CANADIAN

ARCHITECT AND BUILDER

VOL. XIV

1901 :
THE C. H. MORTIMER PUBLISHING COMPANY OF TORONTO, LIMITED,
TORONTO, CANADA.

INDEX

ILLUSTRATIONS IN TEXT.

ILLUSTRATIONS.

PAGES

MISSING

INDEX TO ADVERTISEMENTS

In the "Canadian Architect and Builder."

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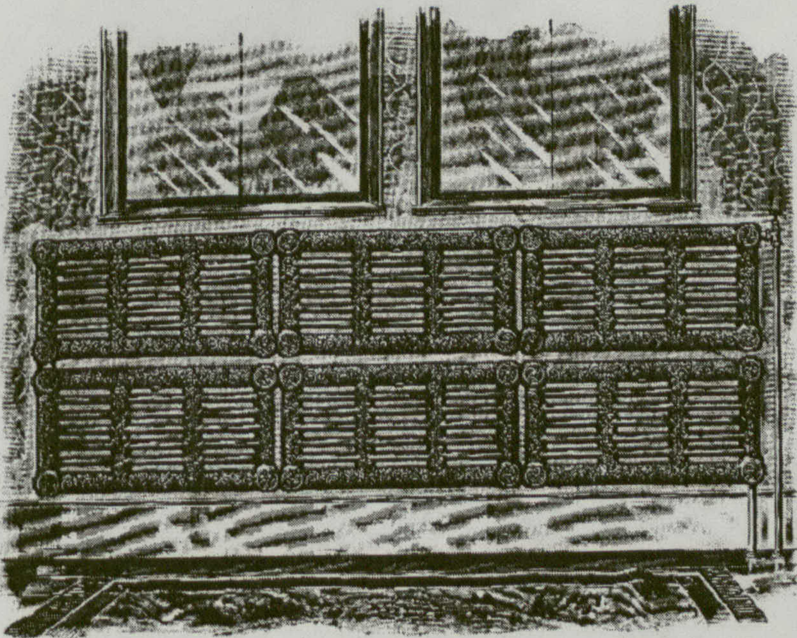

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A VIEW FROM THE BALCONY

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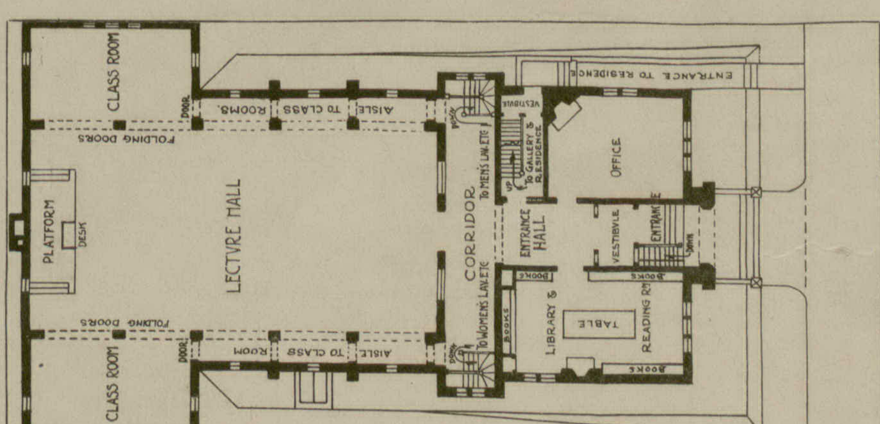

GROUND FLOOR PLAN OF
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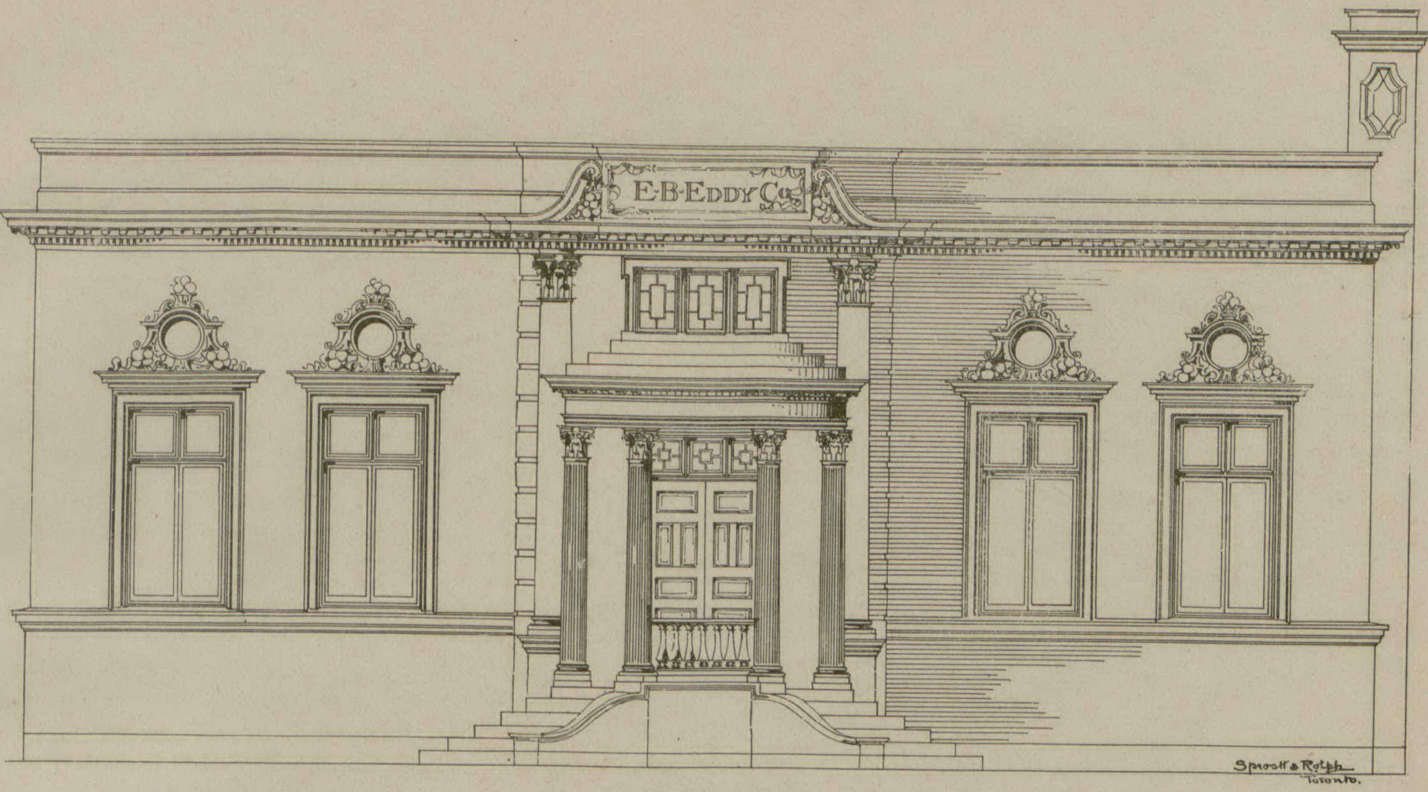
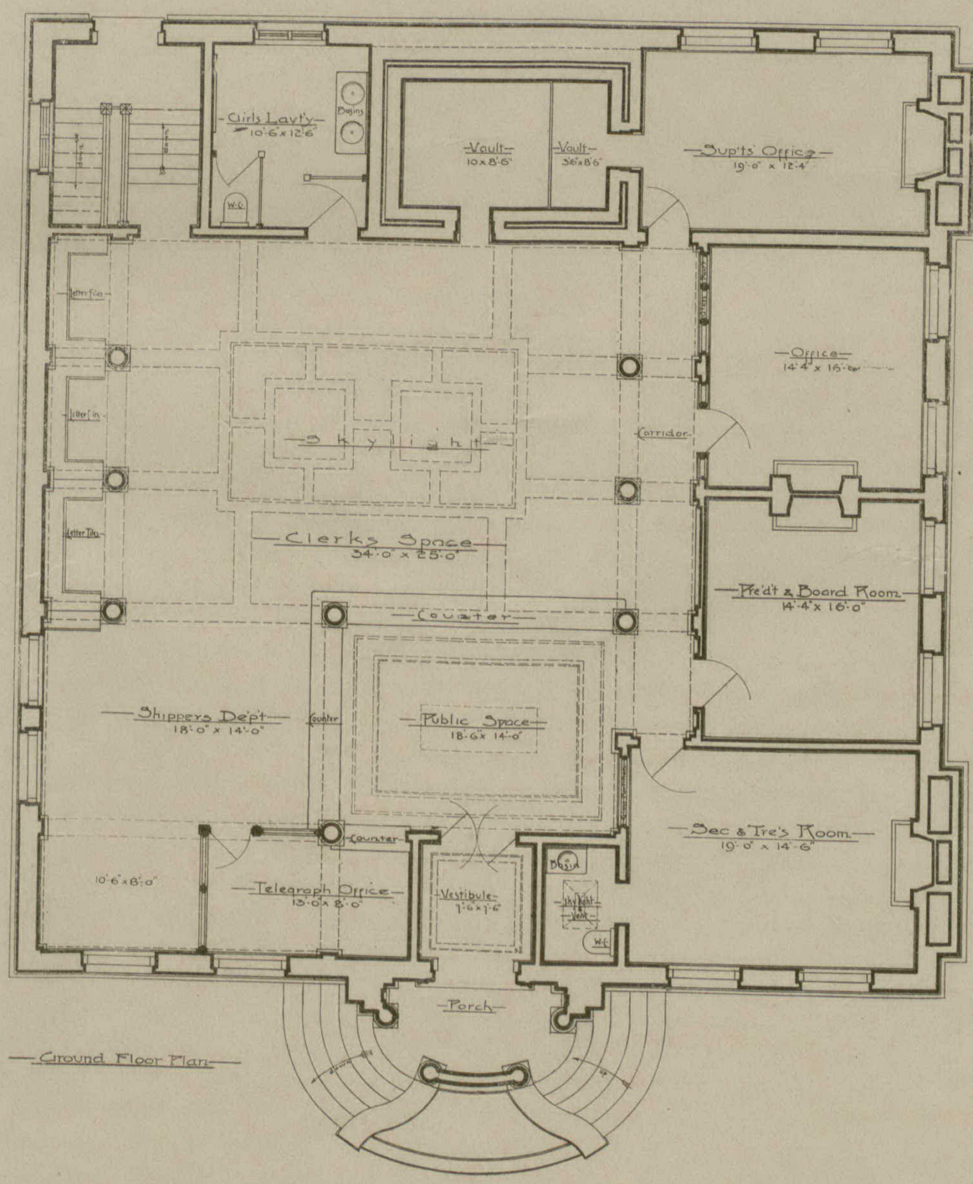


PROPOSED OFFICE BUILDING FOR
MESSRS E.B. EDDY CO HULL, P.Q.

Scale = 4 feet to 1 inch



Ground Floor Plan

THIS PAGE RESERVED EACH MONTH
FOR THE TORONTO ARCHITECTURAL
EIGHTEEN CLUB.

SUPPLEMENT TO
CANADIAN ARCHITECT AND BUILDER
VOL. XIV. No. 1.

The Canadian Architect and Builder

VOL XIV—NO 157 JANUARY, 1901

ILLUSTRATIONS ON SHEETS.

Proposed Office Building for Messrs. E. B. Eddy Co., Hull, Que.—Sproatt & Rolph, Architects.
Plan and Sketch View from Gallery of Bible Training School, Toronto—Messrs. Burke & Horwood, Architects.

ILLUSTRATIONS IN TEXT.

Elevations and Plans for Cottage—Messrs. R. J. Edwards & Webster, Architects.

ADDITIONAL ILLUSTRATIONS IN ARCHITECTS' EDITION.

Photogravure Plates—Bible Training School, College Street, Toronto—Messrs. Burke & Horwood, Architects.

CONTENTS.

A Century's Review. A century's retrospect of architecture is, in the English speaking world, practically a review of the whole extent of modern architecture; that is to say of the period when tradition has given place to fashion, and the individual designer, either in pursuit of the fashion or of his own taste, governs the design both at large and in detail. The history of modern architecture in England is the history of the Gothic Revival, and its consequences. The revival had not developed until the second quarter of the century, but it was on its way when the century opened. "It was the evening of the twenty-first of June, 1788" that George Eliot, in Mr. Gilfil's Love Story, introduces us to Sir Christopher Cheverel seated at dinner beneath a lofty, groined stone ceiling with richly carved pendants, the recently completed portion of a project which, as "an enthusiast for Gothic architecture," he was entertaining for "metamorphosing his plain brick family mansion into the model of a Gothic manor house." We may feel pretty sure that Sir Christopher's efforts were crowned with failure, and that any twentieth century student of architecture who came upon the original of "Cheverel Manor" would find it a monument of misguided fancy. Such indeed seem to have been all the works of the early Gothicists. Rickman, the father of the subdivision of Gothic architecture into periods, though he began studying architecture as an amateur, became in virtue of those studies one of the most successful architects of his time, and built an immense number of churches and other buildings, of which his biographer can only say that "they shew more knowledge of the outward form of the mediaeval style than any real acquaintance with its spirit, and are little better than dull copies of old work, disfigured by much poverty of detail." Pugin probably did his best work in the Houses of Parliament, under Sir Charles Barry, who was too big to allow traditional peculiarities of the style, which was thrust upon him, to fetter his freedom of design. Sir Gilbert Scott's work can only be described as dull, like Rickman's; and the more elaborate it was, the duller. The work of Street, whose law courts are said to have been the grave of the Gothic Revival, was all the more evidence that there was no living power in an imitative revival, because he had mastered the details of his style and worked in it with freedom. But all these experiences of the century only go to give additional proof that "Art is long." We are accustomed to speak of the Gothic Revival as a thing complete in itself. Future generations will perhaps regard it as the first chapter (a stupid chapter, as first chapters sometimes are) in the growth of modern architecture. What was the Gothic Revival? An effort to cast off false conventions and work out what Pugin called "true principles" of design, after the spirit of the mediaeval designers. But that was too great a work for one generation. It was not for nothing that Moses was directed to lead the Children of Israel by the long road to the Promised Land. A nation that has been long in slavery cannot be free all at once But it is getting there. It was only the Gothic part of the revival that was buried in the law courts. One offshoot of the movement in the form of Mr. Norman Shaw's work was already established at that time. Norman Shaw had published his volume of sketches like the rest, but was not, as a consequence, overpowered by reverence for the outward form of mediaeval work to the exclusion of its spirit. Between the pressure of classic tradition on one hand and Gothic revival on the other he took what might be called a resultant line, uniting qualities of both and ending in work which is both pre-eminently modern and pre-eminently English, and which has many followers who may with reason call themselves a legitimate product of the movement to be free. William Morris conducted another off-shoot into the way of sound work and has left what seems to be a very active progeny in the Arts and Crafts designers, with whom are affiliated architects of undoubted originality, who at any rate are going to see to the bottom of the question of design. What the Legitimists, Messrs. Bodley, Pearson, Jackson and others have been doing in the way of advance is not so clear in the colonies, but at any rate they seem to gain applause. The Reversionists are, since the success of the Institute of Chartered Accountants, following the lead of Mr. John Belcher into picturesque English Renaissance, distinguished by a freedom which in form has been suggested perhaps by the Gothic Renaissance of Elizabeth, but in spirit has no doubt its origin in the Gothic Revival.

On this continent, up to the time of the American war, or perhaps until Richardson, England was the leader of architectural fashion in the United States as well as in Canada. So late as 1883, when Richardson was near the end of his short career, we find Montgomery Schuyler in Harper's writing to attack the futilities of the Queen Anne designers and deplore the abandonment of Gothic. Since then what waves of fashion ! all of which have their examples duly set down as a record in that museum of architecture, the city of New York. Now American architecture is French, and, according to Mr. Ernest Flagg, is to be French. Mr. Flagg, as the apologist, if not the greatest exponent of the style, says it is not the imitation of French architecture but the adoption of its principles that is the motive power of this American School of Architecture. Why the principles of the Italian Renaissance which went out just before the French came in would not do, or what principles French Renaissance has which are different from those of other good architecture is not immediately clear, but probably the explanation is to be found in the fact that this is really a Beaux Arts movement. If it develops as expected, its development will be one of the most interesting movements to watch in the history of modern architecture. At present it is very French. It is a great question whether the real American architecture is not quietly developing elsewhere under the hands of Mr. Wilson Eyre and others. The Philadelphia school seems to have elements of true greatness in it.

Our own history is a reflection from both England and the United States. We have our old colonial houses built by families of the loyalists who migrated from the States to Canada ; we have some examples of the Greek wave, chiefly in the way of early public buildings; we have, just as they have in England, the greatest example of the Gothic revival in our parliament buildings ; we have a typical example of Richardsonian Romanesque in the city hall of Toronto ; but no French Renaissance as yet. With these acquisitions of buildings and many more we have had little consecutive architectural development. In the last ten years of the century, however, has begun a change so marked in the relations of architects to one another that there must come from it some result. Time was when the entrance of an architect into the office of another was a signal for covering up the drawings on the drawing boards with newspapers. Now there are associations of architects in three provinces and architects freely discuss in meetings and in each other's offices the problems about which they are thinking. In addition to this, as part of the work of their associations, the architects are furthering the education of students. So that there are signs that the development of architecture in this country is going to begin with the new century.

The Designing of Public Buildings.

If Architecture in Canada is to have a chance of the highest development, some step should be taken to induce the government to devise a different system from that which has hitherto been in use for the designing of public buildings. The peculiar circumstances which caused Mr. Fuller—an architect of great ability who had nevertheless not established a private practice—to be at the disposal of the Public Works Department when they had to appoint a chief architect, are not likely to occur again. Most men of Mr. Fuller's calibre would find it far more profitable to use their skill for the establishment of their private fortune, and the Public Works designer is likely to be always an over driven man working to the least advantage. It is for the best advantage of the country, looking at the question merely from the point of view how to procure the best public buildings for the country, that the designing of public buildings should be distributed to the best designers in the country, selected for evident skill on just the same principle as any large financial corporation would select an architect for its buildings. If that is the case, there will also be some reward for architects who aspire high, and therefore some inducement for such aspiration. So that a matter of this kind would benefit the country both directly and indirectly. Directly by producing the best possible buildings, and indirectly by fostering the art of architecture.

