. You all know the element of dryness is very important in getting at the correct sustaining power of any timber, whether it be its power to support transverse strains or pressure strains. The latest authority I have consulted on the subject is I think borne out by the tests made by the Forestry Commission in the United States during the last six years. They have borne out this fact, that a dry stick is 75 per cent. stronger than a green stick, so when no idea of the amount of moisture in a stick has been recorded any test of that stick can be of little value. Another thing which I have learned recently is that even after a stick of wood is thoroughly seasoned, if exposed to moisture again it becomes as weak as a green stick, so that a stick of wood fairly seasoned if exposed again before the test, by being allowed to lie in a damp place, would be very misleading ; so, as has been said by a recent author, the factor of safety in wood construction is largely a factor of ignorance ; we have been placing it pretty high, just in order to cover all these unseen contingencies. Now that is a very unscientific and very wasteful way of proceeding, and it seems to me highly necessary that we should have a proper investigation of the building timbers commonly in use in Canada. I notice in the tests that have been going on during the last six years under the Forestry Commission of the United States that they have up to the present time made some six or seven thousand experiments or tests on 32 different kinds of woods, but really the only woods there that in any way compare with ours are some pine from Michigan, and some southern pine that is occasionally imported here for special work, and in limited quantities. The range of strictly Canadian building material is not touched upon. Even with those seven thousand tests there are many points they have not yet touched upon, structural points which require further experiment. There is, therefore, before any body which will take this up a very large and extended work, and an expensive work as well, and I am told that while there is a somewhat efficient testing machine here, though not so large as we would like to see, and hence not able to test some of our specimens, the great drawback now is that they have not the funds to carry out proper tests. In order to carry out the tests properly it is necessary that the wood should be selected by an expert. Then a record should be kept of the aspect in which it is grown, and the soil, the time at which cut, and a great many other things, which entail considerable expense, and that simpiy for the selection and preparation of the specimen. Then before the specimens are tested there should be a reduction of each specimen to a certain amount of moisture, such moisture as would ordinarily be found in the inside of a house, or in a dry place, say 12 per cent. In that way there is an immense amount of work and considerable expense necessary before we can have the proper data from which to form our calculations, and, such being the case, I have prepared a little resolution which I would like to have passed by this convention that it may be placed in the hands of a committee to present to the government :

"Whereas there exists no satisfactory compilation of the results of tests of Canadian building materials. And whereas no exhaustive or even relatively complete system of tests has been made of Canadian woods used in building. And whereas the architectural and engineering professions are thus left without accurate information about the materials they are constantly required to use. And whereas the safety of the public and economical use of our native building materials require that such tests should be made. And whereas the Ontario Legislature has emphasized the importance of this matter by providing the School of Practical Science with expensive and efficient testing apparatus. And whereas the benefit of having such apparatus is largely nullified by lack of funds to select and prepare suitable specimens and carry on a complete system of tests.

The Ontario Association of Architects in annual convention assembled respectfully petitions the Ontario Government to place at the disposal of the School of Practical Science an adequate fund for the purpose of selecting and preparing specimens of Canadian building materials and making extended tests of the same for the purpose of preparing reliable data for use in the building trades. And the convention is of opinion that a sum of not less than $5,000 should be given to institute such tests."

I do not think it necessary for me to further enlarge upon the necessity of these tests. The amount I have named may seem large, but it is sufficient to make preliminary tests, so that a preliminary report may be brought in, and the utility of the system of tests demonstrated. I am sure that a further grant could be obtained. In conclusion I may say that I have had much pleasure in looking over a recently published book which is very useful along this line, and I would suggest that it be got for our library. It is called "The Materials of Construction," a treatise for engineers on the strength of engineering materials, by J. B. Johnston, civil engiueer, of Washington University. In it there is a deal of material not necessary for an architect, but also a great deal that is necessary and helpful.

DISCUSSION.

The President : I am sure we are all very thankful to Mr. Gordon for his remarks on this subject, and although we have not now time to discuss it I would like to see the resolution seconded and carried.

The resolution was seconded by the Registrar and carried.

