

CANADIAN ARCHITECT AND BUILDER.

VOL. IV.—No. IV.

TORONTO AND MONTREAL, CANADA, APRIL, 1891.

PRICE 20 CENTS
\$2.00 PER YEAR.

—THE—

CANADIAN ARCHITECT AND BUILDER,

A Monthly Journal of Modern Constructive Methods,
(With a Weekly Intermediary Edition—The Canadian Contract Record),

PUBLISHED ON THE THIRD SATURDAY IN EACH MONTH IN THE INTEREST OF
ARCHITECTS, CIVIL AND SANITARY ENGINEERS, PLUMBERS,
DECORATORS, BUILDERS, CONTRACTORS, AND MANU-
FACTURERS OF AND DEALERS IN BUILDING
MATERIALS AND APPLIANCES.

C. H. MORTIMER, *Publisher,*

14 King Street West, - TORONTO, CANADA.
62 TEMPLE BUILDING, MONTREAL.

SUBSCRIPTIONS.

The CANADIAN ARCHITECT AND BUILDER will be mailed to any address in Canada or the United States for \$2.00 per year. The price to subscribers in foreign countries, is \$3.50. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for, if so stipulated by the subscriber; but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

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The "Canadian Architect and Builder" is the official paper of the Architectural Associations of Ontario and Quebec.

The publisher desires to ensure the regular and prompt delivery of this Journal to every subscriber, and requests that any case of complaint in this particular be reported at once to the office of publication. Subscribers who may change their address should also give prompt notice of same, and in doing so, should give both the old and new address.

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MR. W. C. McDONALD, of Montreal, has placed the youth of Canada under deep obligation to him by his recent bequest of \$40,000 for the endowment of a chair of electrical engineering at McGill University. Thus the means has been provided by which our young men may obtain the knowledge they require without being obliged as heretofore to go beyond the bounds of their own country. We learn that the electrical laboratories in the new building, now in course of erection, will contain all the necessary apparatus and facilities for electrical work, and the classes of the professor of experimental physics with all the apparatus at his disposal will also be available for the instruction of the students in this department.

A MONTREAL plumber addressing the plumbing class at the Montreal School of Arts, is reported to have imparted the following advice: "Improve your minds, read good books of all kinds, take the trade papers, keep posted and well up, and when an opportunity for a good position comes, as come in the course of time it must, you will be qualified to fill it, and if the best qualified you will be sure to get it. * * * Be patriotic, stick up for your town and province and country every time and everywhere. It is your country and my country and well worth working for, and if the necessities ever arise, which God forbid, well worth dying for. See to it that Canada, our country, has some of your time, thought and energy to its building up and future prosperity." This kind of thing sounds grand and inspiring apart from the knowledge that the gentleman indulging in it doesn't practice what he preaches. The patriotism which will assist the progress of this country will consist not of empty sounds, but of deeds.

THE circumstances under which the architect and contractor employed in the erection of the court house at Woodstock, Ont., were dismissed a few months ago, are probably fresh in the minds of our readers. The County Council selected other architects to carry out the work, and appointed them arbitrators to decide what remuneration the contractor was entitled to receive who had been dismissed. The arbitrators have reported that the contractor is entitled to no remuneration whatever. The contractor is not likely to coincide in this opinion, and may be expected to be heard from at an early date through his solicitors. The prediction was hazarded by this journal on a previous occasion that the county authorities of Oxford were unlikely to find that they had arrived so soon at the end of their difficulties in connection with the erection of this court house. Present indications point to the certain fulfilment of that prophecy. It cannot be expected that out of such a bad beginning should come a good ending.

THE Master Builders' organizations of the Dominion could cite a splendid *rationale* for their existence were they to vigorously take up the question of the organization of trade schools after the manner of those being so successfully developed across the border. In these days of machinery and specialization and of jealous journeymen, our youths have little opportunity to learn thoroughly a trade. Masters realize this, but seem powerless to provide a remedy. The supply of well trained mechanics is a vital point in relation to the independence of the master builder and in his ability to turn out satisfactory work. The trade schools, properly conducted, would fill this want, giving boys—sons of tradesmen, mechanics and laborers—an opportunity to thoroughly learn their chosen trade; making the master builders inde-

pendent of the tyranny of the incompetents who so often rule the unions, and raising the technical, if not the artistic quality in a marked degree. Every city has not a Col. Auchmuty. New York may be proud of what he has done for her young mechanics. The Builders' Guilds in Toronto are wealthy enough to institute a successful commencement of the good work. It need not be looked upon as a merely philanthropic enterprise; it would pay from every standpoint, and be a wise move even from a selfish point of view.

The suggestion made by us in our issue for March with reference to the widening of Yonge and King streets, Toronto, at their intersection, appears to have met with considerable favor, as was to have been expected, the congested condition of the traffic in that neighborhood being patent to every citizen. Ald. Score, the chairman of the Parks and Gardens Committee, has put himself on record as being favorable to the improvement. The diagram shown on another page indicates one method of accomplishing it, giving a space from east to west between the buildings of about 140 feet, and extending from King street to the first lane, a distance of about 120 feet. A space in the centre could be reserved for a fountain or statue, and for an oasis or stand where a person could wait for a car, or take refuge in crossing the busy and crowded thoroughfare. These corners—the principal ones in Toronto—will never be dignified in appearance, and will never cease to be dangerous and overcrowded till they are widened and beautified. The increased importance of the new corners and frontages thus opened up would greatly add to their assessed value, and while a considerable portion of the cost of the work could be charged against the properties benefited, the work would be so manifestly to the advantage of the citizens generally that there should be no serious opposition to the scheme. No time will ever be more favorable for a change than the present, the buildings being old and of comparatively little value, and we would urge the wisdom of immediate action.

It is a matter of regret to see imposing and important buildings being erected at the cost of hundreds of thousands of dollars and with little or no protection from total destruction in case of fire. The percentage of the increased cost of fire proof construction is so slight in comparison with the advantages to be gained, that one cannot conceive why level-headed corporations with ample means at their disposal do not see their way clear to its adoption as a matter of course. Several important erections now in progress or contemplation are in fault in this respect. The new legislative buildings are rapidly assuming the appearance, internally, of a vast lumber yard. The University buildings are being largely reconstructed in the old manner, some parts, however, such as corridors, being of slow-burning construction. The stack room only of the new library building is to be fire-proof, which, should it survive intact the fearful baptism of fire that it would have to pass through in case of the destruction of the inflammable portions of the building, would be practically useless without the necessary adjuncts of reading and reference rooms. The Confederation Life Building is another case in point—of semi-slowburning type, but once thoroughly aight, doomed to total destruction with its contents, human and otherwise. Two of these structures will be so high that the most powerful stream of water obtainable would break in useless spray before reaching the roofs, and they would have to be left to their fate. We are strongly of the opinion that no building of more than 60 or 70 feet in height should be allowed to be erected unless of absolutely fire proof construction. We are glad to notice that the Freehold Loan and the Bell Telephone Companies' buildings are to be fire-proofed, and time will show the wisdom and foresight of so doing.

"WHAT this country wants in law, legislation and judicial rulings is a procedure less expensive, more effective, with fewer technicalities and more common sense." With this quotation a Toronto solicitor solicits correspondence from material men and others interested in the working of the Lien Acts with a view to seeking further legislation. We quite agree with the quotation, but not at all with the sentiments of the advertiser. Why in the name of all that is just and fair should Jones have a lien on a load of bricks purchased by Smith any more than Brown who has supplied him with a suit of clothes? If Smith is getting too deeply into Brown's debt, the said Brown refuses further credit

fill the debt is reduced. Why should not Jones do the same? We have no hesitation in saying that the present law has fostered most loose and unbusiness-like habits of doing business. The material men will sell and give extensive credit to irresponsible men, who set up in the business of contracting with little qualification for the position, relying on the Lien Acts to protect them from loss, to the great annoyance of both owner and architect, and sometimes with great loss to the former, who, as a rule, is an innocent and unsuspecting victim. The position of the workmen is different, as they cannot in the same manner protect themselves and at the same time earn their daily bread. For their protection a very simple Act is needed, such as that in force, we believe, in Germany, where the workman has simply to notify the owner in writing that his wages are unpaid, and the amount. The owner then becomes responsible to the extent of any wage-monies yet owing by the contractor, and as this can be done every week, or each day if necessary, the workman runs little risk of loss.