Educational Work of the O. A. A.

It is important to the success of the educational work in behalf of students to be undertaken by the Ontario Association of Architects, that a beginning should be made at as early a date as possible. The work this winter will to a considerable extent be experimental. The suitability of various systems and methods will be tested. The practical experience thereby gained should determine the lines on which the instruction should proceed in the future to accomplish a successful result. One feature which it would seem desirable to incorporate into the teaching system, would be a series of visits by the instructors and students to factories where building appliances and materials are produced, in order that the students may understand the nature of the raw material and the process through which it is made to pass before it is ready for use. Buildings in course of construction should in like manner be visited, that the student may have opportunity to observe the methods of installing and applying the numerous appliances and materials which to-day enter into the construction and equipment of large buildings. Realizing the importance to the student of this phase of education, Mr. Frederick Batchelor, F.R.I.B.A., President of the Architectural Association of Ireland, proposes to organize in Dublin a regular series of demonstrations, in order that the architectural student may have the chance to acquire a personal knowledge of the building trades, to understand the nature and possibilities of the materials which may enter into the carrying out of his designs.

Manual Training Schools.

THE Departments of Education and school boards of the various provinces have been quick to show their appreciation of the munificence of Sir W. C. McDonald, of Montreal, in providing for the introduction of manual training in the public schools. These manual training schools are now a part of the public school system of every province, and about five thousand boys in the three highest forms in the public schools of different selected cities and towns are taking the course under the direction of thirty experienced teachers. The city Toronto has just adopted the system.

Building Failures.

ON the 11th inst. the roof of the opera house at New Westminster, B.C., gave indications that it was about to collapse, and the audience rushed out of the building. An examination is said to have shown that under the weight of an accumulation of snow the walls had been forced out of the perpendicular, and that a very slight additional strain would have brought the structure down upon the heads of the occupants. Three days later one of the walls of the drill hall now under construction at Vancouver, B.C., collapsed. The contractor attributes the accident to severe weather. On the morning of Sunday, the 13th inst., the walls of a four story building at No. 12 De Bresoles street, Montreal, suddenly gave way and the building and its contents fell into a heap of ruins. The cause of the failure is being enquired into. It is truly astonishing that this series of accidents should have occurred without injury or loss of life to any person. This fortunate result is either due to chance or an overruling Providence. It cannot be expected, however, that a like result will always follow, therefore these accidents should lead to the exercise of greater skill and care in the designing and construction of new buildings and to a more rigid inspection of existing buildings by the municipal authorities. Especially should it be demanded that a permit must be obtained before a building designed for a special purpose can be put to a different use whereby there would be imposed upon it a greater strain than it was intended to bear.

Architectural Training.

ARCHITECTURE can surely to-day be called one of the learned professions and it is therefore essential to the welfare of the profession that it was beginning to be realized in Canada that an architect requires to be equally as well trained for his calling as doctors, lawyers and others are for their professions. In the past this training seems to have been thought more or less unnecessary, and any young man who was capable of drawing a straight line and who knew the difference between Gothic and Classic work deemed himself competent to undertake any building that might be given to him, and unfortunately most persons, in the past, have been willing to intrust him with their work without enquiring either as to his ability or his training. Few persons even to-day know, except perhaps in a vague way, what constitutes an architectural training, but it is to be hoped that this state of things will be done away with in the near future. A large proportion of the younger men are beginning to realize that to be a competent architect necessitates long and continuous study, for a building to be a successful structure has to be very carefully studied in all its various aspects. It must be well and economically planned to suit its own especial requirements. It has to be beautiful in its proportions and refined and carefully studied in its details and with all as correctness of constructional minor points, which have often called forth more abuse upon the architect than all others together. To be successful in this requires serious study, an artistic temperament and a constructional knowledge second only to an engineer. Let the man whe considers he can be an architect without hard work on his part be warned lest he fall into the complacency of the ignoramus who despises education because he knows not his own deficiencies. Fortunately for the profession many young men are entering the now numerous architectural schools while others are travelling in Europe and seeing for themselves the quiet dignity of the great buildings in those countries, and the result is beginning to be seen in their work. The article in this number by Prof. Capper, on "Architectural Training for Canadian Students," is replete with valuable suggestions and will repay careful perusal.

THE NECESSITY FOR PROPER FIRE ESCAPES FOR PUBLIC BUILDINGS.

Mr. Chas. Baillarge, the well known architect and engineer, of Quebec, has been prompted by the recent holocaust at Rochester, N.Y., to address a petition to the President of the United States and the Premier of Canada, asking that legislation be enacted to compel hotels and other public buildings in which many persons reside to be provided with an isolated stairway for use as a safe means of exit in case of fire. These stairways should have no direct communication with the building, but access to them might be had from every floor or story of the building (the attic counting as one of the stories) by just going out on to a balcony and from thence entering the staircase.

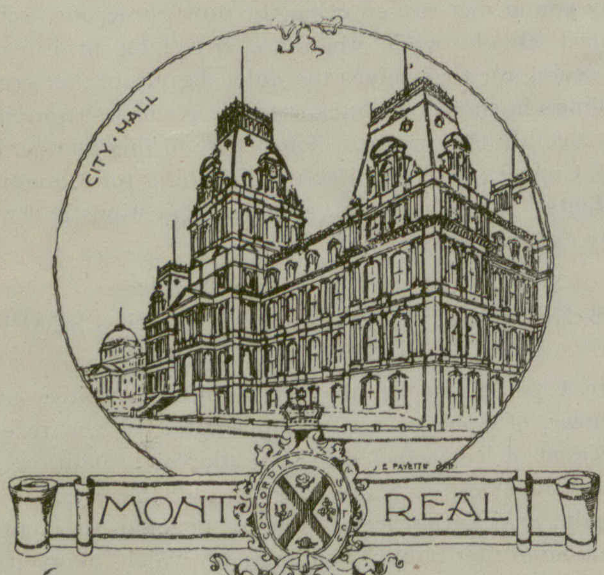
It is suggested that from the staircase—if in the rear of the building—that is, from the foot thereof terminating at the level of the uppermost portion of the first story or floor of the building, there should be a fireproof corridor conducting towards the front, with a fireproof staircase from the outer end thereof, with door opening on to the public highway.

"This," says Mr. Baillarge, "will assure the simultaneous and instantaneous escape of everyone in the building above the first floor level, the occupants of the first floor being supposed to escape by the doors and windows of said first floor at ground level, and the occupants of the basement directly to the open or street through the basement windows or openings of the same ; while, if difficult of access, the staircase to be continued down to basement or sub-basement level and the employees or others of these sub-stories thus enabled to reach the corridor already alluded to and effect their escape thereby."

This system has been carried out in the reconstruction of the theatre at Antwerp, where to each of the five tiers of galleries or boxes there are continuons outer balconies, with 25 doors or rather low silled windows opening unto them at each storey, 125 for the 5 tiers independently of all first floor issues and of those for pit, and for actors at stage end of building. The several balconies are reached from above downwards by suitable iron stairways, while the last flight leading to the level of the street is hinged at top, remaining up until in case of fire or panic it is released by a mere pressure of the foot and then falls to level of roadway.

Mr. Baillarge further suggests that any legislation dealing with this important matter, should contain a proviso that "any boiler for the purpose of heating the building, or lighting it or for other service, as of elevators, etc., be situated without the building in a separate wing, so that in case of explosion, it may not jeopardize the building itself but confine its depredations to the wing in which it is erected."

It is to be hoped that Mr. Baillarges petition will receive from the governments to which it is addressed the measure of consideration which its importance demands.



Branch Office of the CANADIAN ARCHITECT AND BUILDER, Imperial Building.

MONTREAL, January 17th, 1901.

ARCHITECTURAL COURSE OF THE MONUMENT NATIONAL.

As every Montrealer is aware a series of twenty lectures are given each winter at the Monument National. The first fifteen of these are devoted to the theory of construction and the remainder to archæology. These are specially intended for architectural students and those generally interested in construction. This year the professor has at his disposal over 400 lantern slides of the principal monuments of the world.

The course which is given every Tuesday is free for all. Mr. J. Venne, Architect, who was the professor up to this year, has resigned in favor of Mr. Eugene Payette.

BUILDING INSPECTOR'S DEPARTMENT.

Since the departure of Mr. Lacroix from the head of this department Mr. Chausse, a member of the Architectural Association, has had charge and great changes can already be seen. Where lack of business like methods reigned, now order and method are to be found and a material addition to the treasury the natural result. The annual report will be produced at the end of the month but the following items were procured.

1900.	Number of permits.	Value.
January	3	$ 6.00
February	4	8.00
March	5	10.00
April	3	6.00
May	22	44.00
June	77	154.00
July	32	64.00
August	49	98.00
September	27	54.00
October	51	102.00
November	16	32.00
December	16	32.00

As Mr. Lacroix was in power to the end of April it can easily be seen that the changes have been very considerable, and how the committee even allowed a report to be issued with 3, 4, 5 and 3 permits, that is 15 buildings, for 4 months, seems past comprehension. The following list of the work of this department for the past ten years has been compiled by Mr. Chausse and some interesting facts are disclosed thereby :

Year.	Income.	Buildings erected.	
1890	$297.00	937	$3,308,606
1891	290.00	778	3,358,400
1892	179.00	640	2,598,825
1893	327.00	561	2,835,800
1894	303.00	382	1,634,900
1895	237.00	277	1,532,900
1896	230.00	315	1,983,750
1897	288.00	408	1,414,300
1898	241.00	351	1,729,150
1899	307.00	357	2,370,080
1900	1051.00	432	2,670,903

In 1890, it will be seen, there were 937 buildings erected and yet there was only a revenue of $297.00, and in 1900 there were only 432 buildings erected, yet the revenue was $1051.00 or nearly four times as much with not half the number of buildings erected. Mr. Lacroix's office must have been a lucrative one and he will not be missed by those interested in the welfare of the city. A portion of the revenue this year has been from the license charged on woodyards ; these, it appears, were never collected by Mr. Lacroix, and we would suggest that the license be raised to $20.00 as the woodyards are a great menace to the city from a fire standpoint, and they also greatly diminish the value of all property adjoining The present license of $3.00 is certainly ridiculously low.

Beside the improvement above noted in the Building Inspector's Department of this city, there have been various signs of changes for the better in other departments, a large proportion of which can be placed to the credit of Alderman Ames, who has spent a considerable amount of his time and his inexhaustible energy towards the purifying of the city council. For instance take the sanitary inspectors who were recently made to undergo examinations for their qualifications to hold the positions in which they found themselves. The following were the questions asked and it may be fairly said that they were not likely to stagger any person who could possibly be considered qualified as a sanitary inspector, and yet out of thirteen who were examined only four were able to gain 70% of marks or over :

1. Describe the manner in which a test is made with oil o peppermiut and with smoke in order to see whether a new drain is without apparent defect.

2. What is the law regarding the ventilation of water closet apartments ? What style of closet is permitted and what prohibited under the present by-law ?

3. If a room is 16 feet long, 12 feet wide and 10 feet high, what would be the cubic contents, and how many adults could sleep in a room of this size ?

4. What does the present by-law describe as a properly constructed privy pit, and where only are such permittted to exist ? Is it permissible to connect it with a sewer, and if not, why not ?

5. How should a house be constructed in regard to size and material of drains, and the prevention of siphonage ?

6. What is the present state of your own sanitary district as regards, nuisances, privy pits and dirty lanes ? Give approximately the number dealt with by you during the present year.

7. What methods would you suggest for the improvement ot the Montreal water supply ?

8. How can you detect the existence of gas leaks ? How would you take a sample of air for analysis ?

9. In the case of a patient suffering from a contagious disease and removed to the civic hospital, describe two methods by which the sick room and contents may be thoroughly disinfected.

10. If upon your arrival at a house to be disinfected you are met with objections on the part of the inmates, state briefly the chief arguments you could use to convince them of the necessity for routine disinfection after contagious disease.

Anyone who could not gain over 50% of marks on the above paper can hardly be called a suitable person for a large city's sanitary inspector, and it shews plainly how timely the examination has been. These remarks are intended to emphasize the necessity of those interested in hygiene and sanitary science (and who should be more so than architects) to do all in their power to raise the standard in this city. The present building by-laws and plumbing by-laws are very lax, and it is high time that the present council should pass the new by-laws, made up after serious work on the part of a committee appointed by the Architectural Association. Surely something might be done to bring the importance of this question before the council, and one might suggest that a strong deputation be sent to the council, composed of three men from the Architectural Association, the Builders' Exchange and three prominent plumbers of the city—these nine men to meet beforehand and agree definitely on forcing the subject on the council's attention.

FIRE INSURANCE.

The recent returns of the various fire insurance companies doing business in Canada show the barest margin of profit, and in some cases an actual loss. These facts have made the companies in Montreal inspect the various large buildings in the central portions of the city and rate each building according to its present possibilities of prevention of spread of fire. This brings to the notice of architects and owners of property the desirability, in more ways than one, of building so that the fire loss will be small in the event of a fire, and make the study of the different forms of fireproofing, sprinklers, fire hose, and other means of preventing fire a timely one and one that is often not considered with the importance it deserves. There are far too many firetraps in the city holding low rates of insurance, and if these rates are increased it will tend to make owners of real estate look more fully and we trust more intelligently into the question of fireproofing. The present building by-laws are far too lenient on this question and faulty fire escapes and fire hose are allowed (and often even none at all) through a lack of any definite regulation on the subject.

NOTES.

Mr. Raza and Mr. Venne recently returned from an extended tour through England, France and Italy, renewing their acquaintance with many of the English cathedrals, besides taking in the beauties of several Italian edifices in Rome and elsewhere.

The Canadian Society of Civil Engineers, at their monthly meeting in December, discussed the question of various "Structural Paints"—a very important subject in that steel is now generally encased in such a manner that it is impossible to repaint it after the building is completed.

The paper read at this month's meeting of the same society was by Mr. Charles Baillarge on "Masonry Dams and Concrete Works." Mr. Baillarge is well known as a member the P.Q.A.A., and one who sets an example to others in always being present at the annual meetings.

A meeting of the Architectual Association is to be held on the 22nd inst. to consider some proposed amendments to the by-laws. The chief changes suggested are, that the annual meeting should be held during the month of January and that all members standing for election of officers must be nominated at least fourteen days previous to the annual meeting.

Mr. Arthur Vincent, sculptor, of this city, recently spent several months in Rome for the purpose of making drawings of the canopy over the main altar in the Basilica. From these drawings a fac-simile of the canopy, one-half the size of the original, has been erected in St. James cathedral in this city. The canopy is 50 feet in height and 22 feet wide, composed of more than 30,000 pieces, and weighs 11,000 pounds.

WELCOMING THE NEW CENTURY.

In response to the invitation of Mr. Chas. Baillarge, the veteran architect, engineer and writer, of Quebec, fifty-five gentlemen assembled in the dining hall of the Hotel Frontenac in that city on the evening of the 31st December to bid farewell to the old century and welcome the new. Seated around the festive board, the company pleasantly passed the time until midnight, when there appeared on the wall at the head of the room "1901" in electrically lit letters. The effect was very impressive as well as pleasing.

The feature of the occasion was an address by Mr. Baillarge in the closing moments of the old century, in which he briefly reviewed its achievements. It had, he said, been more fruitful of progress, discovery and invention, not only than any of its predecessors, but than all of them put together. "But what we never shall surpass or maybe even equal," said he, "is the classic architecture of the Greeks and Romans. Can anything be more beautiful than the Corinthian column and its exquisite capital? Can we beat a Phidias or a Raphael? Can we even equal them? Antiquity had also taught us that heavy stones can be detached from their parent quarries, moved, transported to long distances, taken hold of and stood on end or elevated to great heights; but they left us no trace of how they went about the thing. Of course the transportation to a distance was then as it is nowadays, in the way an enormous stone 40' x 40' x 20', say 32,000 cubic feet, more than 2000 tons, for the pedestal of the statue of Peter the Great, of Russia, was some 190 years ago moved to its destination, one hundred miles or more, on timbers hollowed out, lined with iron rails and iron balls between them to make the motion easy. The raising of the obelisks on end was not so apparent, nor as to how at Karnac, stones 80 feet in length by 10 ft. in height and 10 in depth were placed on the columns 60 feet high ready to receive them. There is, however, no doubt there can be none, that inclined planes were built to do the needful and then removed so that no trace be left for future nations to do the like. The Romans themselves do not seem to have been aware of how to raise the obelisks brought by them from Egypt to adorn the ancient capital. An engraving of the time shows a scaffolding of the full height of the stone to be upended; but my way of explaining the thing is that the Egyptians did as we would do to-day, the obelisk being tapering and its centre of weight at about one-third only from the bottom, attach it at that point and then swing it into place, or build an incline of one-third the height or so, run the obelisk along it endways, the larger end foremost until the centre of gravity arrived at the apex of the incline; the stone would then dip down until it rested on the base prepared for it and proper tackle bring it into position. The works of antiquity are those rather of brute force or manual labor than due to the methods which to-day have devised engines to do the work, such as the hydraulic ram which enables us to take hold of weights 10 times, 100 times as heavy as those of other days and raise them to any height required, as when the iron tubes at Menai in England 464 feet in length and weighing as much, each of them, as one of Her Majesty's 120 gun frigates of the period (say 5000 tons) were taken hold of and raised bodily to one hundred feet and set upon the piers prepared to receive them.

The construction of the Brooklyn Bridge, the Firth of Forth Bridge and the Tower Bridge of London were referred to as examples of engineering skill and progress in the 19th century.