Professor Galbraith : I think that if some work of the kind proposed could be systematically carried out the results would be of great benefit. Professor Johnston has had a wider experience in timber testing than any investigator in America, if not in the world. The tests carried out by him for the American government were on a very large scale. The staff and equipment employed in the work were altogether independant of Washington University. The work was not done by students nor hampered by the necessities of an educational institution. The object of his investigations was to trace as far as possible the causes of the variations in the strength of timber. The timber tests hitherto made in the School of Practical Science were on the other hand for the instruction of students and not for purposes of research. On this account they have not been published. The results of research ought undoubtedly to be given to the world. I have no intention in making these remarks to throw cold water on the proposition. At the same time I think the Association ought to understand that they are dealing with a large question. As the resolution is quite general I would suggest that it be taken to mean that we carry out such a line of tests as we may decide upon after discussion with a committee of the Association. It is quite possible that we may be able to select a line of work which will fit in with our opportunities and at the same time yield results which may repay the time, labor and money which will necessarily be spent.

The Registrar : I fully understand the value of such tests as Prof. Galbraith has in his mind, but for the ordinary purposes of the architect here they give no satisfaction. One cannot tell when he gets a stick of wood where it comes from, the conditions under which it was grown, or anything of that kind. What one wants is to pick out of any lumber yard timber free from large or loose knots, shakes or other marked structural defects such as we specify the builder must use, and ascertain at what strain it will break, and what is the margin of safety to be recommended. That is what is really and practically useful to ordinary architects not doing engineering work. But there is more than that intended in the resolution ; there are certain native stones we use which are not tested by American testers. There are other stones in the country which are not yet known, and the fact of their being tested will introduce these materials. Such a test need not be published by the School as an effort of research for the finest scientific data, but by the Association as an ordinary test for architects of materials ordinarily used. I do not know whether the Association will bear me out in thinking that this is a practical test, but I think there is weakness in applying the data of very fine tests to very common material.

Professor Galbraith : What I meant was that tests of natural building materials such as wood and stone, unless made as Bauschinger and Johnson made them are almost useless. The kind of testing which Mr. Langton proposes would not, I think, be of very much value. The case is quite different with artificial building materials such as steel, iron, brick, etc. With these the processes of manufacture in general are such that the various specimens in a given class differ but little from the average. Average results in the case of stone and timber are of little value because of the great differences between them and the individual results. Sticks of timber apparently similar will sometimes differ in strength 100 per cent. Investigation to be of value should be devoted to determining the causes to which variations are due. A knowledge of these causes will enable the engineer or architect to make safe and practical specifications.

Mr. Gordon ; What I had in my mind is entirely different from what Mr. Langton speaks of, although he is the seconder of the resolution. What was in my mind was that the School of Practical Science would start with say four or five of the most common and most widely used woods in Canada, and make a thorough investigation, as far as possible, and, that being done, bring in a report on those. That would so demonstrate the utility of the matter that we would easily get a further amount of money to take up other lines of building material, and it is by doing a little and doing it thoroughly it can be possible to attain greater ends.

The President : I think myself that any test made and reported as official would certainly have to be something beyond the ordinary test. I quite agree with Mr. Gordon, and I am glad Prof. Galbraith is prepared to make tests somewhat of the character of those reported by Professor Johnson, although we cannot hope to eave them so exhaustive, still we can make a start in the work,

* Introductory paper presented at annual convention Ontario Association of Architects, Jan., 1898.

and if we had such tests of known good material we could from them make calculations of what to allow for the class of material we are using. But whatever is done should, I think, be done in a thorough and scientific way.

Mr. Aylsworth: It has occurred to me that as we could not at once make all the tests that would be required, would not it be well just to test the common lumber we get in lumber yards for ordinary use, and give us that result to begin with? This school is established to do its work not in one or ten years, but a good length of time must be given. If sufficient money could be obtained to test at first the commonest timber that we get in lumber yards, after that we could have trees specially taken out and tested more scientifically. We can only hope to get a great work of this kind done a little at a time, but in the course of time results will be arrived at that will be very valuable.

The President then put Mr. Gordon's resolution, which was unanimously carried.

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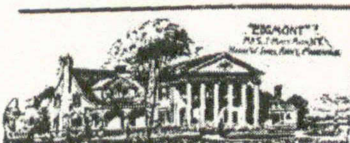

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