A MODEL BUILDING ORDINANCE.

THE American Institute of Architects, the National Association of Building Inspectors, the National Boards of Underwriters and the National Association of Fire Engineers of the United States, recently appointed a committee to draft a model building ordinance for general adoption. The committee having met and considered the matter, report that owing to varying conditions, the task is at present impossible of accomplishment. They, however, recommend the adoption by State legislatures of the following principles essential to safe construction as a basis for local legislation:

1. That all buildings over seventy feet in height be constructed throughout of incombustible materials, protected in the most approved manner for resisting fire.
2. That interior structural ironwork in all buildings be covered and protected by fireproof material.
3. That all buildings over fifty feet in height be furnished with permanent stand pipes and ladders for the assistance of the Fire Department.
4. That the height of buildings to be erected should not be more than two and one-half times the width of the principal street on which they are situated, and that no building, or portion of a building, except church spires, should be more than one hundred and twenty-five feet high, except under a special permit.
5. That the open floor-space, not divided by walls of brick or other incombustible material, in all buildings hereafter erected for mercantile or for manufacturing purposes, should not exceed six thousand square feet, without special permission, based upon unusual and satisfactory precautions.
6. That every building to be erected, which shall be three stories high or more, except dwelling houses for one family, and which shall cover an acre or more than twenty-five hundred square feet, should be provided with incombustible staircases, enclosed in brick walls, at the rate of one such staircase for every twenty-five hundred square feet in area of ground covered.
7. That wooden buildings, erected within eighteen inches of the line between the lot on which they stand and the adjoining property, should have the walls next the adjoining property of brick; or when built within three feet of each other should have the walls next to each other built of brick.
8. That the owner of an estate in which a fire originates should be responsible for damage caused by the spread of the fire beyond his own estate, if it should be proved that in his building the foregoing provisions were not complied with. A certificate from the Inspector of Buildings shall be considered sufficient evidence of such compliance, if the building shall not have been altered since the certificate was issued.

TORONTO WATER SUPPLY.

THE Toronto water supply continues to demand a great deal of attention, and the daily papers are constantly referring either to the quantity or quality of the supply or the management or mismanagement of the water works department of the civic government.

Public opinion, or the opinion of the public, seems favorably disposed to the idea of a supply running down hill instead of being pumped up, and no doubt if it can be got it will be a great improvement. Pure water and plenty of it should be supplied, and every household should be made to pay for his share of the water supply as well as for police protection, street cleaning, etc. The gravitation scheme, even if adopted, cannot possibly be in operation for several years, and the water is required now. A new pipe has been laid, but not yet completed, to bring the

lake water into the well at the pumping house. The present pipe, which for over 4,000 feet is only three feet in diameter, cannot let as much water into the well as the present engines can pump out of it. The present pipe has often so badly leaked at some point that bay water has got in. To many it seems a mystery how a pipe under water, but full of water, can draw water into it out of the bay. The reason is that the present pipe supplying the well is so small that before enough water can be got to flow through it to supply the pumps running at their ordinary speed, the water level in the well is about 13 feet below the level of the water in the lake. Hence the water pressure inside the pipe is less than the outside of it, and any joint not absolutely tight will permit bay water to enter. The new pipe is considerably larger than the present one, and when it is in use the water level in the well will be much higher, and the danger of leakage will be greatly reduced. Even if the new pipe should

be found not absolutely tight, a very simple remedy could be found. By means of a centrifugal pump or a spiral pump, the water could be raised over on the island, and the well at the pumping house kept at a level a little above that of the bay. Any leakage then would be from the pipe into the bay. The water would be more easily lifted by the pumps, and they would work more satisfactorily and pump a larger quantity. The quality of the supply would then be of undoubted purity, and by running the centrifugal pump on the island at a higher speed the quantity could be indefinitely increased as the public demand became greater. After the gravitation scheme has been settled, as in all likelihood it will be, to be doubtful as to quality and too expensive as to quantity, then the question of additional pumping stations will be sure to be raised. From one point of view it is a wise and economical plan to have the machinery all at one point and under one management. From another point of view it is most unwise and positively dangerous.

What would Toronto do for water should a boiler explosion occur at the main pumping station as disastrous as that in Quebec last month? One boiler exploding might do in a moment damage enough to destroy the buildings and to disable the machinery to such an extent that no pumping could be done for two or three weeks? Where would we get water? In some towns water is sold on the streets as milk is here. Imagine bay water carted through the streets and sold at so much per

pint! There should be at least two complete and independent pumping stations, each large enough to supply the city, and so far separate that an accident or fire at the one would not injure the other. Each station should then be kept running at half its pumping power, and should one become entirely disabled, the other would be in order to go on in full power at once.

The gravitation scheme advocate says: "Get our plan and there will be no boilers to burst and no engines to break down!" That may be, but the bursting of pipes and the breaking of water channels have led to as serious results and as long stoppage of supply as ever occurred by the break-down of a pump or the explosion of a boiler.

POLISHING WOOD WITH CHARCOAL.

The method of polishing wood with charcoal, now much used by French cabinet makers, is thus described in a Paris technical

journal: All the world now knows of those articles of furniture of a beautiful, dead black color, with sharp, clear-cut edges, and a smooth surface, the wood of which seems to have the density of ebony. Viewing them side by side with furniture rendered black by paint and varnish, the difference is so sensible that the considerable margin of price separating the two kinds explains itself. The operations are much longer and more minute in this mode of charcoal polishing, which respects every detail

in carving, while paint and varnish will clog up the holes and widen the ridges. In the first process they employ only carefully selected woods of a close and compact grain, then cover them with a coat of camphor dissolved in water, and almost immediately afterward with another coat, composed chiefly of sulphate of iron and nutgall. The two compositions, in blending, penetrate the wood and gives it an indelible tinge, and, at the same time, render it impervious to the attacks of insects. When these two coats are dry, they rub the surface of the wood first with a very hard brush of conch grass (*chien dent*), and then with charcoal of substances as light and friable as possible, because if a single hard grain remained in the charcoal, this alone would scratch the surface, which they wish, on the contrary, to render perfectly smooth. The flat parts are rubbed with natural stick charcoal; the indented portions and crevices with charcoal powder. Alternately with the charcoal the workman also rubs his piece of furniture with flannel soaked in linseed oil and the essence of turpentine.

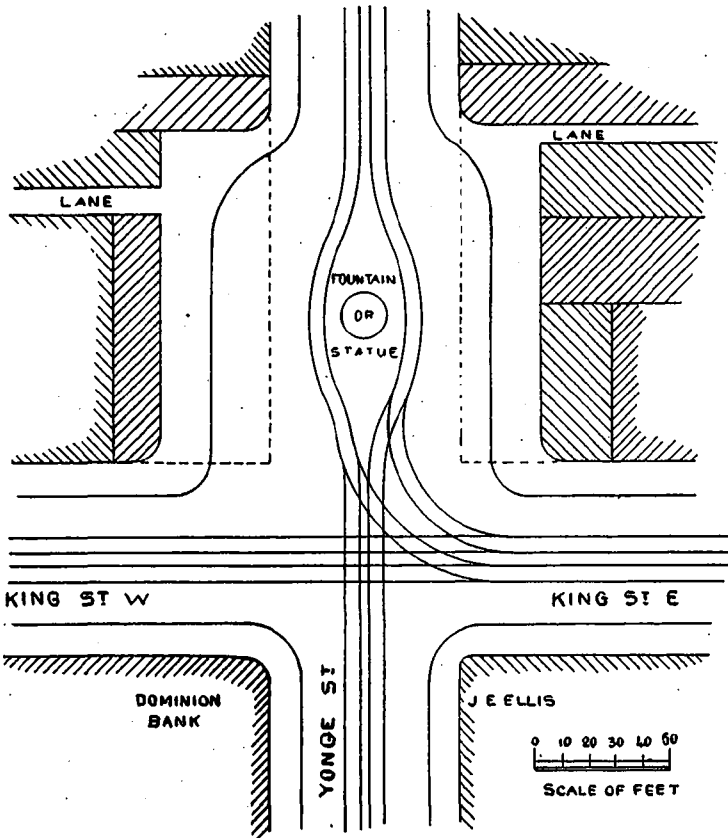


DIAGRAM SHOWING SCHEME FOR IMPROVEMENTS AT THE CORNER OF YONGE AND KING STREETS, TORONTO.