"When," said the speaker, "our engineering friends across the Atlantic remained powerless to explain the discrepancies between the indications of the anemometer and the results arrived at at the Firth of Forth bridge and the Tower bridge, London, it was your humble spokesman who taught that when wind blows against large surfaces it separates to pass around the edge of the structure, thus leaving a partial vacuum in the rear against which the atmospheric pressure on the opposite side re-acts, and to test the accuracy of this statement let anyone stand towards the outer centre of the building we are now in and he will hardly feel the wind, whereas when he approaches the edges of the building he feels the wind there to be doubly increased in force and velocity.

Regarding the new century, Mr. Baillarge ventured to predict that it would witness aerial and submarine navigation, the use of electricity for heating our persons and dwellings, the finding of the North Pole, the disappearance of the horse from city streets, the delivery of boiling water from central stations, and the colonization of James Bay.

PERSONAL.

Mr. Frederick G. Todd, landscape arttst, of Montreal, visited Toronto recently, and made the acquaintance of some of the leading architects of that city.

Mr. W. F. Ruttal, architect, St. Johns, Newfoundland, encloses his subscription to the CANADIAN ARCHITECT AND BUILDER in a decorated envelope bearing the British coat of arms, postage stamps with portraits of the Queen, the Prince of Wales, the Duke of York and the latter's little son. In the lower left hand corner are crossed the flags of Great Britain and Newfoundland.

Mr. J. G. Pennycuick, inventor of luxfer prism glass, died in Toronto a fortnight ago, as the result of a stroke of paralysis. The final interment will take place at Boston, where the wife and children of deceased reside.

Mr. J. M. Gander has been selected as the representative of the Toronto Builders' Exchange on the Board of Management of the Toronto Technical School.

AMERICAN INSTITUTE OF ARCHITECTS.

The president's address, delivered at the 34th annual meeting held in Washington on Dec. 12th, showed the affairs of the Institute to be in a prosperous condition. The address reviewed the relations of the national government toward the art of architecture; the attitude of the Institute toward the youth of the profession; the condition of professional intercourse, and the position of the members of the profession in regard to the art to which they have devoted their life work.

ARCHITECTURAL TRAINING FOR CANADIAN STUDENTS.

BY PROF. S. H. CAPPER.

THE question of the training best fitted to prepare the architectural student for his future career is one that is not lightly to be answered dogmatically ex cathedra. In Great Britain in recent years it has aroused very widely divergent views; and the establishment of the regular scheme of progressive examinations, by which alone admission can now be gained into the ranks of associateship of the Royal Institute of British Architects, met with very decided opposition from some of the architects who stand highest in their profession in England. It is only necessary to mention the name of Mr. Norman Shaw, R.A., who gave the scheme consistent and dignified disapproval, to prove that such opposition was neither petty nor factious in its essence, but one of real principle. It was based upon the view that architecture is so essentially an art, comparable to painting and sculpture, that to subject those who would practice it to the rigid and fallacious tests of mere examination is to confound the substance with the shadow, and to substitute the mere externals for the essence, or (at best) the means for the end itself.

It is not necessary once more to discuss the endless arguments as to whether architecture is an art or a science or neither or both; tbe discussion is apt to be barren, a mere beating of the air and cudgelling of words.

But to decide on the kind of training that will best lead the architectural student to achieve the highest results in his profession involves a very vital question to all who are entering upon the career. It is best answered by a practical regard for the nature of an architect's work.

A fully qualified architect is expected—and justly expected—to have a sound knowledge of construction and of the materials used by him in construction; in the province of Quebec, at any rate, the architect is held legally responsible, along with the contractor, for a considerable term of years for the soundness of the construction employed and the quality of the materials used. Further, the architect is bound to know the principles of hygiene and sanitation, together with ventilation, heating, etc.; very frequently, like a lawyer, he has to set himself to acquire very special knowledge for special cases. He has to have the technical knowledge and skill necessary to make himself perfectly explicit and intelligible by drawing and specification. And, finally, thus armed, he has to set himself to study each problem presented to him, to arrive at the best solution for it from a practical point of view under the conditions obtaining, and, while fully satisfying practical requirements, to design his building with aesthetic considerations ever present in his mind, and to produce a result which, when realized in actual construction, shall satisfy the eye and, so long as it endures, be a pleasure and satisfaction to the beholder.

The task is no light one; the qualities needed for the achievement of genuine success are of no mean order. Even with natural abilities for an architectural career and a strong bent towards the work a student must, it is self-evident, exercise long patience and steady perseverance in training before he can feel himself fitted for his task. And it is well worth serious consideration how his years of training are to be spent to best advantage.

Of the subjects briefly indicated above not all are of equal difficulty in acquirement. Some, such as the elements of architectural jurisprudence, of hygiene and sanitation, are readily enough acquired by no very great amount of study, aided by practical acquaintance with actual work in execution. Others, such as the technical knowledge required in specifications are hardly to be acquired at all except by somewhat prolonged experience and the industry that systematizes the results of experience. The principles of construction, though generally simple enough in ordinary practice, are to a large extent capable of severe mathematical development and in special cases cannot be rightly apprehended without the study of advanced applied mechanics. Hence a thorough knowledge of mathematics and advanced applied mechanics is essential to the architect who aspires to undertake—and understand—the more complicated applications of modern construction. The theory of structures and strength of materials, therefore, evidently form a subject much more suited for academic and theoretical study than hygiene or sanitation; while such a subject as specification-writing is only to be treated in the most general way as academic training, and must be relegated to the period of practical experience for acquirement in practical useful form.

There is, however, that side of the architect's work which is embraced in the term: Design. The readiest definition of an architect is "the man who designs a building." And in design it is that architecture preeminently asserts its right to be called an art and to rank with the other arts that minister to the aesthetic needs of man. It is in design that an architect undoubtedly shows his own artistic individuality and power (or feebleness); in a sense all the other branches of his study and practice are but accessory to design; they are the means to an end which the design expresses and embodies in permanent, vital form. Hence, certainly, design is from first to last the main and paramount subject for architectural training. To it and to the means by which it is to be explicitly conveyed—drawing or expression of form and modelling, or the realization of form and colour-study—the main portion of the student's energies must be devoted during his years of training and preparation.

Not, of course, be it understood, that these "accessory" branches are in themselves unimportant or to be neglected. A practically-minded public is quite ready to take prompt cognizance of that, and to mete out blame unsparingly for even the suspicion of shortcoming. And the public is perfectly right. A building that is insanitary is ill-designed in a very vital way; so is a building that is even inconvenient for its purposes; the designer has not achieved the best solution of his task. And the public or (it may be) private client, having failed to get the best, is naturally dissatisfied and unamiably critical. The attitude of mind of an architect who is himself satisfied to leave these important issues in his design ill-arranged and only half thought out is not very readily to be condoned.

But it is "to set the cart before the horse" to insist on these subjects as the main study of the modern architect; they fall into their places easily enough to the man who is in earnest in mastering his profession; and it is a piece of false perspective to exalt them to the exclusion or detriment of the study of design more properly so-called. For they can be acquired comparatively easily; but the aesthetic faculty requires long and laborious training; slow, perhaps, to waken, it continues to grow and develop and progress with steady cultivation almost in-definitely ; easily atrophied, if allowed to lie dormant, easily perverted, if not trained in the sober paths of "sweet reasonableness," it is the essential quality of the architect, as—though on very difficult lines and with very different circumstance and aim—of the sculptor, the painter and even the musician.

Hence it is that training in design cannot be begun too soon or continued too long for the architectural student ; it is his life-work, training in which proceeds (or should proceed) all through his career, pari passu with every work he undertakes.

It is true that proficiency in design is not to be estimated by hard and fast rules and tests, as in mathematics or any of the more exact branches of study. And hence the opposition that was aroused against the examination test for entrance into the architectural profession, when established in England by the Royal Institute of British Architects. One-sided that opposition may have been, but at least it served to accentuate most strongly the truth that the higher side of the architect's qualifications cannot be appraised by the test of the examination room.

But, if not to be tested by mere examination questions, the faculty of dcsign is most assuredly to be trained and cultivated. Study rightly guided, stimulated by criticism and aided by growing proficiency in drawing (which is the architect's medium for expressing thought in form) is the surest road experience has yet found to acquire this training in the faculty of design.

It is, therefore, easy to understand the strong plea that is urged for academic training in architecture. Nowhere else, outside the academic studio and classroom, can the same education in architectural design be gained. It is easy to scoff at it as "unpractical," "a waste of time," "dilettante study," and so forth. It is just because it is (in a sense) unpractical and dilettante that it can be so valuable in the aesthetic training of the student. In actual practice all sorts of compromises have to be arrived at and accepted for many reasons, such as cost, restriction of site, etc. But in the academic studio the architectural student can put forth all his efforts to make the most of his design, untrammelled by merely hampering restrictions, to work it out by study into the best result artistically and so to train his mind to attain that standpoint of sober criticism which is the final guide on the highroad to effectual achievement.

In the ordinary training to be derived from even the best of architects' offices this is quite unattainable. With the very best intentions on the part of both master and pupil the result is, in the nature of things, totally inadequate ; for the office is not the place in which such training can properly be looked for. A busy architect is bound first to consult his clients' interests ; he cannot make these subservient to his pupils' needs for study ; nor can he (probably) afford to turn his busy office into a theoretic studio for the sake of his pupils' progress. At best and with most favorable conditions the student can secure but piece-meal guidance and instruction of a hap-hazard sort ; while in an offiee where inferior work is done—and there are many such—or where the architect-in-chief (it may be)—it is not seldom true—is all too scantily equipped himself to offer guidance, inspiration or instruction to another, it is only by energy indomitable, deep and genuine love for his work, and perseverance, aided by natural ability and insight that amount almost to genius, that a pupil or apprentice can hope to rise in architecture above ill-trained mediocrity, or to escape comparative, if not total, failure.

This, it may be objected, is to look at architecture from the higher standpoint, to judge of it by the standard of a somewhat high ideal, rather than as a practical, bread-winning, professional career; which may be fully granted. For who would wish to enter on his life-work and deliberately renounce its best and fullest possibilities? The education advocated does not, be it frankly and at once admitted, mean speedier or higher pay. On the contrary it means additional study, costly and adding years, it may be, to preliminary training ; nor does it necessarily promise very promptly even then more work or work more highly paid. But it does mean better work, and that (like virtue) is in all the arts its own reward, while in the long run, too, it brings reward of more substantial kind.

Academic training is no mere superfluity, a luxury without utility, a waste of precious time. It is the best and surest—for most it is the only—road to attain to the best that may be in us, to acquire that trained faculty in design which is architective, and to cultivate that critical aesthetic sense which is the ultimate essential in all branches of art-creation.

Against such training two contentions have been raised : First, that it may stifle genius; second, that it tends to foster mediocrity. Genius, however, is rare; and, when forthcoming, may be pretty safely left to take care of itself. It is sure, sooner rather than later, to "kick over the traces" when they fetter it, to break away and "gang its ain gait." Instances of training-stifled genius belong to romance, seldom to real life. On the other hand, most of us belong to mediocrity, and can have no quarrel with training that raises us to our best—if still, unhappily, mediocre—selves. It is indeed great gain if mediocrity can be trained to do its best, not left to do its worst. Trained mediocrity at least may be respectable, its works void of offence; untrained, it will (and does) afflict us with aggressive failures, that will not be gainsaid.

In Canada, and for Canadian students, the advantage—rather the necessity—of academic training in architecture is peculiarly potent. A young country with no architectural traditions of its own, with no important buildings inherited from the past to form a silent but convincing standard of architectural comparison, her cities are, and have been growing rapidly, and important buildings, private, public and national, are rising from Atlantic to Pacific. It is not easy to overestimate the influence of a really important building, aesthetically for good or bad. It endures for years, perhaps for generations, even in these modern times, so "progressive," so little reverent of the past. It is surely worth while to Canada that Canadian work be done by Canadian architects, and that Canadian architects be on equality of training with those of other lands. Some of our public buildings are notable monuments. Fuller's fine composition at Ottawa, especially, is far from unworthy of its noble site and its high purpose. But of others the story is not pleasant feeling for Canadians ; nor are many buildings in Canada to be compared for successful design with the Houses of Parliament at Ottawa. What may be called the "rank and file" of buildings, public and private, ecclesiastical and civil, do on the whole fail largely and too often from want of academic training in design, betrayed in faulty proportion, in incongruous ornament, in lack of nobility of style, that subtle harmony, felt rather than observed which stamps successful architecture with a note of distinction and of power, without pretentiousness, restrained, convincing.

BUILDING MATTERS IN SYDNEY, C. B.

(Correspondence of the CANADIAN ARCHITECT AND BUILDER).

The extent of the building trade in Sydney and vicinity at present is hardly estimated correctly by outsiders when considered in comparison with that of other points. But it is nevertheless the most important building centre in the maritime provinces to-day, and the building boom shows no immediate prospect of collapse. A lessening in the amount of construction must come at some time, but that time is not yet in sight, and the prospects are that the building trade of the coming summer will exceed that of the last. Since the Dominion Iron & Steel Co. have extended their capital by $5,000,000, which move was decided upon about the end of the year, and have determined upon the construction of ship plate and steel rail manufacture, real estate has advanced greatly in price, and the certainty of a large increase in building is established.

At the same time there has been much ungenerous rivalry among contractors in Sydney, and prices have been cut in many cases to a losing figure. Contractors and builders have come into the town from many directions, but not in such numbers as to warrant the necessity of such ruinous competition. There has been enough for all, but there are some firms which have not been satisfied with many orders but must needs under-figure to cut out others. This has been found to be the reason in most cases where the price has been too ow, and in other cases it has been the result of eager haste and ignorance. There are many builders in Sydney who in other towns could not secure contracts, being too well known, and who have been seizing jobs which they have been none too competent to fill at prices of which they were as little able to estimate correctly as the men who gave them the work.

As in other hastily built towns, the class of men who give their contracts to the lowest bidder and find out their mistake when the house is completed (?) will be largely in evidence until the rush is over.

There are many complaints that the building trade is already over-done in Sydney, but it is nevertheless a better field yet than most other sections, and such complaints come largely from those who are anxious to keep others away from a good thing. Such conservatism, however, will stand in good stead sooner or later. Many incompetent carpenters and apprentices have found openings here and are receiving far more than their services really warrant. There seems a greater need for the good workman who knows his trade and does not get tempted into figuring for himself than for contractors. Such men can get good wages at any time now.

The high price of lumber and the difficulty in obtaining it when wanted is a serious drawback and prices will continue high until spring when there will be a quick drop on water freights being available. There seems to be an opening for first-class wood-working factories which will do more than ordinary work. Freights on manufactured wood goods are very high and most of such goods are brought long distances.

A large number of business buildings have gone up, but very few make any pretentions towards appearance, the majority being quite plain. Some large brick buildings have been erected and considerable stone has been used. The Bank of Montreal, though quite small, is of stone and of good design. The contract was for about $16,000.

The new academy is to cost about $40,000 and is of brick and stone. Work on its foundation is now going on and it is to be completed next summer.

The new town building, which will include an engine house, is nearing completion, and is to cost about $14,000.

A new I. C. R. station will have to be built the coming summer, and it is to be very large and quite expensive.

Numbers of new wooden buildings are being completed on the business streets, and residences are being built in all directions. Few of these latter are expensive or call for high class work. New streets are being laid out at all times, and hundreds of new houses are in process of erection. Many of these appear in little villages in various places among the stumps and trees, which are removed largely after the houses are built.

The steel and coke works lie just outside of what has beeu known as Sydney, and cover an area of almost equal extent, thouge bidding fair soon to be surrounded by the growing town. Their erection has called for a large class of masons and iron workers, though not so many carpenters or wood workers. Their construction has been a mammoth undertaking, and the works comprise such construction as is seldom seen in eastern Canada. The erection of the ship plate and steel rail plants is to be proceeded with immediately, and will require a large number of men.

Glace Bay and its neighboring villages have been growing remarkably, and hundreds of new houses are being erected down that way. In North Sydney the building business has picked up also, but though business is better and many new buildings are under way, there is not the same extension of trade as to the south of the harbor.

Sydney has been placing a new system of sewerage, and work on this has been pushed forward during the winter months in spite of the depth of frost.

The town is yet to suffer from the want of a better fire system. Though some fire apparatus was recently purchased and installed it does not come up to requirements under new conditions. It is to be regretted that the proposed brick district was not established. It was to have included the principal business portion of the town, and would have been about three-eights of a mile long and one-eighth of a mile wide. Not enough interest was shown in it by the business men. If a district be yet established it will probably include only about 100 feet on either side of Charlotte St., from the Post Office to the Reserve Railroad.

Messrs. Elliott & Hopson, architects, of Halifax, have opened a branch office in Sydney, and Mr. Hobson is in Sydney now most of his time. The firm have had charge of the principal works of construction in the town, and have done a large business. They designed and have charge of the new residence being built by Mr. Moxham, manager of the D. T. & S. Co., which is the most important erection in town. It is being erected about three-quarters of a mile from the town. The cost of the building will be about $110,000, and, including the grounds, conservatories, lodges, barns and stables, etc., about $140,000. The house is constructed of Wallace freestone throughout, and its exterior is now nearing completion.

H. A. Magoon, architect, takes charge of the architectural work of the D. T. & S. Co. Mr. Magoon practised in Chicago for several years, as also in Oelwein, Iowa. In Chicago he studied under Prof. Debolke. He has just completed the plans for 25 single residences which are to be erected in the spring, and has charge of the construction of 28 houses for employees in Colby, the company's hospital, laboratory, etc. The plans of the new general offices of the company are now being completed. This building will be built in the spring at a cost of perhaps $50,000. It is to be extra well built of brick and stone, size 124x59, four stories.

Mr. J. W. Campbell, architect, is the building inspector in Sydney, and has an office in the town building. Mr. Campbell formerly belonged to Dartmouth, though he came to Sydney from Massachusetts.

R. B. Whitten, architect, is doing business in Sydney. Mr. Whitten is a graduate from the architectural department of the School of Technology in Boston. He left Sydney a few weeks ago for a month's trip to Boston and vicinity.

THE CONSTRUCTION OF ICE HOUSES.

Editor CANADIAN ARCHITECT AND BUILDER.

DEAR SIR,—In your item of the CONTRACT RECORD, 9th inst., you have reprinted from a Boston paper an article on ice houses The ice trough as proposed to be constructed on a hill-side with northern exposure is no doubt the right thing, and ice would keep well in such a tub 15 feet deep in the ground, 15 feet diameter at top, 10 feet at bottom, lined with poles all around, covered with a goodly thickness of straw. But this deep trough would be tiresome to get at several times a day, when on the ice getting low a ladder would have to be used to reach it.

What we want is an ice house above ground, easy to reach under cover of rain and weather, and such that the ice stored in it will last out till the time for putting in the next crop. Myself and several others have at our country seats ice houses put up for us by several so-called specialists, but our supply has always melted away by the beginning or middle of September instead of holding out till November at least, as it should do, and better still, as said before, till the next ice crop.

Maybe some of the young gentlemen of the Toronto School of Science will endeavor to design such a structure, requiring as it does a very thorough knowledge of the behaviour of currents of warm and cold air.

CHAS. BALLAIRGE.

QUEBEC Dec., 1900.

HINTS FOR PAINTERS.

Something not generally known by painters who are called upon to re-paint an old house, may be learned from the following: After cleaning off the old work, prepare three gallons of water, into which put one pint of flax seed, and boil for an hour. Then remove from the fire and add enough water to make four gallons. After this has properly settled, add sufficient Spanish white (whiting) to make it as thick as good whitewash; then add a half pint of raw linseed oil, well stirred in. Then apply with a brush. Should the whiting fail to mix properly, add more water. A flax seed solution containing linseed oil as above, is much better than glue, and will not easily chip or fall off, and it makes a first-class base for painting over. One of the best painter's size is made by heating raw linseed oil in a shallow pan until a black smoke begins to arise, then set it afire. After it has burned a few minutes, cover the pan to extinguish the blaze. Before the oil cools pour it into a bottle containing a moderate quantity of pulverized red lead and litharge. Leave the bottle in a warm place for about two weeks, frequently shaking it; then it will be ready to pour off into other bottles and be fit for use. This makes a size of great value to the painter, as he can rely upon it in any work where a good durable size is required.

SETTING TILES.

A booklet recently published by The Tile Manufacturers' Association of America, for the purpose of stimulating and encouraging a more general use of tile, contains some valuable information on the "setting" and "hanging" of tile, that should be more generally known. As a preliminary, the following suggestions are laid down: "A good foundation is always necessary, and should be both solid and perfectly level. Tile should always be laid upon a concrete foundation prepared from the best quality Portland cement and clean sharp sand and gravel, or other hard material. Cinders should never be used, as they have a tendency to destroy the life of the cement and cause it to disintegrate. A foundation, however, may also be formed of brick or hollow tile imbedded solidly in and covered with cement mortar. Concrete should be allowed to thoroughly harden before laying the floor, and should be well soaked with water before laying the tile. Lime mortar should never be mixed with concreting. Concrete should consist of one part Portland cement, two parts clean sharp sand, two parts clean gravel, and thoroughly mixed with sufficient water to form a hard solid mass when well beaten down into a bed, which should be from 2½ to 3 inches thick. If the concrete bed can be made over three inches in thickness, the concrete can then be made of one part Louisville cement (natural), one part clean sharp sand, one part clean gravel, and thoroughly mixed with sufficient water, as before directed."

LAYING TILES ON FLOORS.

For floors, the surface must be level and finished to within one inch of the finished floor line when tile ½ inch thick is used, which will leave a space of one-half inch for cement mortar, composed of equal parts of the very best quality of Portland cement and clean sharp sand. The distance below the surface of the finished floor line, however, should be governed by the thickness of the tile. When tiles are laid on wood floorings in new buildings, the joists should be set five inches below the intended finishing floor line and spaced about twelve inches apart and thoroughly bridged, so as to make a stiff floor, and covered with one inch rough boards not over six inches wide—boards three inches wide preferred—and thoroughly nailed, and the joints ⅛ inch apart to allow for swelling. A layer of heavy tar paper on top of wood flooring would protect the boards from the moisture of the concrete, and will also prevent any moisture from dripping through to a ceiling below. In old buildings, cleats are nailed to joists five inches below the intended finished floor line, and short pieces of boards ⅛ inch apart are fitted in between the joists upon the cleats and well nailed, and the joists thoroughly bridged. The corners on the upper edge of the joists should be chamfered off to a sharp wedge-like edge, as the flat surface of the joists will give an uneven foundation. When the strength of the joists will permit, it is best to cut an inch or more off the top. When joists are weak they should be strengthened by having wide and thick cleats spiked on each side of them the whole length of the joists. When a solid wood foundation is thus prepared, concrete is placed upon it as directed in the foregoing.

TILING WALLS.

Where tiles are to be hung or laid on old brick walls the plaster must be all removed and the mortar raked out of the joints of the brickwork to form a key for the cement. On new brick walls the joints should not be pointed. When tiles are to be placed against studding, the studding should be well braced by filling in between the studding with brick set in mortar to the height of the tile work, or brick may be omitted and extra studding put in and thoroughly braced and bridged, so as to allow as little spring as possible, and this studding should then be covered with sheet metal lathing. Tile must never be placed on wood lath or on old plaster. The brick walls must be well wet with water and then covered with a rough coating ef cement mortar, composed of one part Portland cement and two parts of clean sharp sand. When tiles are placed against metal lathing, hair should be mixed with the cement mortar to make it adhere more closely to the lath. The cement mortar should be half an inch thick, or sufficient to make an even and true surface to within one inch of the intended finished surface of the tile, when tile half an inch thick is used, which will allow a space of half inch for the cement mortar, composed as described for rough coating the walls. The face of the cement foundation should be roughly scratched, and allowed to harden for at least one day before commencing to lay on the tile. If any lime is mixed with the cement mortar for setting the tiles, it should never exceed 10 per cent., and great care must be used to have the lime well slaked, and made free from all lumps by running through a coarse sieve in order to guard against "heaving" or "swelling," and thus loosening or "lifting" the tiles. It is very important that the foundation for both floor and wall tiling be thoroughly brushed, to remove all dust and small particles adhering to it, and then wet well before putting on the cement mortar. To insure a perfect bond, it is best to coat the foundation by brushing over it pure cement mixed in clean water. The very best quality of Portland cement should always be used for setting either floor or wall tile and for grouting the floors, and the very best quality of Keene's imported cement for filling the joints in the wall tiling. Clean sharp grit sand, free from all salt, loam or other matter, and perfectly screened before mixing with the cement, should always be used. The mortar for floors or vitreous tiles, should be composed of equal parts of cement and sand, and for wall tiles one part of cement and two parts of sand. The mortar should not be too wet, but should be rather stiff, and should always be fresh ; as mortar when allowed to set before using, loses a portion of its strength. Tiles must always be thoroughly soaked in water before setting, which makes the cement unite with the tiles.

EXCAVATING CELLARS.

In estimating the cost of a building, about the first thing we are confronted with is the digging or excavating the cellar and trenching for foundation walls. This work is generally estimated by the cubic yard, and the contents in cubic yards may easily be obtained by the following method : First obtain the number of square feet on the surface and divide by nine, which will give the number of square yards on the surface, then multiply by one third of the feet in depth. The result will be the number of cubic yards. Thus, to find the number of cubic yards in a cellar 18 x 30 feet and 7 feet deep, there are 540 square feet on the surface, which, divided by nine gives 60 square yards. Multiplied by 2⅓, which is ⅓ of 7 feet, we have 140 cubic yards. The cost of excavating varies with locality, quality of materials to be removed, distance of hauling, and in other particulars, but the usual cost where all things are favourable, may be put down at from 20 to 30 cents per cubic yard, including hauling. To excavate clay costs more than to excavate sand or loamy soil, gravel still more and shale and rock very much more. Limestone rock, if blasting is necessary, may cost from $2.25 to $3.25 per cubic yard, according to conditions. Hard conglomerate may cost from 40 to 70 cents per cubic yard, and often more when it is naturally cemented together.

SETTING PARTITIONS.

In setting partitions care should be taken to select straight studding for all door openings, as it will greatly facilitate the work of setting the door frames. All partitions should be set plumb, not near enough, but perfectly plumb. A partition that is not plumb is sure to cause trouble when the doors are being hung, as the outer point of the door will either strike the floor or will stand off at an unsightly angle when open ; but, in either case, the door will present an ungainly appearance to those who can judge good work. The setting of door jambs is a very particular piece of work if it is to be done in a proper manner. They must be level, plumb, square and out of wind, and the jamb must be perfectly straight to accomplish these conditions. The head must be level, or it cannot be made square with the plumb jambs. The edges of the jambs must also be plumb as well as the face, and if parallel, then both edges will be plumb. In case a partition is out of plumb, and it is too late to be remedied, the skilful carpenter will set his jambs in a way to overcome a part of this defect, and this is what he should do, but he must exercise considerable care in order to determine just the proper amount he can vary the jambs from the plumb to bring about the best results, all things considered. He can often overcome defects in bad construction in ways that will never be noticed.

QUESTIONS AND ANSWERS.

A subscriber at Calgary writes : The purchase of a stone crusher is under consideration. It is expected to crush any size stone usually found in a gravel bed. I may say we have them as large as 14 inches in all directions, and they propose to use electric motive power. The only current available here is the alternating current, and the company are installing synchronous motors, which, of course, require to be brought up to speed by some outside agency, but even if they put in a direct current machine, will not the load be too variable? Will it be either profitable or practicable to run it by electricity, the load varying each time it strikes or completes the crushing of a stone from zero to full capacity of machine ? Let it be understood that a heavy fly-wheel will be used.

Ans.—The running of stone crushers can most emphatically be accomplished by means of electric motors. It is of course desirable that all the details of the proposed plant should be submitted for competent investigation, but the following are the main points : Alternating motors are preferable to the direct current type because of their ability, due to the absence of moving contacts, to successfully withstand very large temporary overloads, which will always be encountered in this class of work, owing to irregularity in the feeding of the crusher, the occurrence of hard heads, etc. On the other hand, a direct current type, unless having a horse power capacity very much in excess of that required to run the crusher under normal loads, in which case the installation will become unnecessarily expensive, will give more or less trouble from sparking at the commutator, though this can be partially avoided by careful handling of the plant. We would say that, generally speaking, induction motors would be preferable to the synchronous type, because they will work under much larger voltage variations than will the latter, are easier to look after under the extreme conditions of dirt and dust usually prevailing in such work, are more simple and therefore require less skilled attendance, and will probably cost you less than will the latter. It is of course highly desirable that large balance wheel capacity should be installed, no matter what the motive power, and it is also advisable in order to avoid as much as possible the disturbance of the line voltage incident to the starting of a heavy machine such as this, that the motor be started first, and, after it is running, the crusher brought up to speed by means of a clutch or tight and loose pulleys. The question as to whether it will be profitable to operate your crusher electrically is one governed entirely by local conditions. In the absence of the details obtaining we are unable to give you an opinion; the interest on the cost of the plant, the cost of attendance, the cost of repairs, and the cost of fuel will form the basis on which to calculate the expense of operating by steam or gas or fuel oil; the outlay for electrical operation will be made up of the same components, excepting that the price paid for current will be substituted for the cost of fuel.

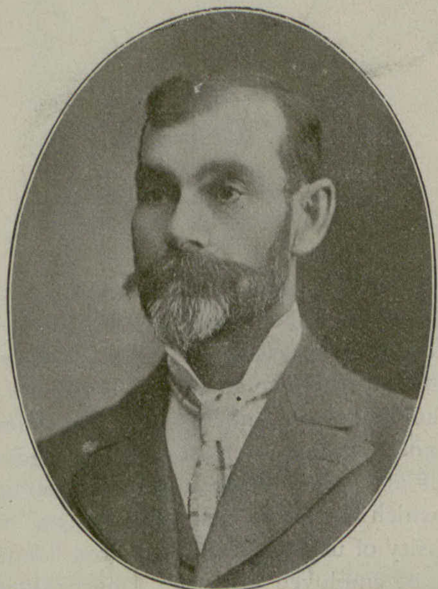
Among the new companies who have recently been granted charters of incorporation is the Laurentian Stone Co., of Ottawa, capital $40,000.

The big brick factory erected in the past year in Pugwash, N.S. and now being run by the Maritime Clay Works Co., Limited, will be illustrated and described in a future issue. This is by far the largest works of the kind in the Maritime provinces, and is one of the best and most modern in methods in Canada.

MESSRS. H. & S. LOWE, CHARLOTTETOWN, P. E. I.

Among the largest building firms in the maritime provinces is that of H. & S. Lowe, of Charlottetown, P.E.I., and they are now by far the largest in that province.

Mr. Wm. Lowe came to the island in 1830 from his native home in Norfolk, Eng. He had learned his trade

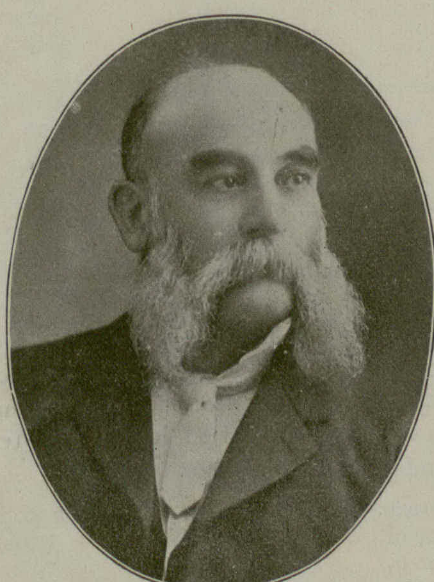


MR. HENRY C. LOWE.

in the old country, and took up building when he arrived.

His two sons, whose portraits we publish with this article, learned their trade with him and went into partnership 25 years ago. Mr. Henry C. Lowe is the senior of the firm and is 52 years of age. His brother, Samuel Lowe, is but two years younger.

Both are married, and live in a pleasant new double residence most comfortably finished and tastefully furnished, on the corner of Hillsboro and Heuston streets.



MR. SAMUEL LOWE.

The firm has enlarged its business from time to time, until it now employs a large number of men permanently. They are intending to acquire in the spring a large and well equipped wood-working plant in the city, which will give them much better facilities.

They have constructed some of the largest and most important buildings in the province. Some that might be mentioned are the Cameron block on the south side of Queen's Square; the Rogers building, Queen St.; St. Paul's Anglican church, in Queen's Square; and the brick Roman Catholic church at Fort Augustus, which cost $20,000. The two first named were done in the past two years. They remodelled the interiors of the First Methodist and St. James' Presbyterian churches in the city, and have erected a large number of fine residences in the immediate vicinity of their own home. They were the builders of the pork packing buildings, which they secured in a contract of $50,000. The contract for these structures, which were briefly described in the December issue of the CANADIAN ARCHITECT AND BUILDER, was signed in May, 1897, and they were turned over complete in November of that year.

Last summer the firm erected nine dwelling houses, a brick church, an extension to the Davies hotel, an hotel at Stanhope, and other buildings. The Stanhope hotel, which was of wood and cost $6,000, was wanted for the tourist trade. It was put up, plastered, painted and turned over for use in 21 days.

Work was recently begun on enlargements and repairs to the city drill shed which will cost about $10,000. The firm are now completing a residence for E. H. Beer which is costing $2,000 ; also one for Robert Palmer at same cost. They have just begun work on the new Apothecaries' hall or Desbrisay building, which is a $14,000 contract. The firm feel confident that building will be good during the coming summer and are preparing for good orders.

INTERCOMMUNICATION.

[Communications sent to this department must be addressed to the editor with the name and address of the sender attached not necessarily for publication. The editor does not hold himself responsible for the expressions or opinions of correspondents, but w ll, nevertheless, endeavor to secure correct replies to queries sent in. We do not guarantee answers to all queries, neither do we undertake to answer questions in the issue following their appearance.]

A correspondent in Ottawa asks the following : "Is there any rule for determining of the number of seats required for the use of children—boys and girls—in closets built for Public schools ?" I am anxious to know how many seats would be quite sufficient for 300 boys and how many for 300 girls.

W. R. G., of St. Catharines, Ont., sends in the following query : "What are artificial cements and natural cements ? What are the usual tests for Portland cement ? For what purpose is silver sand used in combination with Portland cement ?"

W. B., of Toronto, asks for an explanation of the word "gesso." "What it means, and if a material, for what purpose is it used ?"

T. W. R., Hamilton, writes asking us to explain what is meant by "secret nailing," and to describe the manner of doing the work. "I am," he says, "a new subscriber to the CANADIAN ARCHITECT AND BUILDER and am much interested in its columns, having already obtained many good things from its pages, but having learned my trade in the old land I never heard the term 'secret nailing', therefore am anxious to know what it means."

T. V., Orillia : "I am interested in a large stock of red oak and would like to know how it can be kiln dried without spoiling it, as I find the usual manner of kiln drying seems to honeycomb the stock and render it totally unfit for fine work. It looks all right when taken out of the kiln but the moment it goes through the planer it is full of pin holes and cannot possibly be employed for finishing purpose? Any information will be appreciated.

W. D., London, Ont., writes: "Can you give me the names of some good books on gothic architecture which would be of service to a student and draftsman? I would prefer books giving details and construction with necessary explanation, rather than long treatises on the theory and aesthetics of gothic art."

Jas. N., Aurora, Ont., asks if there is any method of making a pitch board for outside stair work so as to obtain the tread pitch without the necessity of resorting in common with most carpenters, to the preparation of a pitch board as for ordinary stairs, and after the work is laid out take off ¼, ⅜ or ½ inch as the case may be? This method besides increasing the possibility and probability of errors, contracts the rise just the amount that is taken off and thus destroys the proper proportion between tread and riser.