ARCHITECTURE FROM AN ARTIST'S STANDPOINT.*

By G. A. REID, R. C. A.

In attempting to arrange for you this address, giving some of my ideas on the subject of architecture, I have felt from the beginning that it was rather preposterous in me to speak to a company of architects on the question. The reason for this is not because I have not thought about it, but because my ideas have grown up unconsciously to myself, and have lain in such scattered confusion till now. The only indications of the possession of ideas have been the pleasure I have felt on seeing anything I intuitively commended, the disgust and pity with which I have regarded all ostentatious architecture, and the dissatisfaction which I have felt concerning the conditions which result in the erection, on the one hand, of buildings embodying all the art which wealth can command, and on the other, of those ungraceful and often even temporary shelters devoted to manufacture and living.

I believe the artist's mission should not be essentially different from that of the architect; if it were not that the love of proportion and decoration accuates men very vitally, there would be no need of the architect. The engineer would do all that was necessary in the construction of the shelter required. In the same manner, if it were not that the painter believes that the aspiration towards the beautiful is essentially an ethical quality, he would adopt the profession of the cold calculator of facts. The painter may decorate by the representation of life, and record historical phases of the same, but in all his composition he has for his model, Nature, whether he conventionalizes or not. As the painter must always observe from the point of view of effect, the architect must do so no less; both are educators through effect, though the observer is ignorant of the means by which it is produced. Gracefulness of line is little considered by those who do not habitually design, but nobility of mass is appreciated by all.

As I have already indicated, the combination of nature's forms I believe to be the basis of design, and as we enter upon the widest phase of the question of design, the composing of masses, let us ask ourselves how, and by what subtle reasoning, we feel our way. *Exactly how*, can any architect tell? Can any artist attempt to explain, except be in an academic slave? We borrow a bit, we in some round-about way grasp an idea, but who can divine the method? The formulated method for the intuitively free is like a cage for the migratory bird. Intuition develops unconsciously, and if allowed full freedom will feel its way with absolute safety, but our tendency to overcome and rectify bad conditions leads us to the evil of binding this subtle faculty to formulas, and the institution of academic rules shows our lack of wisdom in the extreme care to be safe. As a result, we have directed and taught until we have no confidence in the sciences of feeling, and prejudice is our only guide. If the student be supplied with the simplest directions, teaching him to observe, and be given the material and tools with which to work, you have combined the two principles necessary for the development of his powers.

Now if we have satisfied ourselves that good taste is indispensable to any kind of good work, and if we know that what a man likes determines what kind of work he will do, the same principle applies to everything which indicates man's presence in the world—the arts, literature, science, religions, morals, governments, are all indexes of the character of men and nations. When conditions are poor, recourse is had to borrowing, and originality is no longer a moving impulse, but a cold and mechanical performance takes its place. If I were to picture to you the result of good conditions in the development of your art, I would necessarily have to describe to you an architecture, noble, diversified, and utilitarian. It would show its morality by its adaption to human needs, first, by being simple enough to avoid waste, and decorated only to emulate virtue, and stimulate the observation. When I speak of those people whose art is only borrowed, I mean the style-mongering kind, which borrows but cannot pay back, and acts like a boomerang on the workman, debasing his art until it is no longer worthy of the name. True art, however, borrows and is able to pay back, and while it recognizes the values of all styles and employs them as a mine of experience from which to draw, and to which to refer, knows that the principle by which these were originated must be retained. Now I am actually ignorant of styles in architecture, and I consider the possession of that knowledge quite unnecessary to good taste. To merely imitate and reproduce ever so purely an old style, that is not the mission of the sincere artist, because that within him which chooses is the inheritance of all that has preceded him, and no academic rule can teach it.

The most prominent defect in modern architectural designs is a disposition to seek perfect symmetry, but the architect who draws his inspiration from nature recognizes that perfect symmetry is as much abhorred by nature as a vacuum. True balance is by a law of physics as much a necessity to any structure as that force which keeps the earth in its orbit is to the earth, but the placing of windows, doors, towers and gables with exact regularity is in direct opposition to the spirit of the whole outward world. The designer must of necessity avoid all such regularity if he would avoid monotony and stiffness.

The arrangement by which light and shade are grouped is as important as the grouping of general forms; in the composition of a picture the painter who appreciates his light and shade will regard a shadow cast by a figure, or any object, as having as much value as the object itself for his purpose.

Towers, turrets, chimneys, gables and roofs, if put on merely to balance, will from some point of view throw a building out of balance. I have in my mind a long structure with two small towers at the ends, and a large

one in the middle, all on one side. From certain points of view the effect is that of over-balance. I remember when approaching Burgos, in north Spain, shortly after sunset, the silhouette of the spires of that wonderful Gothic cathedral were to me a lesson in grouping and true balance. In passing quickly by them, they cluster from every point of view in long and short points, giving the feeling of symmetry without regularity. If the architect places with regularity towers and spires ever so beautiful in themselves, along the sky-line, the effect will be like a burned-out forest on a ridge of hills. This monotonous regularity is perhaps a still more crying evil in what I think is called landscape gardening—placing trees in rows, flower beds in geometrical designs, and cutting walks and paths by the line. Many of you have noticed this tendency in our own public gardens, and those who have been in Paris can appreciate how diligently the gardener cuts and trims, and even squares the trees off underneath.

After massing, breadth in general effect is important to the architect no less than to the artist. If the architect spreads over his design ever so beautiful ornament, the result is what a painter calls "spottiness." In painting, we illustrate the opposite of this by the pictures of Meissonier as the best examples of work which, retaining breadth, possess great fineness of detail. And although many painters long for extreme simplicity and use great flat masses of light and shade in their own compositions, yet exquisite detail is not incompatible with such, for the secret lies in keeping detail subordinate to mass. I feel that to enlarge upon this principle would possibly mar to a great degree the simplicity of the idea, but in case the terms "mass" and "breadth of effect" may sound like artistic cant, I will try to illustrate what they mean to a painter. When I speak of a "mass" of anything, it may be light or dark, and of any color, and "breadth of effect" is the result of the subordination of the markings within each respective mass, so that at certain distances no detail can be distinguished. Take for example a tree; when near to it, the eye can resolve each small mass of light and dark into separate leaves; at a greater distance only larger masses can be seen, and when sufficiently far away the eye perceives one flat mass, composed of trunk and foliage. I do not mean to say that painters have a monopoly of this principle of harmony, for all people with good taste must feel some of its truth at least, and I am sure that architects practice it continually, although I sometimes think it is too dimly understood, and as it involves color, the subject for the architect alone is inexhaustible. To the painter it is almost the beginning and end of his technique.

I will now turn to some practical illustrations of that of which I have spoken in general terms. I have prepared some rough scribbles in color, some of which show the suggestiveness of natural forms for designs of buildings, the similarity of some buildings now in existence to natural forms, *et cetera*.



FIG. 1.

This pastel is from a sketch made a few miles out of Paris, near Sceaux, and I have attempted to construct from it, in a general way, a group of buildings which might very readily be suggested by the tree shapes; some engineering modifications would be necessary, but general form could be adhered to. In the Yellowstone Park there is a low peak called "The



FIG. 2.

Column Rocks," a rough sketch of which is shown in No. 3. In the Sierras there are some remarkable buttes, which stand alone on a sort of plain; they suggest whole buildings, towns, chimneys and steeples. No. 4 is a design for an entrance suggested by a part of the Castle Rock in the Sierras. In interiors crypts, naves, and vaulted roofs are instances of the similarity

* Paper read before the members of the Toronto Architectural Sketch Club.

which exists between many buildings with which we are familiar and natural forms. In No. 5 is illustrated a part of the great Mammoth Cave in Virginia. No. 6 a tower in Germany, and the Cathedral Rocks, Virginia. If time only permitted, hours could be spent pointing out such examples of similarity, as well as the wealth of suggestion that still lies in Nature, waiting to be used.

For the sake of reference to the social condition influencing architecture, I will take as an example a well-known Toronto building which has noble



FIG. 3.

proportions from any point of view; at twilight its effect is especially harmonious, but in the light of day it will bear critical examination from the front only. No. 7 is from a sketch made at evening from my studio, and No. 8 a view of it from the corner of Bay and King streets. You surely do not ask me what is wrong with it! who can pass it without seeing its great blank side walls in strong contrast with the ornamented and windowed front? What ingenuity the architect has had to exercise to light it from the front and back, and with what anguish he must look upon it until the speculators

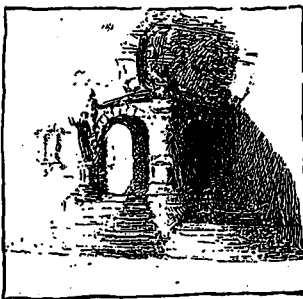


FIG. 4.

allow enterprise to raise buildings alongside to cover its nakedness. How much better it would be if they could buy the air on each side, and decorate and light the building properly. "Buy the air?" you say; "Why that would check enterprise" and I answer "Do we not check enterprise and trample on natural right as much now by buying land?" Besides, air can virtually be bought here, and it is *actually* bought in Constantinople, for the Bible house there owns the air above a large block of buildings, and its view of the city can never be blotted out, no matter how high the value of land rises.



FIG. 5.

In conclusion I wish to point out that I am not challenging either the honesty or good taste of our architects and builders. They are as helpless to create a noble architecture as our painters are to paint good pictures, while not surrounded by the necessary conditions. When I speak of conditions, I mean to say if they are not favorable we cannot expect to have any worthy art. In feudal times great castles and beautiful churches arose because the power of the feudal lord and of the church could buy all the art of the community. In its earliest aspect art was confined to the castles; then when the church became more powerful cathedrals were evolved, and, as a

wider liberty grew, the public buildings and residences were more and more decorated. As we have not yet shaken off the shackles of feudalism, the workman still lies under the thrall of some power. That power is the same as was exercised by the feudal lord, although it may not be so absolute.

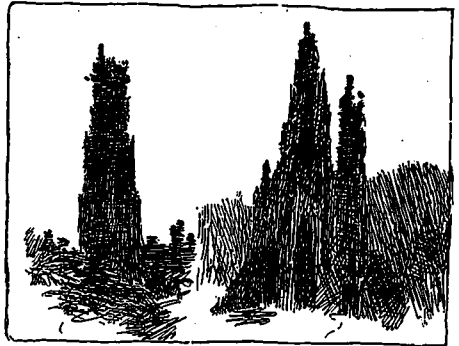


FIG. 6.

During the ages the spirit of independence has been developing, and now social reformers are demanding equality of right for all. If it is true that the more division of right there be to the absolute ownership of land, the more the power to control art and labor is broken, then there can be no doubt left that if the land is absolutely the possession of all who live on it,

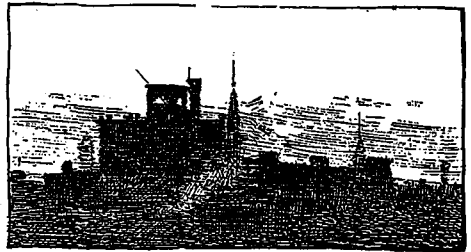


FIG. 7.

the monopoly of art by a few is lost, and the tendency to beautify will be more widely spread.

Many may think that such a change in our social conditions as I have hinted at would not affect architecture, except to rob it of its patrons; that is exactly what is needed to make our arts noble.—We want no patrons—

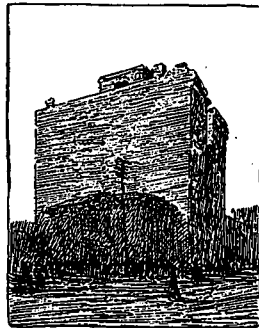


FIG. 8.

we want an independent spirit which will no longer cringe before amateurs and men of wealth, but which, with freedom from pinched necessity, will find the possibility of refusing to prostitute its art for any consideration. Then when art has an opportunity to produce spontaneously, we can look for results more worthy of the larger liberty.

CONNECTING STEAM PIPES TO BOILERS.—After boilers are properly arranged and set up, the next important point to be considered is the arrangement of the main steam pipes and their connections, for unless these are properly designed and put up, much trouble is apt to come. The points to be considered, but which are very often neglected, are to provide for the effects of expansion and also to make allowance for any settling of the boilers which may, and generally does, occur after they have been run a short time.

ARCHITECTURAL EDUCATION IN CANADA.*

By R. W. GAMBIER-BOUSFIELD, A. R. I. B. A.

In undertaking the preparation of a paper on the subject of the education of would-be architects in Canada, I was conscious that I had a difficult matter before me, and as I have proceeded with the work I have not found the difficulties decrease materially. It was simply a matter of looking down the law, and saying that a student should learn this and that and follow such and such a particular line of instruction, there would not be much difficulty, but the point with us, what a student should learn to make him proficient in this country, where he labours under some disadvantages. But when I say this, some of you may remark, "surely the standard of proficiency should be the same in all countries." No doubt that is very true, but how is it possible that that amount of knowledge which is considered a proficiency in the most refined countries of Europe, and which is only attained by years of close companionship, and consequent intimate acquaintance with, the examples of the work of all ages, and to be found only in the old world, is to be attained by our youthful aspirants who in forty-nine cases out of fifty have not the means to enable them to take even a short tour in Europe.

At the time of preparing this paper, I had before me the report of the Committee of our Association on Education, which was passed by the Council at their meeting in December last. No doubt all of you have read it, and I propose as I proceed to call attention to some of its details.

I have said that students in this country are placed at some disadvantage. European students can read, and they can then go straight to see an example of the thing which they have been reading. They can look only read, and employ their imaginations to picture for them the subjects. They have illustrations to guide them, certainly, but what is the picture of a building or the mechanical representation of a portion of it to the actual structure—the uninterrupted study of the practical working out of a conception or idea which tends to a comprehension of the reason of every feature and detail? Examples of construction they have before them, good, bad and indifferent, and a young man has to become a first rate business good architect? The public seem to think it does, and so long as a man carries out a house or a church, or other building, in a way that it will not tumble down, the public are content. But there is a change coming—even now commencing. We have greater facilities than heretofore for visiting Europe, and for being visited from Europe; there is a greater interchange of ideas; there is a better knowledge of the things which are going on among the public; and in the near future we shall find, if we have not found it already, that students are not so ignorant of what real art is as previous generations of clients have been.

In general, professional men have here, as in all new countries, been more intent upon trying to make money than upon trying to educate the public. I do not blame them. What is the good of trying to educate the public? What is the good of trying to teach an ignorant client such and such and such a good style, and that so and so is? No good at all; we shall only be considered fools for our pains, and so we have gone on. But what if the public is beginning to know something about the difference between good and bad, between art and "Builders' Gothic"? What if a client should turn round upon his architect and say, "if you don't mind, Mr. So and So, I should prefer to have all the windows of my house of one date." I do not think this is likely to happen just yet, but we are now considering education, and what our students should learn, and if this does not happen in our days, it will in theirs. Of course, there are many well educated men with whom we may come in contact as clients, and they naturally prefer to employ that architect who will make their buildings beautiful, as well as sound and substantial. Hitherto we have had too much to do with the dollars and cents. I do not mean that we have had the finest things in our work, as much as we have done, but we have had to deal with men who had, and who were very chary about parting with them, and these men have employed those who would do their work for the lowest remuneration, in preference to those who would bring to their aid the best professional ability.