ROOF FRAMING.

By George H. Blagrove.

A king post, we must remember, is upheld between the heads of two principal rafters, which are mortised or joggled into projecting shoulders cut for the purpose in the upper part of the post. If the post does not give way by rupturing at its smallest section—i.e., at the middle—it may do so by having the two sides of its head sheared off by the upward thrust of the principals. The shearing resistance at the shoulders should therefore be equal to the tensile resistance at the smallest scantling. As the tensile resistance of fir is about seven times its shearing resistance, the united depths of the two upper shoulders should be seven times the smallest breadth of the post, or the depth of each shoulder should be three and a half times that breadth.

Two other shoulders are commonly formed near the foot of the post to receive a pair of struts, which help to stiffen the principals. The depth of these lower shoulders ought, for security, to be as great as that of the upper ones. But another consideration may necessitate their being deeper. We cut into the lower part of the king post in order to obtain a fixing for the wrought-iron stirrup which upholds the tiebeam, and the post being thus weakened at this place its full scantling should be carried up well above the point where this fixing is made. The well-known gib-and-cotter arrangement is the most approved fixing for the stirrup now-a-days, and its security depends upon its being sufficiently high up in the post not to rend its way through the latter. If fixed 12in. above the tiebeam we find by a simple calculation that there need be no fear of its giving way, even when the beam carries a ceiling and a floor. Of course, if the tiebeam is cambered, the stress upon the stirrup will be increased, but we do not advise the cambering of tiebeams, because when a cambered beam settles, it tends to thrust out the walls.

The head of a queen post is supported upon one side by a principal joggled into its shoulder, and on the other by a straining beam, which frames into it horizontally. Under these circumstances it is doubtful if the full tensile strength of the post becomes available. Certainly, the scantlings habitually employed for both king and queen posts allow for more tensile strength than is requisite; and this is just as well, because stress of wind and other causes will often bring slight transverse strains to bear upon such posts. With regard to iron straps being used for connecting the heads of the posts with principals and straining beams, as is usually the practice, we are inclined to think that they are of very little service. The straps are not subjected to a direct tensile strain, such as they are best fitted to bear

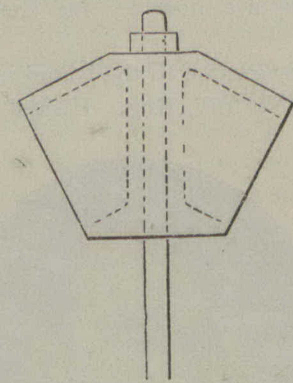


Fig. 1.

but often to a transverse strain which may injure them. Moreover, if the timbers shrink, these straps may be subjected to a compressive strain, which they are neither intended nor fitted to sustain. They are chiefly of use in holding the timbers together when a tenon breaks, and for this purpose bolts would be equally efficacious and safer, while capable of being drawn up tighter, which is not the case with straps. To obviate the necessity of using either, cast-iron heads may conveniently be employed either in king or queen trusses. They may be ⅝ in. thick or upwards. Fig. 1 shows an iron head for a king truss, and fig. 2 one for a queen truss. The dotted lines show the boxings to receive the

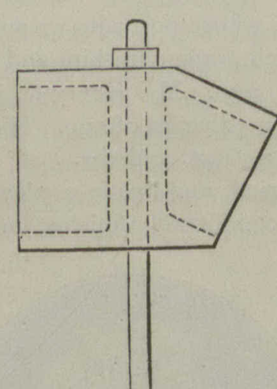


Fig. 2.

heads of the timbers, and the vertical holes for the suspension rods, which are substituted for king and queen posts. The following tables show the scantlings ordinarily in use for king and queen posts (exclusive of shoulders for struts and principals), with the diameters of wrought-iron circular suspension rods, which may be substituted for them if desired. It is assumed that there are ceilings to be carried in the king trusses and ceilings and floors in the queen trusses:

Table.—King Posts and Suspension Rods.

Span.	Posts.	Rods.
20 ft.	4 in. by 3 in.	⅞ in.
22 ft.	5 in. by 3 in.	1 in.
24 ft.	5 in. by 3½ in.	1 in.
26 ft.	5 in. by 4 in.	1⅛ in.
28 ft.	6 in. by 4 in.	1⅛ in.
30 ft.	6 in. by 4½ in.	1⅛ in.

Table.—Queen Posts and Suspension Rods.

Span.	Posts.	Rods.
32 ft.	4½ in. by 4 in.	1¼ in.
34 ft.	5 in. by 3½ in.	1⅜ in.
36 ft.	5 in. by 4 in.	1⅜ in.
38 ft.	6 in. by 3½ in.	1⅜ in.
40 ft.	6 in. by 4 in.	1⅜ in.
42 ft.	6 in. by 4½ in.	1½ in.
44 ft.	6 in. by 5 in.	1½ in.
46 ft.	6 in. by 5½ in.	1½ in.
48 ft.	6 in. by 5½ in.	1½ in.
50 ft.	6 in. by 6 in.	1⅝ in.

When suspension rods are used instead of posts, the small struts which stiffen the principals will take their bearings upon the tiebeam instead of upon shoulders cut at the feet of king or queen posts. It is then usual to employ small straining pieces, with ends cut to receive the tenons of the struts, as shown in fig. 3, the straining pieces being secured to the tiebeam with two

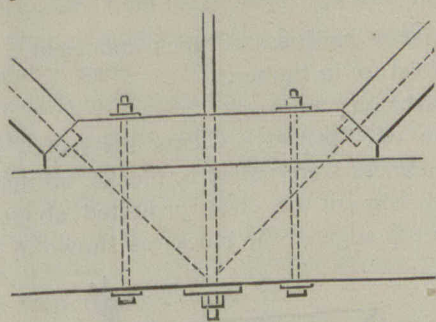


FIG. 3.

¼ in. bolts. The direction of the thrust from each strut coincides with its centre line, as dotted in the diagram. The two centre lines should intersect not lower than the head of the iron suspension rod. When this is the case, as it is in fig. 3, the extra transverse strain thrown upon the tiebeam is so slight that it can safely be disregarded.

PURLINS.

In calculating the scantlings of purlins, they must of course be regarded as beams uniformly loaded, the amount of the load being estimated by the extent of the roof surface, including the allowance for wind and snow, carried by each purlin, the span being the distance between the trusses. As the principles of calculation have already been sufficently explained, we give the following table of scantlings, the distances between the purlins being measured on the slope of the roof and the trusses being assumed to be 10 ft. apart :

TABLE.—PURLINS.

Distance apart.		Scantling.
6 ft.	....	6 in. by 4 in.
7 ft.	....	7 in. by 4 in.
8 ft.	....	8 in. by 5 in.
9 ft.	....	9 in. by 5 in.

Sometimes it is convenient, in exceptional circumstances, to place the trusses as far apart as 20 ft., in which case the principals, struts, etc., must be made proportionately stronger ; or it may be that trusses can be dispensed with altogether, the purlins taking their bearings upon walls. Heavy timbers would be required for purlins, and hence it would be desirable to substitute iron for wood. Rolled T irons are suitable for this purpose, the table or flange being placed downwards and bolted to the backs of the principals or to blocks of stone bedded upon brickwork. The common rafters are then made in short lengths, bearing from purlin to purlin upon wood blocks or plates screwed to the iron. With trusses 20 ft. apart, the rolled T-iron purlins should be as follows :

TABLE.—ROLLED T-IRON PURLINS.

Distance apart.		Size.
6 ft.	....	4 in. by 4½ in. by ½ in.
6 ft. to 8 ft.	....	5½ in. by 5¾ in. by ½ in.

The above sections of rolled iron are usually kept in stock. When the distance between the purlins exceeds 8 ft., specially rolled sections are required, or steel sections can be used.

COMMON RAFTERS.

The scantlings of common rafters depend upon the distance between the purlins, or between the purlins and the wall plates and ridge. The ordinary rule for the depth of common rafters is sufficiently near for practice—viz., to allow ½ inch depth for every foot of bearing. Thus, with 9 ft. bearing we should have rafters 4½ in. deep ; but no rafter should be less than 3½ in. deep. As regards thickness, 2 in. is a common dimension. We do not, however, recommend less than 2¼ in. or 2½ in., to allow for the proper fixing of slate battens or boards.

THE STRENGTH OF NAILED JOINTS UNDER A SHEARING LOAD.*

BY WILLIAM KENDRICK HATT, A. M. C. E.
Associate Professor of Applied Mechanics Purdue University.

Many determinations have been made of the force necessary to withdraw nails, spikes and screws from timber, a good summary of which will be found in Kent's Mechanical Engineer's Pocket Book. Of these tests, the principal are:

(a) Those of Professor W. H. Burr made at the Watertown Arsenal in 1893. The direct tensile adhesion of cut and wire nails driven in spruce and pine was determined; and cut nails showed superior resistance to the wire nails in the proportion of 3.2 to 2 in the harder wood, and in the proportion of 2 to 1 in softer wood, the resistance being compared on a basis of the number of square inches of surface of the nail in the wood.

(b) Those of F. W. Clay, described in Engineering News, Jan. 11, 1894. The results may be summarized as follows: In resisting a pulling force directly along the length of the nail, the cut nail was superior to the wire nail both per unit of weight and surface; the relative holding power in different woods was as follows: White pine, 1.0; yellow pine, 1.5; white oak, 3.0; chestnut, 1.6; beech, 3.2; sycamore, 2; elm, 2; basswood, 1.2; laurel, 2.8; a sharp point increased the resistance of the nail; the surface of nail should be rough; barbing a nail decreased its strength‡; the length of the nail should be about three times the thickness of the thinnest piece nailed; the resistance decreased slightly with time. Mr. Clay observed that when a wire nail was being pulled out from the wood, the decrease in resistance was gradual, but that the resistance of a cut nail suddenly fell off after the nail was started. It thus would seem that the above comparison of results from steady tests would be somewhat changed in case of nails subjected to vibration.

Tests were also made to determine the strength of nailed joints under a shearing load. Mr. Clay determined the force required to cause a relative sliding of the surface of two sticks which were nailed together. The nails, which were not driven up to the head, were under an action partly of the nature of shearing and partly of bending. Under this kind of test the cut nail was superior to the wire nail both per unit of weight and per unit of surface; the greatest tenacity was had when the length of the nail was at least twice the thickness of the piece nailed; the strength per unit of area of surface in the wood of different sizes of nails was approximately constant§, and equaled 900 pounds when driven into yellow pine through an oak cleat; the greatest resistanee was obtained when the nail was driven perpendicular to the surface of the wood†.

*Reprinted from the Proceedings of the Indiana Engineering Society.

‡Decrease of efficiency when barbed is also shown in Watertown Arsenal Report for 1884 ; shown also for shearing load tests at Purdue Universlty

§Shown also in tests at Purdue University.

†Thus, ⅝ inch cleats were nailed to chestnet with six six-penny nails. The resistance when driven straight in was 1725 pounds ; slanting in direction of shear 910 pouuds ; slanting against shear, 1400 pounds. Shown also in tests at Purdue University.

(c) The tests of Messrs. Walker and Cross, published in the Journal of the Association of Engineering Societies for December 1897. A cleat was nailed to a block, and the force required to slide the cleat on the box was measured. Wire nails were used in Norway and white pine. The results of the tests point to the following facts: The strength of a joint is directly proportional to the number of nails used; if the diameter of the nail is kept at the same value and the length of the nail gradually increased, then the load at first slipping is not affected, but the maximum load increases in the direct proportion to the length of nail;† the strength per nail at first slip is expressed fairly well by the expression c d^2, where d = diameter of nail in inches, and c is a co-efficient which is about 5500 for white or Norway pine and 13,500 for oak. These tests were made with nails from 6d to 8d. It is to be noted that the values obtained in these tests are low, compared with results described below.

(d) Trautwine states that boards of oak or pine nailed together by from 4 to 16 ten penny common cut nails, and then pulled apart in a direction lengthwise of the boards across the nails, tending to break the latter in two by a shearing action, required about 300 to 400 pounds per nail to separate them as a result of many trials.

It is to be noted that the results of experiments on nails driven in timber and subjected to a cross load must be expected to be very irregular. The strength of the combination of wood and iron is a complex function, and will vary more widely than the quality of the timber, which itself is not all uniform. One does not expect the degree of uniformity to be had in tests of a material like steel. Special value should be deduced for each kind of timber. The strength of nails in rough scaffolding and grand stands will be largely different from the values determined in laboratory tests, which are conducted with specially chosen material, and under carefully applied loads in order that the effect of a change in some one factor may not be masked by a change in other factors. The laboratory results themselves under the best chosen conditions are somewhat irregular. The average values, however, indicate fairly well the laws of action.‡ On the whole, then, the laws cited in the above summary are fairly well established.

TESTS AT PURDUE UNIVERSITY.

The present paper describes a series of tests on nailed joints in shear made as a thesis investigation during the winter of 1898 by Messrs. H. D. Barrow and D. W. Buchanan, senior students in Mechanical Engineering of the class of '98, working under the direction of the writer. The outline of the tests was arranged and the work under way before the results of the investigation of Messrs. Walker and Cross were availadle. The outline as originally conceived was, however, carried out although it involved some repetition of the work of these gentlemen.

Scope of the Tests.—In all, about 250 joints were were tested, slip and accompanying load being observed at about 12 different points for each joint. The work included:

(1) The preparation of tables showing the maximum resistance per nail and per pound of nail for both cut and wire nail up to 60d in oak and pine, using a thickness of cleat in the different tests to correspond with the use of practice.

(2) To determine the effect on the resistance of the joint of the following factors:

(a) Number of nails in joint.

(b) Diameter of nail constant, length varying.

(c) Length of nail constant; diameter varying.

(d) Angle with surface at which nail is driven.

(e) Relative direction of applied load and fibre of timber.

(f) Relative hardness of block and cleat.

(g) Moisture in timber.

(h) Barbs on nails.

Method of Testing.—Cleats six inches square of proper thickness were nailed to blocks, so that the top horizontal) edge of the cleat projected about one inch above the top edge of the block, as shown in Fig. 1.

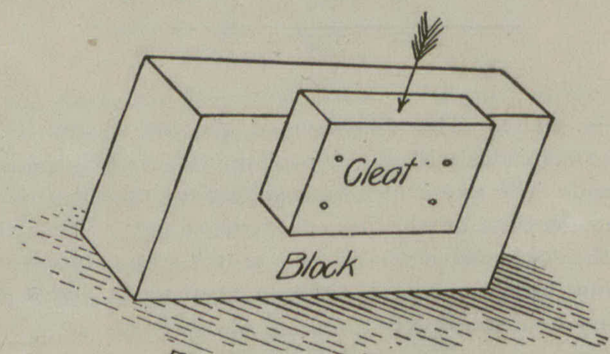


Fig. 1

The sides of the block projected ¼ inch and 1¾ inches, respectively, beyond the sides of the cleat. These joints were all nailed together by one man under uniform conditions, care being taken to square each joint. The nails were driven to the head and perpendicular to the surface, except when noted to the contrary. A series of preliminary tests (see series a) and the results of Messrs. Walker and Cross showed that the strength of the joint varied directly as to the number of nails; i. e., four nails were four times as strong as one nail. The number of nails used in making the joint varied from 1 to 4 thus:

For 8d and under 4 nails were used.

For 10d and 12d, 2 nails were used.

For 8d fence, 12d fence, 16 and over, 1 nail was used.

The number was fixed by the liability to split the wood in driving.

The thicknesses of cleat used were intended to represent such sizes as would be used in practice with the size of nail under test. In general, three thicknesses of cleats were used for each size of nail.

TABLE
Strength Per Pound of Nails in Pounds.

Pennyweight.	Pine. Wire.	Cut.	Oak. Wire	Cut.
Common 2d....		93,900		115,000
" 3d....		63,400	94,000	102,000
" 4d....	66,500	54,600	71,000	88,000
" 6d....	43,200	39,300	56,500	53,200
" 8d....	34,700	34,200	45,400	45,800
" 10d....	48,500	49,400	51,000	43,600
" 16d....	39,300	35,600	41,000	33,200
" 20d....	27,900	21,700	40,500	31,800
" 40d....	24,700	16,320	29,700	22,500
" 60d....	21,000	14,880	18,600	
Finish 4d......	64,400	70,600	113,000	103,000
" 6d......	55,300	48,500	76,600	63,400
" 8d......	41,200	39,500	56,000	567,000
" 10d......	55,800	46,000	60,600	
" 12d......	41,800		53,500	
Fence 8d......	46,200	30,200	47,500	34,300
" 10d......	38,500	26,000	46,400	31,100
Fine 3d........	88,800		121,000	

The values in this table are obtained by multiplying the strength of one nail by the number of nails in one pound. It will be seen that the smaller nails hold more per pound than the larger nails, and that when driven into pine, the wire nails hold more per pound than cut

†Shown also in tests at Purdue Un versity.

‡In series (a) of following investigation nine tests were made, under uniform conditions, with a range from 590 pounds to 513 pounds, which is a less range than one might expect.

nails in 12 cases out of 14; when driven into oak the wire nails hold more per pound than cut nails in 8 cases out of 13.

CONCLUSIONS.—Summing up the various results of the investigation, the following conclusions seem to be justified within the limits of the tests, both as to size of nails and kinds of material:

(1) Wire nails hold somewhat greater loads than cut nails, when compared on the basis of the strength of one pound of nails.

(2) Cut nails hold somewhat greater loads than wire nails per unit of surface, and per pennyweight.

(3) Nails of small body hold more per pound than nails of large body, both in case of wire and cut nails.

(4) Common nails, both cut and wire, when driven into oak hold greater loads than when driven into yellow pine in the proportion of 1.5 to 1.

(5) The strength of a joint varies directly as the number of nails used.

(6) The strength per inch of length is constant for 16d nails cut to different lengths.

(7) The best angle of driving is a right angle or nearly a right angle.

(8) Joints diminish in strength with prolonged soaking.

(9) A decreased efficiency results from barbing the surface.