And now come the questions: What should our students learn, and how should they learn it? An architect has little time to spare to teach youths fresh from school the very rudiments of his profession, and yet, in order that the raw material may be fit for use, he is likely to have to be of use to him later on, he has to devote some time to looking after the young fellows. As a set-off for this, it is customary in many places for a boy who wants to be an architect (as the phrase goes) to pay a premium for the instruction he is to get from an architect. In England an architect of reputation has his choice of pupils, who are only too ready to pay large sums for the privilege of doing work in his office for a stated number of years, for as a matter of fact this is really what it amounts to. The pupil who pays a large premium knows no more at the end of his time than does the boy who has got into the office of our architect of repute to pick up what he can for himself. The matter is reduced to one of ability in the youth, having little or nothing to do with the amount of time the architect spends at his elbow. But (and it is hardly necessary to say so), we are not in England. We have to do our own work for ourselves, and the little we can trust entirely to our clerks and draughtsmen in the matter either of construction or design, and it is often far easier to do all the work oneself, than to correct the errors of our clerks. The draughtsmen whom we can get hold of are for the most part not properly educated. They have (I say, the majority of them), been "fetched" up somehow, not trained, and we certainly cannot spare time to teach them. We may be glad that we have at least in connection with the School of Practical Science, a chair of architecture, and that the purpose is to put boys who want to be architects through a course of instruction, and do much for them that will prepare them in part towards being of some use and towards instructing themselves when they enter an architect's office as pupils; and although we want a great deal more than we have here at present, I hope it is a step in the right direction. But let us glance for a moment upon the systems of education for the practice of our profession in Europe and in the United States, and ascertain what in various countries is considered a standard of proficiency, and what a young man must do and pass through in order to be named as sufficiently competent to practice the profession.

There is no country so strict in connection with the professional training of architects as France. The French Academy of Architecture was founded since the year 1671—of now two hundred and twenty years standing. Its establishment was in connection with the French Academy of Arts, founded in 1635 by Cardinal Richelieu. The story of the foundation of the archi-

tectural branch is somewhat amusing, and shows that the treatment we receive from the public is very similar to that meted out to architects two hundred years ago. Bernini, the Italian, was summoned by the king, Louis XV, to go to Paris and prepare a design for the re-construction of the Palace of the Louvre, but first he had to win the approval of the friends of the French architects, who were much disgusted at his arrival—that there would be hindrances to his carrying out the work, he wisely decided to get back to Rome, and making some excuse, withdrew from the work. A competition was instituted, apparently without the appointment of a professional referee. Only two sets of plans were sent in (architects seem to have been wise in those days). The design of Lemaire was recommended by the Academy of the Louvre, but the Academy of the Académie des Beaux-Arts, upon decided on having the other one carried out, turned out that this was not by an architect at all, but by a doctor, Claude Perrault. A building committee was then appointed to superintend the execution of the design, with Charles Perrault, the brother of the physician, as one of its members, and this committee was the origin of the Academy of Architecture.

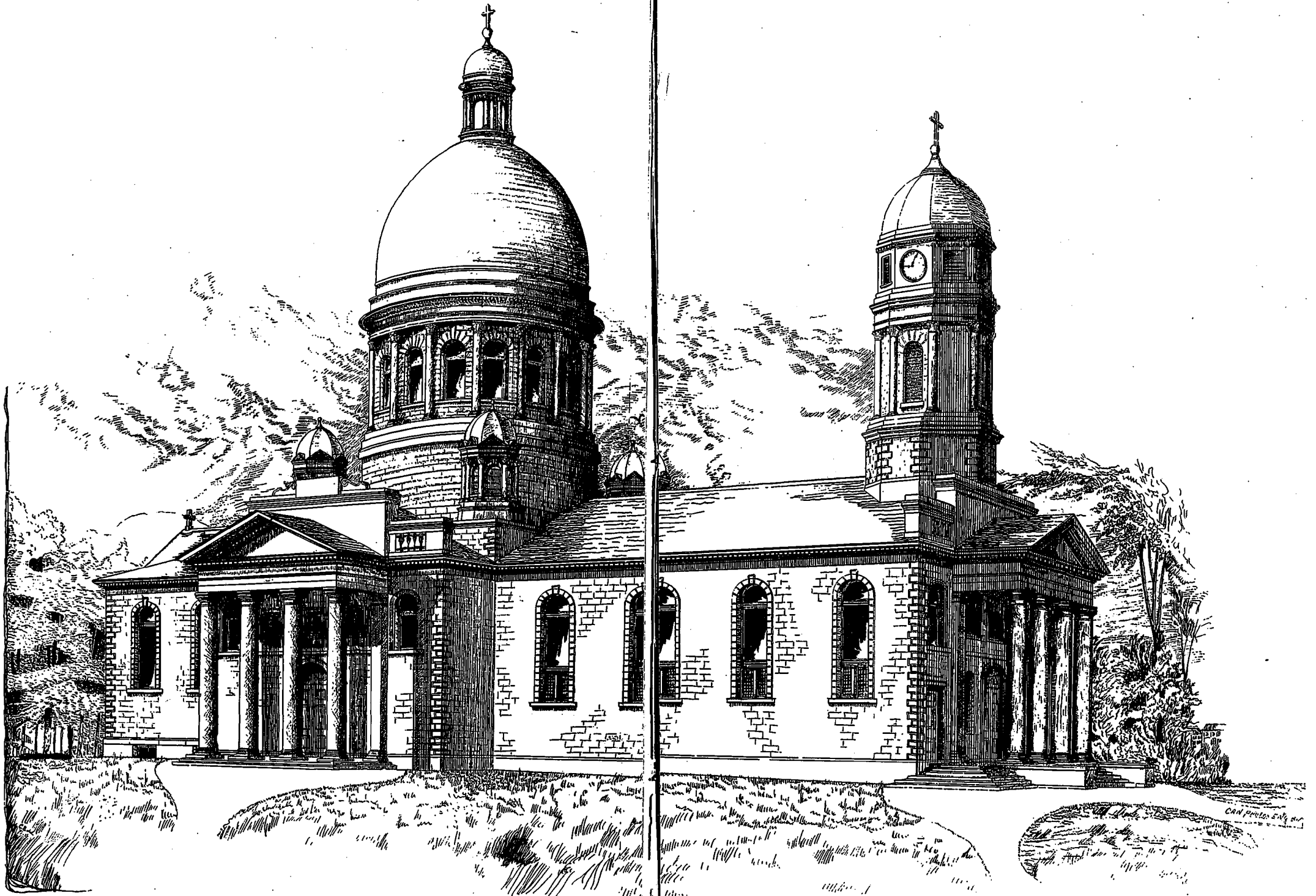
At the time of the suppression of the Academy 1793, during the Revolution, a number of semi-private schools or ateliers were organized which gave rise in 1816 to the Ecole des Beaux Arts, which were separated in 1863 by Napoleon III from the Academy and placed under the charge of a director and numerous professors of arts, of whom nine were professors of architecture. This school of fine arts affords free instruction to all comers, whether French or otherwise, between the ages of 15 and 30, on condition that they will enter in the subject of all these subjects. The total course occupies about three years, but by this time the student has only passed through the lower school, and not then unless he has been very diligent, as the number of marks to be obtained in order to ensure success at the examination can only be reached by a student devoting all his time to study. Having passed, however, the student then goes to the upper school, where he still has to enter competitions in design, drawing, and modelling, and may take part in the contest for the Grand Prix, which he will be going to win, and which will entitle him to a diploma, the standard of which is very high, the examination very vigorous and searching, entailing a course of study covering in all six or seven years at Paris. No architect, without having gained the diploma, can carry out a public building, and although he may engage in private practice, his clients cannot hold him responsible at law, and naturally those without diplomas cannot expect much work for their worth either. The French system, it is said, is that the art is studied to an extent that leaves too little room for the study of the science.

In Germany the system is the reverse to that in France. Training in practical work is considered of greater importance than a knowledge of the art of architecture. The student must study a year in an architect's office before entering the school, and if he aspires to the rank of Baumeister (master of building), he must spend three years of a clerk of works in a Government building, before he passes to the superior branches of the school. But the man who looks forward to employment under Government must pass two examinations—the first, to test his knowledge gained in a technical school, which, if he is successful in passing, entitles him to be an inspector of government works. Between this examination and the second the candidate for government work must pass two years in the practice of his profession, either in the general work of an architect's business or in constant supervision of actual work—like a clerk of works, in fact. Success at the second examination entitles him to employment under government.

In England there is no regular school of architecture akin to those on the continent, except the Royal Academy in London, so far as it goes. A youth outside the office of his master or employer may take up any line of study he thinks best, or that is commended by his friends. His drawing classes at the schools at which he can get a clerk of works, have access to libraries from which he can borrow standard works on art and construction, and he can study examples of both anywhere in the country or on the continent in his holidays. He may be much helped by joining the associations of students, which are no doubt doing great good. There are prizes to be competed for by all comers offered by the Royal Institute of British Architects, the Royal Academy of Architects, the Association of London, on subjects such as essays, drawings, models, measured drawings of ancient buildings and designs, all of which tend to show the pupil how he should steer his course, but the standard of success in these competitions is high. A youth whose tastes lead him to study construction rather than design soon finds that he must devote equal attention to the art. The obligatory examination of the Royal Institute of British Architects, established in 1868, certainly has done good, if only in the way of giving students a line to follow and a goal at which they can test themselves and shew that they are qualified to practice, to undertake whatever may be entrusted to them. A student in England sees the necessity of studying the French language, for unless he can read fairly well, the valuable collection of works on architecture published in France during the past 250 years will be of little use to him. The dogged persistence, the character of the English student, however, may be expected to surmount all the difficulties in his way arising from the lack of regular schooling for the profession. A youth determined to succeed does so—he takes pains, and that is the secret of success. And England has produced and is now, no doubt, producing men who have been and men who may be classed as some of the greatest architects of the world, and there is no reason why her credit should take up a boy as the leaves of the school and give him a thorough grounding in drawing, construction, in the history of the art, and in professional practice. The use of these few words as summarizing the course is an easy way of classifying a great deal of work, but in reality they represent a most complete course.

French architects are more artists than builders, because in the schools they study together with artists—painters and sculptors. German architects are more builders than artists because they study together with engineers. In England a man may be whatever he likes to make himself—a theoretical or a practical architect, or if he understands his calling, an admixture of both. In the United States the aim and object of the school is to make a man an "Architect," which means equally well instructed in every branch of his profession; and this is the evident intention of our scheme our committee have prepared for the guidance of students in Canada.

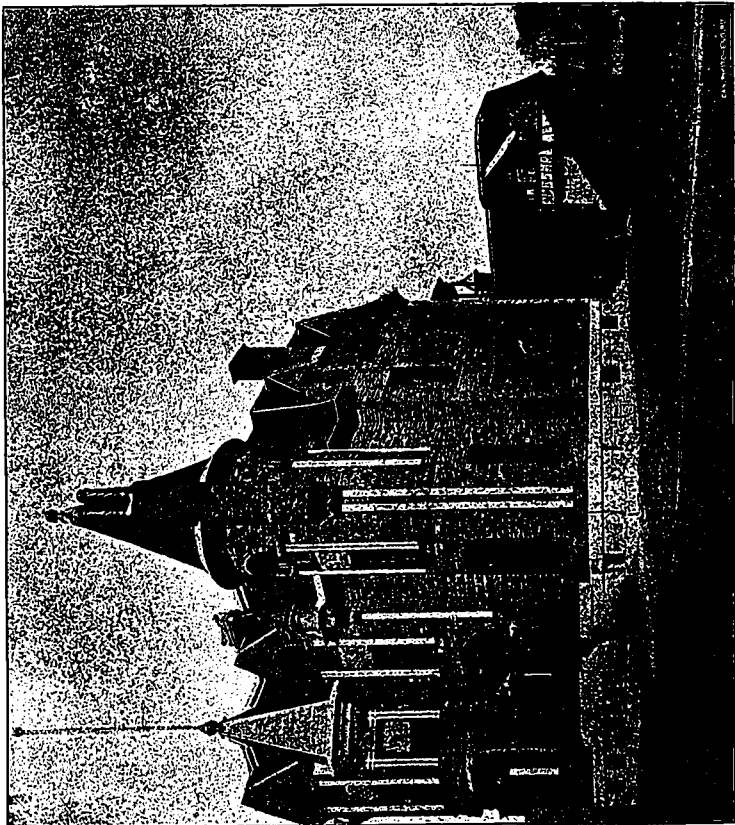
* Paper read at the Third Annual Convention of the Ontario Association of Architects.



ST. GEORGE'S CATHEDRAL, KINGSTON, ONT.
MESSRS. POWER & SON, ARCHITECTS.



CLUB HOUSE FOR THE ATHENÆUM CLUB, TORONTO.
MESSRS. DENISON & KING, ARCHITECTS.



RESIDENCE FOR MR. P. LYALL, MONTREAL.
MR. JOHN JAMES BROWN, ARCHITECT.

But to return to the questions: what shall our students learn, and how shall they learn? The latter question is easily answered. How shall they learn? If men for the past two hundred years or more in England, without any guidance, have determined to succeed, have succeeded, and their youths can do the same. If they will not learn, nothing on earth will make them. Young fellows are sometimes found sighing, "If I only knew what to study." Why, study anything; surely you can use your eyes; surely you know how to read. But they are most of them now-a-days in such a hurry to be earning a small weekly wage that they think it best to wait till some one will show them the shortest cut towards putting themselves into a position to earn a salary, rather than that it is best to make themselves proficient. I like to see young fellows anxious to support themselves, but if they are not content to give up all ideas of supporting themselves for some time to come, a profession is no calling for them. If they would be architects, they must be patient. Now they are apt to feel aggrieved that when employed in an architect's office they have to do tracings or copy letters when they think that they ought to be engaged on drawings that will give them perhaps more direct instruction, forgetting that in everything they do they will find something to learn, and that they are not at school. At school they have got accustomed to being taught—in an architect's office opportunities for learning are given to them. It is for them to take advantage of these opportunities if they want to learn.

The Students' Association here is doing good work, but it seems necessary also to force some of the members to take the shortest cut towards solely with the view of helping them. I need not, however, dwell longer on these points, but it is a serious thing for students in Canada to consider, and if they fail to perfect themselves in their calling, they will find too late that draughtsmen from a distance occupy the places that should have been theirs.

When a boy comes as a pupil to an architect, he should possess some knowledge of the work he is about to take up. He must at least have developed some taste for drawing, and have shown that he takes some interest in building operations. He must have had a fair education, which of course includes a grounding in mathematics, mechanics, chemistry, geology, and so on; and so much the better if his opportunities have enabled him to master the rudiments of geometry, and perspective and other mechanical drawing, and if he has done something in the way of sketching.

On leaving school and entering an office he must give up the idea that he is entering a higher branch of his school. Here it depends upon himself to keep up and improve his knowledge on many subjects of vital importance to him as an architect, but for the study of which he will have little or no opportunities given him in the office. He must draw, and draw constantly. He must read both in French and English, if not in German. His drawing must be both mechanical and freehand, and his reading must be on the history of the art, on materials and their application. He must familiarize himself with the characteristics of the various styles of architecture, and he must practice design and devote some time to the study of planning. It has been said that the plan of a building provides the skill of the architect, rather than the elevations. When a man builds he generally prefers to have his home arranged to suit his comfort, rather than to attract the notice of passers-by by an elaborate edifice without the comforts of good planning.