THE CONSTRUCTION OF A ROOF.*

By GEORGE H. JONES.

In our climate the roof of a building is of the first importance, for however perfect the structure, however elaborate the conveniences and fittings, however artistic the decorations, and scientific the sanitary arrangements, unless the roof is well constructed and water-tight, all the labour is in vain.

The subject of roofing generally (embracing as it does construction and materials) is too large to be dealt with in a short lecture like this, but a few notes will probably be of use.

I would urge upon those of our younger members, who have an ambition to become general foremen or clerks of works, the importance of studying the roofs of the carpenter. The iron roofs of our railway termini, markets, and other public buildings are also well worth the consideration and study of our members, though these structures are, as a rule, the work of the engineer rather than of the architect.

The chief use of a roof is, of course, to protect the inmates of the building from the extremes of temperature, from wind and rain. It must be designed and constructed in such a manner that it is a support to the walls that carry it, and unless it fulfils these requirements it cannot be considered a satisfactory, much less a perfect roof. In the designing of a roof there are many things to be considered—the span or width between the walls, the height of the ridge, the weight of the covering (whether lead, tiles or slates), and the relative strengths of the various timbers. If it is a high-pitched roof it is generally trussed on the king-post principle, or if low pitched, on the queen-post principle, or sometimes by a combination of both. Though the problem of designing does not devolve upon the clerk of works or the general foreman, it is essential that they should understand the principles of construction and proper framing.

The simplest form of roof suitable to our climate is what is known as the lean-to roof, that is, a roof that slopes only one way. This was probably the earliest form of roof constructed in this country. Then would follow the ridged roof, or the roof which slopes two ways, with the end walls called gables, carried up in brickwork or masonry. After this would follow the hipped roofs, sloping three or four ways. It would soon be discovered in the roof sloping both ways that the feet of the rafters had a tendency to spread and force out the walls. The next step was to tie the feet of the rafters together, and thus arose the tie beam. The sagging of the tie beams over large spans would next attract attention, and the remedy was found by suspending it from the ridge. Here then was the truss, the king-post truss. The queen-post truss is but the extension of the king-post truss. The latter is probably the earliest, as it is the simplest form of roof truss. The king-post holds up the middle of the tie beam, and the struts support the middle of the rafter; they should be at right angles to the back of the rafter and should be tenoned and shouldered on the king-post. Nowadays, in roof framing, the tie-beam is frequently dispensed with, being replaced by a timber at a higher level than the feet of the rafters, sometimes as high as half the distance to the ridge; this is called a collar beam, and when it is fixed at a high level it is framed to the feet of the rafters by braces. Any piece of timber in a truss on which the stress or strain is in the extension of its fibres is, and may be called a tie (sometimes brace). When the strain is in compression of its fibres it is a strut. Thus a king or queen-post is a tie, and not a strut.

The cost of trussing every pair of rafters would soon lead to longitudinal framing and so came the purlin. The purlin is usually laid on the back of the principal rafter, sometimes at right angles and supported simply by a splay block spiked on the rafter, and sometimes fixed vertically and notched down over the rafter. When the principals are far apart, the purlin is sometimes strutted from the tie beam, or from the sides of the principal rafter in open roofs; and these are called wind braces by some. They are of very little use when fixed to the side of the rafter, but some persons admire them in open roofs. If a roof is placed on inner and outer wall plates, these should always be framed together by cross-pieces halved and dovetailed, and not morticed and tenoned as I once saw done. Roofing is, in my opinion, the perfection of the carpenter's art; and the open roofs of our churches are, in many cases, even more beautiful than stone groining. To those of you who do not agree with me, I recommend a visit to Westminster Hall.

Thus we have seen the truss or principal rafters carry the purlins and ridge, the common rafters being fixed on the purlins, ridge and wall plate. There is a German method of dispensing with the common rafters; this consists in fixing purlins at intervals from plate to ridge and then boarding them over to carry the slates or battens. I should think a roof like this would be less effective against wind pressure than one built in our usual way, though it would probably be less expensive to construct.

When a roof is described as being framed in rough fir or oak it is meant that the timber is used as it comes from the saw; when it is to be planed it is described as wrought; the framing is the same in both cases. When the soffit of a common rafter comes below the back of the purlin it should be caulked into the sides of the lat-

*Paper read before the College of Masons at the Royal Architectural Museum, Westminster, on October 23rd, 1900.

ter, but nothing must be taken off the back of the purlin. In some cases it is advisable to double caulk, in order to save the sectional area of the purlin as much as possible. I find there is a tendency to forget the caulking in rough framing: this, however, is important, and must be insisted on; especially when the purlin is at right angles to the rafter. In joggling in braces, etc., the shoulder should always be at right angles to the thrust, and if the joggle is long it should be twice shouldered for the same reason given above; in morticing never cut away more than is necessary. In fixing the bolts in a truss the bolt should in almost every case be fixed at right angles to the bi-section of the inside angle of the two timbers to be bolted together.

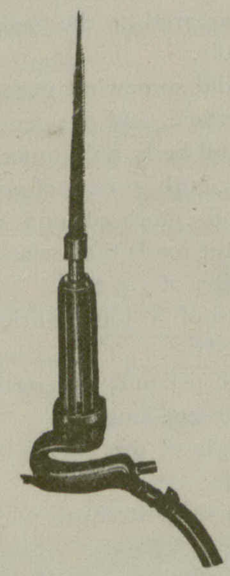
An excellent roof which I saw fixed on a building is constructed on the king-post principle with the addition of a hammer beam; the need for this beam being obvious in this particular case. The main principals are constructed with rafters, collars, braces, ashlars and hammer beams, with iron tie-rod and king-bolt. The feet of the rafters are, with the ends of the hammer beams, framed into a cast-iron shoe, through which the tie-rod passes; the rafters are framed together in a cast-iron head, and the king-bolt passes through and suspends the tie-rod. There is a seat or collar cast on each side of this head to carry the ridge, which is bolted through it on each side. From the hammer-beam there is a curved strut framed into the wall-post and beam resting on a stone corbel. The intermediate principals have no tie-rod or king-bolt (these are replaced by a king-post), and the collar is braced to the rafters; the iron head and shoe remain. The collar is strengthened by straps to king-post and rafters. In this truss there is a short tie-bolt passing through the hammer-beam and holding in the longitudinal beam. This latter runs the whole length of the building and the hammer-beams of all rafters, principal and common, are framed into it.

The purlins are housed and tenoned into the sides of the principal rafters. This is necessary, because backs of all rafters lie in one plane. The common rafters are all framed in trusses and caulked into purlins and notched over ridge and plate. The framing pieces of the plates are so arranged that every alternate rafter shoes on top, the others being bird's-mouthed to the plate. The reason for this is obvious after my previous remarks about purlins. The common rafter truss consists of rafters, collar braces, ashlars, and hammer beams, and alternate long cross-braces, with a short collar between. In framing the plates the principal hammer beams are notched down over the inner plate, while the outer plate passes by almost clear of the cast-iron shoe. The hammer beams to common rafters lie on the top of the plates. The roof is also counter-rafted diagonally, the slate battens being nailed to these rafters.

We have several times had occasion to say something upon this subject, but again we want to point out a field which it will pay to cultivate—gas ventilation. It requires very little gas indeed to move a relatively large quantity of air. There does not seem much reason why schoolrooms, assembly halls, offices, smoking rooms, dining rooms and restaurants, and many other places should not use gas to ventilate them economically and successfully.

A PNEUMATIC HAMMER-SAW.

We show a rather novel application of the pneumatic hammer. On the end of the piston rod of the machine is placed a saw blade which is reciprocated rapidly, approximately to 1,000 strokes per minute, and in this way a pneumatic saw of very handy construction and rapid work is made available. Here is a portable hand



saw, which may be placed in any position and which, without exertion on the part of the operator, is capable of doing rapid and economical work. This saw can be operated by a boy when used for common work. It should be useful in pattern shops for cabinet work, and for wood carving. We have been informed that this machine is in practical operation in a packing house in Chicago, and that it is used there for the purpose of sawing ham bones.

EARLY USE OF A BUILDING BALANCE.

An interesting explanation has recently been given of the methods used by the architects and builders of the early cathedrals to determine the equilibrium of the arches and supporting columns. The various problems connected with their construction were solved by a graphic method, which involved the use of the "Bauwage," or building balance. This consisted of a flexible cord in the form of an inverted arch, passing over pulleys at either end, the cord being drawn into an equilibrium polygon by weights suspended at various points along the cord, each proportionate in position and amount to those which the arch would be required to carry at its various points. By means of weights connected with the cords passing over the pulleys at each end the system was supported and the horizontal force also measured. From the curve thus obtained the various elements could be readily calculated and a reliable method of construction devised. The system was employed by the so-called master builders, who were included in a guild that extended over Europe during the Middle Ages. Through this guild the traditions and higher knowledge of the building art were confined to a few masters in each country, and there is every indication that they were endowed with more than mere artistic feeling and intuition in carrying out out their constructions. The graphic method described was used before 1585, but previous to that time it is hardly thought to have carried with it any special knowledge of the laws of statics.

A company has applied to Congress for leave to lay underground pipes in the streets of Washington, the U.S. capital, for the purpose of distributing cool air through residences and business establishments. The air will be pumped through a refrigerating plant.

FIRE ESCAPES ACTS.

In the Revised Statutes of Nova Scotia, Fifth Series, the Act dealing with fire escapes provides for the establishment of a Board of Fire Escapes in every city, town and village in the province. The board is authorized to examine buildings and is empowered to order the construction of fire escapes where it deems them advisable. Each board is instructed to pay particular attention to all churches, charitable institutions, poor houses, insane asylums, school buildings, factories, theatres, hotels and other buildings within its jurisdiction in which an unusual number of persons work, congregate or abide; and it is given power to order the enlargement and alteration of the doors, passage-ways, stair-cases and windows in all such buildings in such manner as it may deem best for the protection of the inmates and so as to afford a ready means of escape in case of fire or panic. The board was further required to report annually. In 1892 the Fire Escapes Act was further amended so as to place the appointment of the boards with the town councils. Each board was to consist of three members, and provisions were made to require attention to their duties. The British Columbia law on the subject is somewhat similar to that of Nova Scotia.

CLASSIC IRONWORK.

At the meeting of the Birmingham Architectural Association held on Friday evening last, Mr. Thomas S. Elgood (of Elgood Bros., Leicester) read a paper on "Different Types of Classic Iron-work," a subject to which says the Builders' Journal, he has devoted many years of study.

Beginning with Italy, he pointed out that though that country was the very home of the Renaissance, though the Italians produced such marvellous results in every other branch of art yet they did not evolve any great and characteristic Renaissance style of iron-work. Rather, the different cities seemed to develop little styles of their own, that of Venice being very distinct from many of the others. This was illustated by sketches made in Pisa, Florence, Venice, and Verona.) The Germans, too, though they were so great in smith-work and so readily adopted Renaissance qualities in their armour, locks, and other articles, did not freely assimilate classic ideas in their architectural iron-work, but wasted their ingenuity and strength upon the well-known puzzle iron-work, the flatness and insipidity of which is fortunately relieved in many cases by really good foliated and floriated crestings. When they took up the Rococo they overdid it in the most painful manner. The French, in the times of Louis XIII. and Louis XIV., produced that most remarkable and most Classic style known as the Baroque or Jesuit style, and embellished their buildings with gates, balconies, and balustrades designed in the best spirit of the Renaissance and executed with unsurpassed skill. (This was illustrated by many examples from Paris, Versailles, and Rouen.) Of the Rococo which followed, the lecturer had little to say, and few examples to show. Later, again, in the time of Louis XVI. and the Empire, a more simple and Classic taste returned, but not the wonderful genius of the Baroque period. In Spain at the end of the fifteenth and on through the sixteenth century the Plateresque (or silversmiths') style of iron-work grew up, giving to posterity all those wonderful screens or rejas in the great cathedrals at Toledo, Cuenca, and Palencia; also that wonderful gem—the pulpit at Avila, and balustrades like that at Burgo. The illustrations of these examples were taken from Mr. A. N. Prentice's book and were supplemented by a fine photograph of the exquisite Spanish gates in Chester Cathedral, which are of the very best period. In England the so-called Queen Anne style of ironwork was developed. Small beginnings are noticeable as far back as Elizabeth; the most remarkable developments took place during the reign of William and Mary, particulary under Wren, who employed at Hampton Court and at St. Paul's Cathedral Jean Tijou as designer and Huntingdon Shaw as smith. Some of the best illustrations to the paper were from these two buildings, Mr. Elgood's favourite being the gates leading into the choir aisles at St. Paul's, which he spoke of as one of the very finest examples of the architectural treatment of wrought iron. Under Anne and the early Georges the style became more simple, and examples are too numerous to catalogue. They may be studied to advantage all about London, in the Cathedral cities, and at the Universities (particulary Cambridge), as well as in the gates to many country parks. Thus we have three great styles: The French Baroque, the Spanish Platersque, the English Queen Anne; and three lesser ones: The Italian, the Rococo, the Empire; and of them all the most adaptable and most economic is the English.

TESTS OF MASONRY AND BRICKWORK.

The Royal Technical Testing Laboratory at Charlottenburg under the direction of Professor Martens, has been making for some time a series of actual tests of brickwork and other masonry under conditions approaching, as nearly as possible, those which obtain in chimney construction.

The tests were instituted to examine into the following conditions:

1. Resistance of the single pieces to pressure, and to the action of weather, water, and acid vapours.
2. Resistance of mortar joints in general.
3. Resistance of mortar when the force acts at right angles to the constructlon as in the case of wind pressure.
4. Resistance of the vertical joints to circumferential pressure.

Some of the results will be of interest. The mean of a number of crushing tests upon brick alone was 671 kilogrammes per square centimetre, or about 613 tons per square foot. The compressive resistance for mortar joints from 1 to 5 centimetres thick, and 28 days old, ranged from 230 down to 54 kilogrammes per square centimetre, the higher values being for the thinner joints; and the general mean of 300 tests was 131.7 kilogrammes per square centimetre, or about 120 tons per square foot. Tensile tests of motar joints showed figures ranging from 0.8 to 3.9 kilogrammes per square centimetre, or from 10 to 55 pounds per square inch, the mortar in the highest case being 90 days old. The transverse and longitudinal trials were practically shearing tests, and gave the resistance of the combined brick and mortar, the rupture taking place through the mass and breaking both portions of the section. For mortar 90 days old the resistance to horizontal shearing was about 14 kilogrammes per square centimeter or about 200 pounds per square inch, while against vertical shearing it was about 9 kilogrammes, or about 130 pounds per square inch. Crushing tests made of brickwork masonry 9 months old gave an ultimate crushing resistance of 239 kilogrammes per square centimetre, or 218 tons per square foot, figures which may be of service in other connections than that of chimney construction.

BY THE WAY.

THE strengthening value of central real estate in Toronto, is indicated by the renewal of a ground lease on King street west the other day at $1,800 per year which under the former lease brought the owner only $1,300.

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MR. Lennox, architect of the new Municipal Buildings at Toronto, states that there were used in the construction of these buildings 12,000,000 bricks and several hundred thousand feet of quarried, dressed and cut stone. More material and workmanship is said to have gone into these buildings each year since 1892 than would be required to erect the largest offiice building in the city.

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A WRITER in the Builders' Journal discusses the origin of the word "Galilee" as applied to the porches of churches. He thinks the learned authors have been looking in the wrong direction when searching Hebrew dictionaries for a derivation of this term, which he contends is a corruption of the word "gallery" or "galery" from the low Latin Galeria, a long porch.

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THE ambition of the citizens of "The Ambitious City" as exemplified in the work of the City Improvement Society, is highly commendable and should serve as an example to other cities. As its name implies the society was organized to promote public improvements. Prizes were recently awarded by the society to citizens for the most attractive lawns and windows on Smith avenue, James street, North Napier and Pearl streets.

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THE City Solicitor of Toronto reports that the fire by-law of that city compels the placing of fire escapes on factories, hotels, boarding and lodging houses, places of public amusement, and other public buildings over three stories high. The enforcement of the law devolves upon the City Commissioner. The City Solicitor states, however, that under the terms of the provincial laws, the enforcement of the by-law with respect to factories and hotels is taken out of the city's hands. The need of proper fires escapes is nowhere greater than in the case of hotels and factories. It is to be hoped therefore that the provincial inspectors are doing their work as it could be done by the city.

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THE subject of heating and ventilation of churches has been under consideration of late in the pages of the religious and secular press, and as usual opinions differ. The Christian Observer says that every autumn there is need for a careful study of church heating and ventilation. The fear of the Observer is that owing to defectives pipes or chimneys it may get hot—be consumed in fact. The Toronto Globe says:—We know of churches, however, where the difficulty is that on cold Sundays there is not enough hot air comes up through the registers to keep the temperature much above freezing point. References on such occasions to another and a warmer world have no terrors for the preacher's shivering hearers.

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THE expression "The Great Unwashed" has become a familiar one to designate the lowest strata of society in our large cities. It would seem that many respectable persons are in danger of being included in the category, simply because proper facilities for cleanliness are denied to them. Recent enquiry has revealed the fact that out of 115 houses within a certain area in one thickly populated district of Toronto, only five contain baths. No better proof is required of the need for public bathing facilities such as are provided by every town and city of England. Mr. W. J. Gage, an enterprising citizen, offered to build and equip a public bathing house if the city would provide a suitable site ; but the council were so lacking in appreciation that nothing was done. By the purchase of the Athletic Club buildings for a technical school, the city has recently come into possession of magnificent swimming baths, which under proper restrictions should be placed at the disposal of the thousands whose circumstances compel them to live in houses which not only have not "all modern improvements" but lack that essential to cleanliness and health, a bath tub.

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TORONTO archeologists will be interested in the description given by Mr. D. H. Every, of Pickering, of a mysterious stone or monument, situated on the east bank of Duffins' Creek in that township, about two miles south of the village of Pickering. The monument rises about eight feet above the level of the ground, and is about eight feet square. It was evidently built square, and is not a stone proper, but made up of a number of stones, cemented together with a cement resembling mortar. The stones are small, and just such stones as are to be picked up in the fields. The monument is covered with moss, and a large pine tree has grown on the upper part of it. This tree has been cut down, but the stump still remains. Within the memory of the oldest settler it is said there was a hole to be seen in the top of the monument filled with lead. This hole, however, cannot be seen now, as it is overgrown with moss.

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THE Chinese have a god of architecture who is worshipped when a new house is built, but he is ignored until the time comes for the builders to commence work. The Rev. W. Hopkyn Rees says, in the December issue of the Magazine of Art, that there is no society to safeguard the interests of architects in China, as professional architects do not exist ; each man settles his plan verbally with the builder. There is little fear of dissatisfaction, however, as no break in the "style" has occurred for centuries. Comparatively few of the buildings have any architectural beauty. Kiln made bricks cost 10s a thousand, sun-dried bricks about 2s 6d a thousand, while the windows of the houses are made of wooden gratings covered with oiled paper. Some of the pagodas (of which there must be at least two thousand in the empire) are elegant—like that, for example, in the Summer Palace at Pekin—and it is remarkable how long they remain standing. There is one not far from Shanghai, 170 feet high, which was built in the twelfth century. The White Pagoda in Peking was built in 1100 A.D. But looked at by Western eyes Chinese architecture is a poor thing ; it is not comparable with the great Indian buildings.

Egg-shell gloss in paint work may be prepared by a number of coats carefully rubbed down between each, and by using plenty of turps and a little oil in the last coats—not sufficient, however, to render the job glossy, and yet enough to prevent it from drying entirely flat.

MANUFACTURES AND MATERIALS

THE QUARRIER.

When the fuse is lit and the blast goes off,
The whole hill shakes with the shock;
For there's thirty feet of a quarry face,
And most of it solid rock.
The quarrier's heart beat fast and high
With the clash of hammer and drill,
For he feels as the giants felt of old,
Who warred with the ribs of the hill.
The hammer of Thor that split the rocks
And cleft the hills apart,
He wouldn't take for his tried old "spawl,"
The delight of the quarrier's heart.
Old as the world his kingdom is,
And wide as the widest hill:
As a king he rules with an iron rod,
His sceptre a jumper or drill.
What Nature made in a million years
By the light of sun and star
He overturns in a single day
With hammer and gad and bar;
He knows the seams where the stone will split
To the sturdy stroke and strong—
Where the waters waved o'er the hard'ning mass
For myriad ages long.
He tells of tons by a shot brought down—
A "knack" that it's hard to acquire—
Of "narrow squeaks" when the fuse was damp.
And the treacherous blast hung fire.
With hairy arm like the old moss'd rocks,
And hands that are as hard as stone,
The quarrier boasts of his deeds, and thinks
No trade is as good as his own.

—"Uloola," in the Quarry.

PLATE GLASS.

Plate glass, says the Journal of Building, is made of sand, soda and lime, fused at a very high temperature into a double silicate, which is called glass.

The casting may thus be described: When one enters for the first time into one of the vast plate glass works at night the furnaces are closed, and the dull sound of a violent, though captive, fire alone interrupts the silence. From time to time a workman opens the working hole to look into the furnace at the condition of the glass. Long, bluish flames then light up the sides of the annealing ovens, the blackened beams, the heavy casting tables, and the mattresses on which half-naked workmen quietly sleep. Suddenly the hour strikes, the call is beaten on the iron slabs which surround the furnace; the whistle of the foreman is heard, and thirty strong men rise up. The manœuvres begin with the activity and precision of an artillery movement. The furnaces are opened, the glowing pots are seized, drawn out and raised into the air by mechanical means. They pass like hanging globes of fire along the beams, then stop, and are lowered over the immense cast-iron table, placed, with its roller, before the open mouth of the annealing oven. The signal given, the pot is inclined quickly, and the beautiful opal liquid, brilliant, transparent and unctuous, falls and spreads over the table like ductile wax. At a second signal the roller passes over a red-hot glass, a workman, with his eyes fixed on the firey substance, skims off the apparent defects with bold and skilful hand, then the roller falls and passes off, and twenty workmen, provided with suitable tools, quickly push the glass into the oven, where it is annealed by slowly cooling. The workmen then return the emptied pot to the furnace and begin again without disorder, without noise, without rest, until all the pots of the furnace have been cast. The pots are refilled, the furnace reclosed, darkness again falls, and the continuous noise of the fire preparing fresh work is again the only sound heard.

The glass is now opaque and must undergo the different processes of grinding, smoothing and polishing to make it transparent. As it has to transmit or reflect light, no defect in it must disperse or obscure its rays. By this mechanical work the glass loses at least one-third of its weight.

When we add to this the fact that about ono-half the weight of the lime and soda originally used to produce the glass, released by heat, escapes into the atmosphere in the shape of carbonic acid and sulphuric acid, one may get some idea of the vast waste of material and the consequent cost of converting such homely substances as sand, soda and limestone into such a beautiful article as plate glass.

But here comes the mistaken idea of the costliness of plate glass. Scarcely any article manufactured in this country has so greatly declined in price. Formerly it was looked upon as a great luxury, in which none but the wealthiest could indulge; but now, if it has not become a necessity, it has reached a point where anyone who can build a house, however humble, can well afford to use plate glass in it, for there is nothing that adorns the beauty of a home, gives equal delight to its possessor, or adds so much in value to it at so slight a cost as plate glass.

PRODUCTION OF BUILDING MATERIALS IN ONTARIO.

The annual report of the Ontario Bureau of Mines as usual contains statistics of the quantity and value of building materials. In building materials proper, including stone, brick, lime and cement, the values were $3,556,366, or $1,107,704 more than in 1898. The value of cement rose to $561,266, being $184,948 more than in 1898, and nearly 80 per cent. of the whole was Portland cement. Since 1894, when this cement began to be made in the Province, the production has increased from 30,580 barrels to 222,550 barrels, and the value from $61,060 to $444,227, and during this time the value of imports has been steadily increasing. In the last fiscal year it reached 1,300,424 cwt., valued at $467,944, in the face of a duty of $147,145. The value of drain tile, sewer pipe, paving brick and pottery in 1898 was $522,152, or $48,435 more than in the previous year.

MANUFACTURING NOTES.

It is reported that a syndicate has been formed to buy up all the quarries and water privileges on the Magaguadavic, near St. George, N.B., with the idea of controlling the red granite trade of Canada.

The City Engineer of Toronto has reported adversely to the Committee on Works on the advisability of the city buying and testing all the cement used in the construction of sidewalks and roadways.

Incorporation has been granted to the Canadian Bridge Co., of Walkerville, capital $250,000, to manufacture railway bridges, etc. The provisional directors include B. S. Colburn, F. C. McMath and G. F. Porter, all of Detroit, Mich.

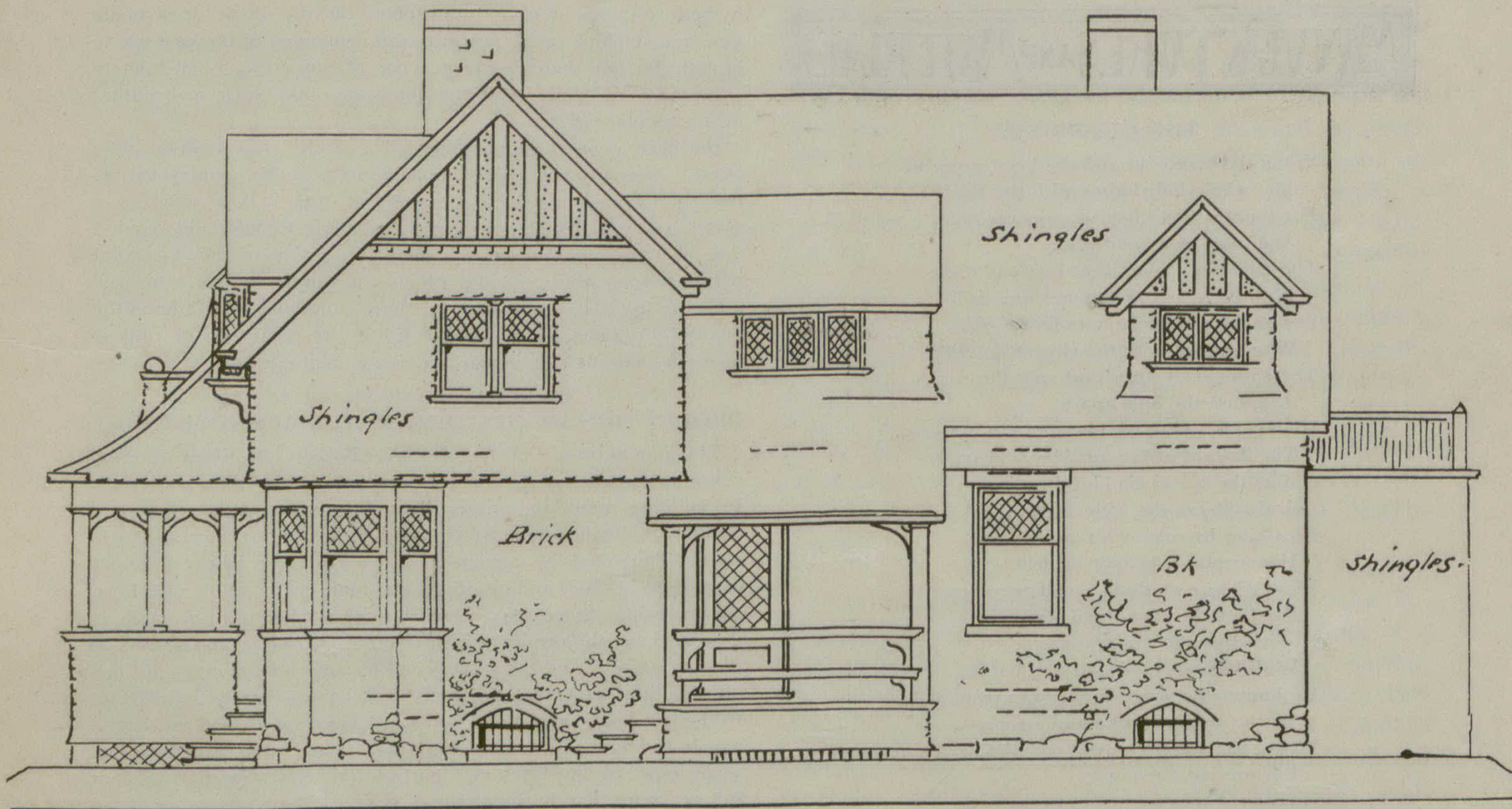
The following companies have recently been granted charters of incorporation:—The Hanover Portland Cement Co., capital stock $50,000; The Windsor Turned Goods Co.. capital stock $50,000; The Welland County Lime Works, Port Colborne, Ont., capital stock $30,000.

A most enjoyable evening was spent by the members of the Canada Paint Co. and their guests on the occasion of the ninth annual company dinner, held at the Place Viger Hotel, Montreal. Mr. D. W. Parks, who is severing his connection with the company, was presented with a gold locket.

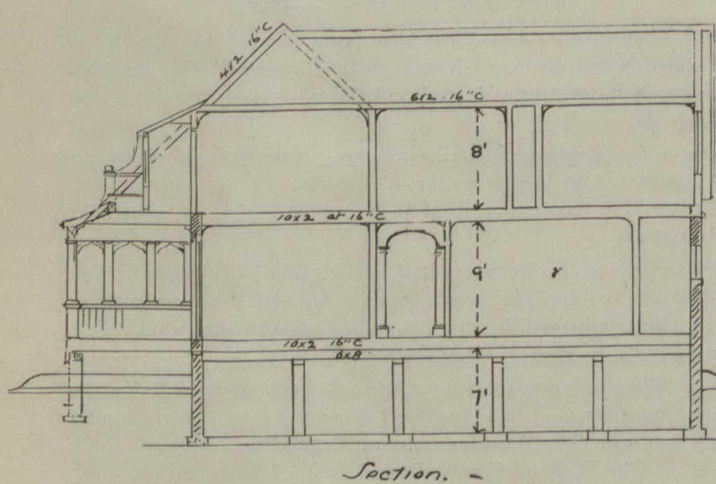
The Imperial Varnish Co., of Toronto, have recently issued an attractive booklet referring to the variety and quality of their architectural varnishes. They state that these varnishes, which are adapted for exterior and interior use, are very carefully prepared from selected materials, are thoroughly ripened, properly tested before filling into cans, and are guaranteed to do the work for which they are designed.

Some time ago a number of manufacturers of stoves and heating apparatus in Ontario gave an option of purchase of their properties to the representative of an American syndicate. The amount of money required .o carry out the idea was between $7,000,000 and $8,000,000. The time limit expired on the first of January, without the purchase having been consummated, and it understood that so far as most of the companies are concerned, the deal is off. Some Hamilton firms are said to have given a second option.

A strong effort is being made in North Wales to introduce improved methods in slate mining. At Festiniog, the great centre of the slate industry, the quarrymen and managers held a conference and decided that the time had arrived for the establishment of a mining school. This conference approached the authorities of the Bangor College, and succeeded in getting them to acknowledge the need and in endeavoring to meet it. The object in view is to reduce by scientific methods the cost of production, and thus to withstand foreign competition.



SOUTH.



the same principle as glazing and graining. Hence the more transparent the color used, the better the stain.

RED STAINS FOR WOOD.—For the production of red stains for wood the "Allg. Tischler Zeitung" gives the following directions in reply to the question of a correspondent:—Since the stains have, as a rule, a bleaching action on the wood, the latter may generally be colored red without special preparations. If, however, the wood to be stained is not light-colored, it is advisable to bleach it previously. For this purpose, lay the wood for about one-half hour in a bath of 2 parts lime-chloride, 1 part chrystallized soda, and 48 parts water. After the bleaching lay the wood, to remove the adhering traces of the chloride, in a solution of 1 part sulphurous acid, in 10-12 parts water and wash it off with clean water. Now place the wood in a solution of 1 part Marseille soap, in 54 parts water, or rub it with it and apply aniline red (fuchsine) in a sufficiently diluted state so as to produce the desired shade. Fuchsine (crimson), coralline (high red), and eosine (amaranthine), belong to the aniline colors which are dissolved either in alcohol or water.

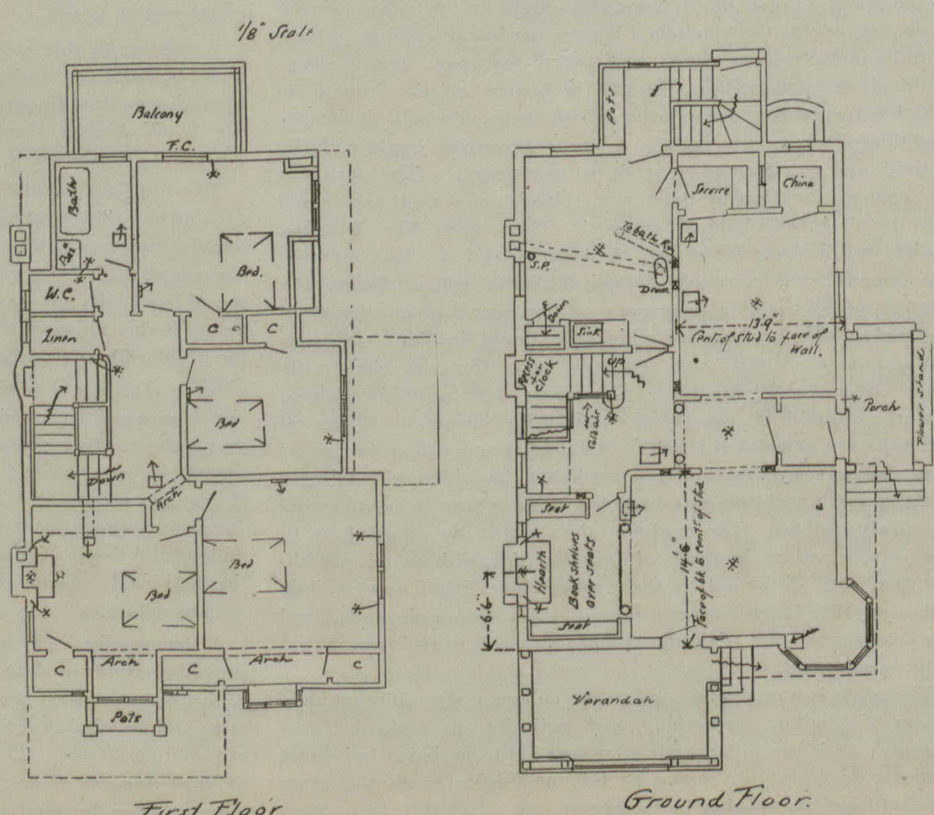
BUILDING IN TORONTO.

The total value of buildings for which permits were granted in Toronto during 1900, is placed at $1,957,274, being $50,000 less than 1899, which was the best year since 1892. The sum of $988,000 was expended for warehouses and factories, indicating a substantial growth in manufacturing and population and an increased demand for dwellings, of which a large number will no doubt be built next season.

USEFUL HINTS.

In finishing white maple, use only one coat of varnish, in order that wood shall retain its whiteness; and let this be the lightest copal, of good body.