In the study of planning, a student must know what are the requirements of the class of the man to which his supposed client belongs, or if he is planning a public building, he must find out what are the necessary contents, and he must have some idea of the pranks and freaks of sound before he can design a church or public hall. One sees young fellows planning houses, with no doubt an idea of what in their ranks in life constitutes domestic comfort, but with little idea of construction, and the moment you ask, "How do you propose to roof that in?" the very complete domestic castle becomes an impossibility. To plan well, a youth must have a knowledge of materials, of sanitation and ventilation, and must know where to use iron or wood, stone or brick constructively. I do not mean to say that he cannot begin to plan until he knows all the things—if he works at it he will be many years before he made an attempt—but planning brings to the student's mind these and many other matters; and practice in planning gives him experience in all these things, so that in no case should this subject be neglected.

Drawing, as I have remarked, should be mechanical and freehand, but that is hardly definite enough. Freehand drawing consists of many kinds—drawing from nature, from the eye, from the hand, taking the subjects from nature and vegetables life. Ornament is an important study, but one that deserves great freedom of pencil and a trained eye. Every style has ornaments peculiar to it, and therefore characteristic of it, and although it is easy to get a carver who has made a study of ornament to design and execute your caps and panels in proper character, yet so much at least of the work will not be your own if you do so.

Ornament certainly includes color decoration, but it can hardly be necessary to urge a certain amount of study in color, when there is nothing either natural or artificial that is without color, so that if a student thinks he can do without color, he must find some other world to practice in. All cannot be picture painters, neither is that necessary, but a knowledge of the proportions in color, exercise in the application of colors, tones and shades, is decidedly so. If you can get your own colors to have done a school for you, why not employ at the same time an army of specialists—heating and ventilating engineers, artists, iron workers and so on, as well,—and then employing them to do the various parts of your works for you, you need learn nothing at all.

It is quite true that supervision takes up so much of an architect's time that he cannot find time to work out his own schemes of decoration and so forth. This, however, is one of the evils that we hope some time to have done away with, and perhaps when the students for whom we are suggesting a course of study come to practice for themselves, clients will have learned that it is for their own interest that their architects should have all the time they need to elaborate their designs entirely, and to employ a clerk of works to look after the mechanical work in execution.

But besides all that is contained under the course of design and construction, there is another thing to be learned of no less importance. An architect has to write specifications, reports of all kinds, to make up statements of the cost of various schemes. He must be a man of address—with a polish of manners. Reading and writing are essential studies—not mere penmanship, but composition—to be concise needs practice. Fluency of speech is also of great importance, but that there is so few really good speakers shows that it is an accomplishment not easily attained. Speaking and dictation should be practiced; writing essays should be encouraged; and the student must not overlook the importance of grammar, both for writing and speaking. These may appear to be elementary, but does not every kind of success depend upon the kind of foundation that is laid for it? If a man's rank in life does not provide him with a polish of manner, education will do a great deal for him.

In regard to examinations I would urge that the preliminary one at no rate should not be too severe at first, although the final one, which is any good at all unless it is one that will thoroughly test a man's qualifica-

tions for practice, must be fairly searching and complete. We do not want to frighten our students or to trouble them about matters that present students have little or no opportunity to study. Periodical examinations should be encouraged—they should be made stones on the way to the final, by which the knowledge acquired in the intermediate periods can be tested; they should be arranged with a view to showing a student what he should accomplish at each stage, and they should therefore be no harder than necessary. They should be an assistance rather than deterrents.

Our Council has wisely arranged an "Honor Course," by which it is meant that certain subjects should be taken up only at the final examination, should be encouraged—they should be made stones on the way to the final, by which the knowledge acquired in the intermediate periods can be tested; they should be arranged with a view to showing a student what he should accomplish at each stage, and they should therefore be no harder than necessary. They should be an assistance rather than deterrents.

If we make our examinations too severe, we shall fall into the error other architectural associations have fallen into, of discouraging students, and this to an extent that will nullify the benefit of our Association and leave room for the formation in the future of a rival society that will more nearly meet the necessities of would-be architects, and which will take the wind out of our sails.

In conclusion, let me say that in my endeavors to bring this matter particularly before this congress, I am conscious that I have given it a very cursory treatment, and that it deserves more than it has now received, but I trust that the inadequacies of my paper may be in some way made up for by the discussion that I hope will follow.

DISCUSSION.

Mr. Gordon: In rising to move a vote of thanks to Mr. Bousfield for his excellent paper, in opening up this subject, I would like to ask you if the Council have arranged the curriculum of study and examination for the various students in the various years? What has been done in that?

The President: I am hardy prepared to answer that question. The Secretary: The question has been taken up to some extent, and what has been done was published a month or six weeks ago. Although the matter has not been fully determined upon by the Council, they have published this as the statement of what has been done so far, with a view of ascertaining the feeling of the other members of the profession upon the subject. (Reads outline of studies, etc.)

The President: Does that meet your requirements, Mr. Gordon?

Mr. Gordon: Yes, that is what I wanted placed before the meeting.

The President: That was the course Mr. Bousfield mentioned in his paper; it has been fully determined upon.

Mr. Darling: I decidedly think the question of design should come into that honor course. It is very much higher than levelling and such things, which only touch on our profession, but are not a part of it. (Applause.)

Mr. Billings: Has this outline been determined upon by the Council, and is it to be considered by this meeting?

The President: These have not been finally determined upon. The whole subject is in the hands of the Council, and will be further discussed by them.

Mr. Billings: Is any discussion allowed at present on the subject?

The President: Oh, yes.

Mr. Billings: Many of the members of the Institute at Ottawa did not understand why two languages should be required of a student. In Ottawa, though we have both English and French people, none of the architects write specifications in French, nor do they use two languages at all. Even French contractors find it easier to read the specifications in English. The Ottawa architects thought French might be a very good thing for a student to know, but wanted to know what the ideas of the Council were in placing it on the list as a necessary subject for students to pass on. Another thing that they did not understand was why these particular kinds of architecture should be specified for intermediate examination; they thought it was rather old-fashioned kind of work, and that almost any examples from any architectural work, that had been carefully measured or copied, would probably do just as well, as long as they were chosen well. They thought Norman might do as well as Decorative, and Byzantine would do as well as Perpendicular. Then, again, "one set detail construction of roof, traced, with joints and iron work drawn to large scale." Now, iron roofs are things that a student, as a rule, in his second intermediate, is hardly up to.

A delegate: It is a wood roof.
Mr. Billings: It says "with joints and iron work drawn to large scale."

The President: There is a certain amount of iron work—bolts and straps.

Mr. Billings: Still, a man might have a roof without any iron in it at all. (Laughter.) There is one thing the Institute are very anxious to learn about—

Mr. Curry (interrupting): How does it come that two members of the Council in Ottawa are members of that Institute, and this matter was settled when those members were present, and they know as much about this question as we do? There is an impression that the Toronto members have done something without consulting the Ottawa members. Now, there has been nothing done whatever as far as I know. (Order, order.)

The President: When one gentleman has the floor he must

be permitted to end his remarks before any other person rises to answer. (Applause.)

Mr. Billings: I am not in the habit of addressing public meetings, and probably Mr. Curry has misunderstood me. I don't recollect saying anything about the Ottawa directors; I had no intention of doing so in any way, because the Institute is not connected with the Council in any way, although they may sit in it. There are 18 members of the Institute in Ottawa, and two of them only are directors, and it is competent for any of these men to ask any question; and as I happened to be the only one here they have asked me if I would kindly get this information. (Hear, hear, and applause.) Mr. Arnoldi said that these details, though he understood them in a certain way, were not positive, and as a large number of the Council are here, I thought I could get the information first-hand. One thing they want to know particularly is this: Any architect—whether he passes through any course or not, so long as he called himself an architect—has been allowed to register himself up to a certain date. On the other hand, students who were bound by articles at the time this Bill passed, so I understand, are required to pass examinations which they never expected when they entered upon their articles—which it strikes me is very unfair. The idea of the Institute was, that all those students that had been articulated previous to the passing of the Act should be allowed to go on and pass through their course precisely as they expected they would have done when they went in as novices.