A stain to show at its best must exhibit a tone of color which comes from a combination of the color of the wood and the pigment or stain used, on



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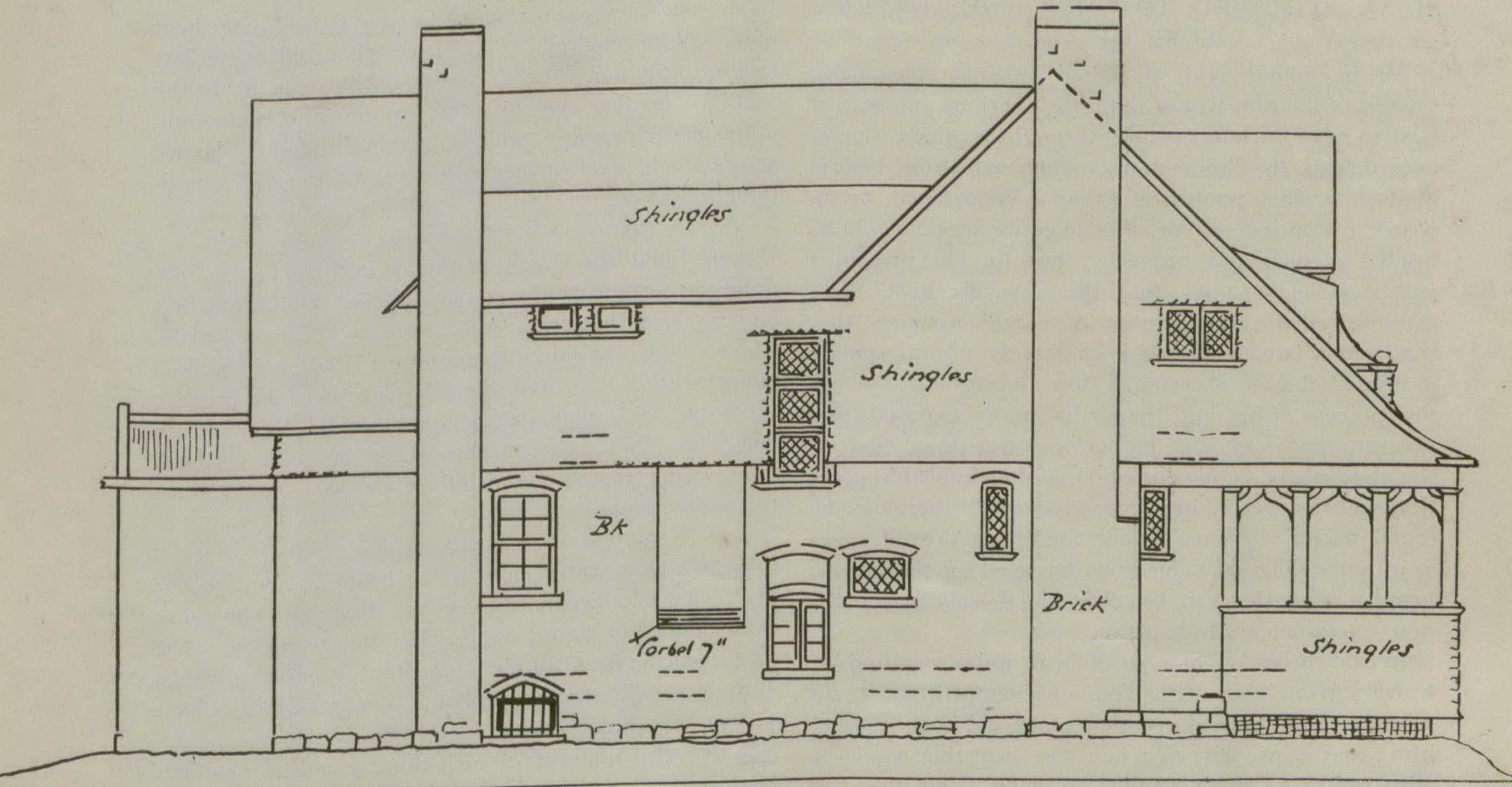

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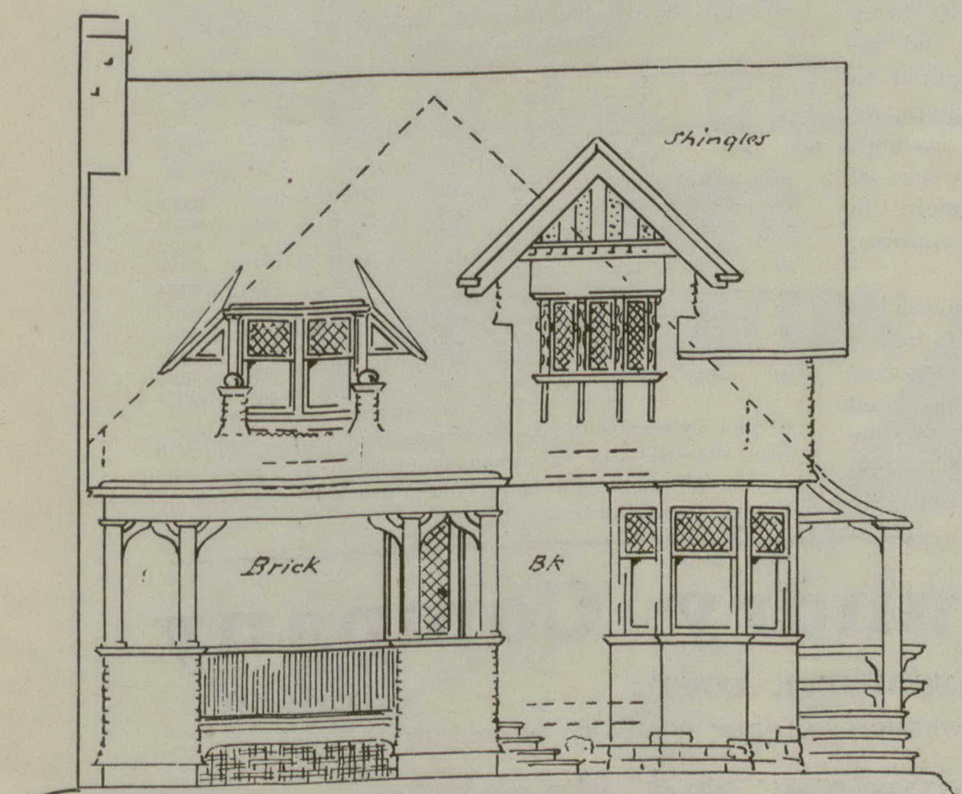

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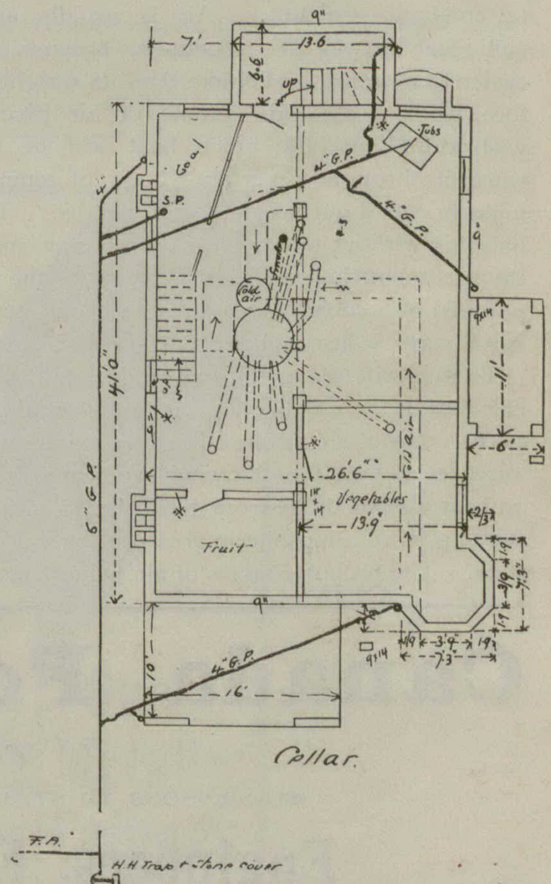

WORKING PLANS FOR COTTAGE—R. J. EDWARDS & WAGNER, ARCHITECTS.

HEAT REQUIRED TO RAISE THE TEMPERATURE OF AIR.

Air, in common with all other gaseous substances, possesses the property of requiring various amounts of heat to raise its temperature through a given range, according to the circumstances under which the heat is applied. This point is of so much importance, says a writer in Compressed Air, that an entire article would be needed to elucidate it properly ; but for the present it will be sufficient to say that the "specific heat" here given for air (i.e. the number of 0.238) assumes that the air that is to be heated is constantly at atmospheric pressure—that is, it assumes that throughout the entire process of heating, the air is never exposed to a pressure that is sensibly higher or lower than that of the atmosphere. This condition is often fufilled in practice, and the specific heat here given will therefore be found useful. When other conditions prevail, however, some different value must be used for the specific heat—a value that can be determined only when the new conditions are fully given.

In calculating the number of heat units required to warm a given mass of air from one temperature to another one, we proceed precisely as we did in the case of iron ; that is, we first calculate the heat that would be absorbed by an equal weight of water, and then we multiply by 0.238, which is the "specific heat" of air (at constant pressure.) Air is usually estimated in cubic feet instead of in pounds, because it is much easier to measure its volume than its weight. If, therefore, we have a certain volume of air given, and we wish to find out how much heat will be required to warm it through a certain range of temperature, we must first find out how much it weighs. To accomplish this without too much labor we may make use of the accompanying table, which gives the weight (in pounds) of a cubic foot of air at various temperatures, but always at atmospheric pressure.

To illustrate the use of this table, and the method of calculating the number of heat units required to heat a given mass of air through a given range of temperature, let us take the following problem : It is proposed to heat a mass of air from 50° Fahr. to 110° Fahr., by passing it, at atmospheric pressure, over a coil of steam pipe. The proposed mass of air, when measured at 50° Fahr., occupies 500,000 cubic feet. How many heat units will be required ? To solve this problem we first find out how much the air weighs. By referring to the table we see that one cubic foot of air at 50° Fahr. and atmospheric pressure, weighs 0.078 of a pound. Hence 500,000 cubic feet (measured under these same conditions) will weigh

$$500{,}000 \times 0.078 = 39{,}000 \text{ pounds.}$$

Having found the weight of the air in this manner, we proceed to calculate the amount of heat required by first figuring it as though the substance to be heated were water. Thus the initial temperature is 50° and the final temperature is 110° and the difference between these is 110°—50° = 60°, which is the number of degrees through which the temperature of the mass must be raised. There being 39,000 pounds of the air, we should have to communicate

$$39{,}000 \times 60 = 2{,}340{,}000 \text{ heat units}$$

to it, if it were water, in order to heat it from 50° to 110°. To take account of the fact that the substance is air instead of water, we multiply this result by 0.238 (the "specific heat" of air at constant pressure), just as in the case of iron we multiplied by 0.117. Thus we have

$$2{,}340{,}000 \times 0.238 = 556{,}920 \text{ heat units,}$$

which is the quantity of heat that would be required to raise 500,000 cubic feet of air from 50° to 110°, the air being measured at 50° Fahr., and its pressure remaining equal to that of the surrounding atmosphere throughout the operation.

WEIGHT OF A CUBIC FOOT OF AIR, AT ATMOSPHERIC PRESSURE (.0 to 600° F.)

Temperature of Air. (Fahr.)	Weight of a Cubic Foot. (Pounds.)	Temperature of Air. (Fahr)	Weight of a Cubic Foot. (Pounds.)	Temperature of Air. (Fahr.)	Weight of a Cubic Foot. (Pounds.)	Temperature of Air. (Fahr.)	Weight of a Cubic Foot. (Pounds.)
0°	.0864	100°	.0710	200°	.0603	300°	.0523
10	.0864	110	.0698	210	.0594	320	.0510
20	.0828	120	.0686	220	.0585	340	.0497
30	.0811	130	.0674	230	.0576	360	.0485
40	.0795	140	.0663	240	.0568	380	.0474
50	.0780	150	.0652	250	.0560	400	.0463
60	.0765	160	.0641	260	.0552	450	.0437
70	.0750	170	.0631	270	.0545	500	.0414
80	.0736	180	.0621	280	.0538	550	.0394
90	.0723	190	.0612	290	.0531	600	.0376

Green grey woodwork may have medium robin's egg blue with a frieze of deeper blue, a cornice of bluish green, greys and silver, a ceiling of light bluish and green grey, and the upholsterings and draperies of citron yellow.

LEGAL.

DEVINE V. McDONALD.—J. Lorne McDougall (Ottawa), for defendant, moved to set aside verdict and judgment for plaintiff for $1,000 in an action for negligence tried before Rose J., and a jury at Ottawa, and for a non-suit, upon the ground that there was no evidence of negligence to go to the jury, or for a new trial. The defendant was contractor for the erection of waterworks in the Village of Hintonburg, and in the course of doing his work used dynamite and exploding caps. The plaintiff, a boy of eleven, picked up a cap upon a vacant lot near the works, and, after some fruitless attempts, exploded it. The result was that he lost one eye, and that the sight of the other eye was affected. There was no direct evidence that the cap was left on the vacant lot by the defendant or his workmen. Plaintiff's counsel opposed the appeal, and contended that the onus was upon the defendant to rebut the presumption that the cap was left lying where the plaintiff could get it by the negligence of defendant's workmen, and that the defendant had not discharged that onus. Held, that upon the answers of the jury to two of the questions the defendant was entitled to succeed. The jury did not find that the cap was left lying where the plaintiff found it by the defendant's workmen, and they did find contributory negligence on the part of the plaintiff. Order made setting aside judgment and dismissing action, but without costs.

A CASE UNDER THE WORKMEN'S COMPENSATION FOR INJURIES ACT.—A Canadian firm of cement manufacturers had in their factory a machine known as a 'screw conveyor,' which took from one part of the building to another the current discharged into it from a drop spout connected with a conveyer. The conveyer was operated by machinery, and made from 70 to 80 revolutions per minute. It was formed of a large iron screw set in a wooden box, the cover of which was removed. Some months after, the machine was put up, partly in order to mix some fine cement with the ordinary cement which was passing from the spout. This fine cement was in sacks which, when full, weighed about 65 pounds. An employee was, as directed, slowly emptying the cement from one of these sacks, when it stopped coming out. He shook the bag, and in doing so lowered it. The screw caught it, and the jerk pulled the employee round, and his hand was brought down between the side of the box and the screw. For the injury he thus sustained he sued his employers, and the jury gave him $500 damages. The cement manufacturers appealed from this on two grounds, which will be considered separately. (1) They said that there had been no negligence on their part, and that the employee would not have been hurt if he had not been negligent himself. The court decided that though the machine was perfect for the purpose for which it was made (i.e. as a conveyer), yet that it was not meant to be a 'mixer,' and therefore when it was used as one it was a defective machine, and therefore the employers were liable for injuries caused by it to their employees. It was also held that the employee himself had not been careless. (2) The Workmen's Compensation for Injuries Act (under which this action was brought) says that the injured employee must give written notice of the injury to the employers within twelve weeks after the accident. In this case the cement manufacturers claimed that, as his notice had not been duly given, the suit should be dismissed. But another part of the same Act provides that if the employers intend to rely on the want of this notice as a defence to the action, they themselves must give the employee notice that they mean to do so 7 days before the trial. In this instance that had not been done. The employers had merely mentioned the want of notice in their statement of defence, which was not sufficient. The verdict for $500 was therefore upheld.

The name of the Georgian Bay Portland Cement Co., Limited, of Owen Sound, Ont., has been changed to The Imperial Cement Company, Limited.

Mr. Hoyt in company with Mr. Peters, city engineer, recently inspected several sites in St. John, N. B. for smelting works. It is estimated that one hundred tons of limestone per day will be required in connection with the smelting operations.

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PLUMBING IN TORONTO.

From the report of the Health Department of Toronto, it is learned thar the character of the plumbing in that city has vastly improved within the last three or four years. During the period of speculative building an enormous amount of plumbing work was done. Since then the adoption of a plumbing by-law which provides that all plumbing and house drains must be inspected and certified to by the city's inspectors, has led to a large part of this defective work being done over again and made to conform to the proper sanitary requirements.

Colour is to the vision what sound is to the ear; but like sound, it should be properly understood and well harmonized, so as to produce as pleasurable sensations for the eye as the notes of a great musician produce for the ear.

Mr. C. W. Young, publisher of the Cornwall Freeholder, has issued a most interesting and creditable souvenir number of that paper to mark the opening of the 20th century. It is handsomely printed and illustrated, and is devoted principally to articles descriptive of the town of Cornwall and its industries and institutions.

The past season has been a rather quiet one so far as building operations are concerned in Hamilton. The number of permits issued was 162, and their value $335,000. The bulk of the work done represented enlargements and alterations of existing buildings and factory work. There is a probability that steel manufacturing works may be established on a large scale in the east end of the city. If this project should be carried out, it is estimated that 5,000 workmen will be employed, and a large number of workmen's dwellings will be required. It has been suggested that if these works should be established, opportunity would be afforded a capable architect of designing and arranging to the best advantage these new dwellings. There is, however, no certainty as yet that the works will be established.

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DESECRATION OF THE TOWER OF LONDON.

Anything more atrocious than the new guard house at the tower of London could not well be imagined, says the London Builders' Journal. Not that the building itself is any worse than the general run of buildings designed in the present age ; but to set down this fiery red-brick erection with its staring stone dressings under the scarred grey walls of the White tower, pregnant with a nation's history, is a piece of vandalism that could only be accomplished in the nineteenth century. It would be interesting to know why a new guard house was needed at all, for no one can pretend that the tower is an active fortress upon whose efficiency the safety of the city in time of war depends, and the garrison it possesses is there placed more as a courtesy to its past power and grandeur, for convenience sake and as a guard to the regalia, than as an active fighting force. As the years go by the public is being gradually shut out of the tower altogether, and it is becoming evident that from motives of economy the authorities desire to turn the place into barracks and end its more fitting career as a museum of feudal history. But even the total exclusion of the public from the tower would not justify the destruction of its beauties by such buildings as guard houses, and it is small balm to antiquarian feeling that the Roman citadel foundations and well have been generously preserved while the new erection remains to shriek our shame and inappreciation to the coming generations.

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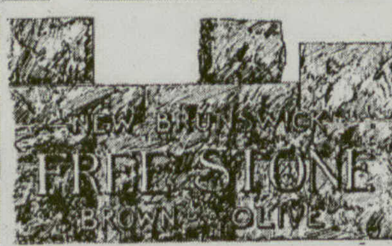

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