Mr. Edwards: I rise to second Mr. Gordon's motion of thanks to the essayist. I think the discussion on this matter of examination is all out of order. I wish to ask if it is in order to discuss this matter, or the paper which we have heard?

The President: This code of by-laws are under the government entirely of the Council, but at the same time they have been published and sent around to each member of the Association with a view of opening the question.

Mr. Rastrick: I beg to say they have not been sent around to each member of the Association.

The President: I understood so. At the same time, we don't want to do anything in a corner, or opposed to the wishes of the Association (hear, hear), and as the matter has been introduced now, I think it is only fair that we should hear an expression of opinion on these matters if they are at all objectionable to the Association. (Applause.)

Mr. Gambier-Bousfield: I may say that the object of this paper was simply as a basis for discussion on this very subject. The motion of thanks was then put and carried.

Mr. Bousfield, in responding, said the questions discussed in the paper should be well threshed out. There are several things in that paper that might well call forth a discussion. Mr. Billings brought up the question of languages. Now, what I said there was that if you don't learn French you shut yourself out entirely from that splendid library of works on architecture in the French language which has been collected for the past 250 years. (Hear, hear.) It is all very well to learn only French in the Quebec province, to speak to the workmen and that sort of thing, but we want more than that.

Mr. Langton: The comparison Mr. Billings makes between students being compelled to pass the examination, and architects, is not a proper one, because an architect in full practice could not very well be required to stop his practice in order to learn subjects which he had not previously learned, in order to pass an examination. It would be an injustice to him; but to a student whose principal object for the first years of his entrance into the profession is to study, it is far from doing him an injustice—it is an advantage to him and to the country—to be compelled to take a little better course than he would otherwise have done. (Applause.) One great desirability for French is that now-a-days every man sooner or later goes to the continent; and he is shut off from a great deal of convenient intercourse if he cannot speak that language. There is hardly any country in Europe in which a man cannot make his way with comfort if he has a certain smattering of French; and for a student to go alone—as he very often does—into a country where he cannot communicate with the natives in any way, is a great hindrance to him, to say nothing of the fact that some of the best works on architecture are written in the French language.

Mr. Townsend: The amount of French or German required of students is only such an amount as is equal to the examination of the second form of the Collegiate Institute—which is a very small amount; just enough to give the pupil an opportunity of continuing the study. He may drop it after the final examination, for anything there is upon the order, if he wishes to. As to the particular classes of examples required, these are simple papers or drawings calculated to show that he has covered a certain amount of study of existing examples of work. It can make very little difference as to what particular examples he studies, or what particular style, so long as that studying is done; and I think early English and Decorative work covers the ground pretty thoroughly.

Mr. Bousfield: I don't know why Norman is left out. Is there any particular reason for that?

Mr. Darling: It seems to me it would be better not to say that they would have to do certain things as definitely as apparently it speaks of them there, but to say that they are liable to be examined and to be asked to send in sheets of drawings touching upon certain things. It makes a mar cover a much

wider range of ground than to be asked for certain things. In accordance with that he may say, "Well, I am only going to look at early English, Decorative and Perpendicular—I am not asked for anything else."

Mr. Townsend: Those drawings are not to be made at the examination—they are work that he does beforehand, and that he brings in to show that he has covered a certain class of work. You cannot ask him to bring in indefinitely three or four classes of work, because he may be doing bad work instead of good.

Mr. Darling: I understand that; but the papers are asked for the final examination.

The President: No, they are for the intermediate examination.

Mr. Darling: Would it not be advisable to have something more definite as regards architecture proper? There is nothing said anywhere that he is to study the whole of the orders of architecture and all the different styles thoroughly and well, and he is liable at any moment to be put through a severe course of examination on his final on all these subjects. It does not seem to me that it is definite enough. There is nothing here said that you can ask a man at his examination, and he certainly ought to have that at his fingers' ends. It seems to me this is not definite enough as to that. There is not enough about architecture. (Hear, hear, and applause.) It seems to me, from what little experience I have had, that men are trying in this country to design exactly the same as a man might try to write Latin prose without having learned his Latin grammar. It is the whole trouble all through—it either runs too much to the artistic side or too much to the engineering side. There is a great deal of architectural grammar that ought to be learned, and examinations ought to show it. (Applause.)

Mr. Paull: The prospective education seems to be well thought of, and of benefit to those who are likely to be architects for the future, and all very necessary; and it shows that the Council have given to this their very careful consideration. As to the students who have gone into offices without expecting an examination, I have every confidence in the Council, that they are men of liberal sentiments, and will do justice to those students as they would to their own sons or for any other members, so that we should be safe in their hands in any matter of that sort.

Mr. Curry: This discussion is the result of bringing up a matter that has not been properly digested. At the last Council meeting we had considerable business, and the session ran over two days. This examination question was brought up, and we were having any amount of discussion and were not getting ahead; and the result of what we did was this paper the Registrar has read. We had to arrive at something, and that something resulted in this. The Council has no intention of carrying these things out, as far as I know. I certainly have not. But it is the desire to work a little further. We have to have a foundation, and what was done is just a step towards the end. As far as the examples that have been asked for, that was simply thrown in to show what sort of paper would be required, so with that drawing to rule. This examination was, in a sense, proposed to be an examination for a continuous course; but that examination would not be similar throughout—it would be changed each time. Then as to students; in preparing that course we were considering those who should enter the profession from now, not the students who are now in. Of course, whatever is done, there is no intention of forcing students through a regular systematic course who have already entered the profession as it stood in the past, and who have now advanced some years in it. To such it would be somewhat of a hardship to go through that course. The only intention is to have the first examination reasonably fair; the next one somewhat stiffer, and so on, until we have the final examination of students who entered knowing exactly what they were expected to do. The student who enters now would know exactly what he would have to do, and it would be no hardship to him whatever. The examination of draughtsmen or students who are now in the profession, or have been for several years, will be made as light as possible, but at the same time they must show that they are reasonably good men. We don't propose to have an examination which means no examination, but at the same time we have no intention of putting the screws on too hard, or holding candidates back and making them go through a course of study which they never supposed they would have to pass through. Still, I agree with Mr. Langton that it would be to the student's benefit even if he were asked to go through such an examination; but I don't think it would be altogether fair. I think we are agreed that students should be able to understand French or German. French would be the more advisable of the two. Then as to the honor course; it is not, properly speaking, an honor course. Some thought that there were questions outside that some students might like to take up, which could not reasonably be put in the regular course; hence the so-called honor course. Then as to whether the examinations are engineering or artistic, I think we can all have but one opinion, after all—we are hardly examining a man on his artistic abilities. We certainly teach him as much architecture as possible, but the principal thing is that a man should have a thorough training in what are really the essentials of good construction, planning, and so on. If a man is entirely without artistic qualities, I think we can hardly train him into artistic qualities; but it is possible to take a man with some artistic qualities and train him to a knowledge of mathematics to some extent. I think it is agreed all round that it is almost an impos-

sibility to examine a man in such a way as to ascertain his value as to artistic accomplishments, as you can with mathematics. There is a general consensus of opinion as to what is, art, but it is not a question that can be argued down to facts, as construction, science, and kindred branches can be. This outline is only a suggestion of what the paper should be.

Mr. Paull: I see no provision in this draft for the recognition of those who had articulated themselves, and perhaps filled their articles.

Mr. Strick: This matter of students having entered upon their pupillage before the Act was passed is a serious matter that we ought to make some provision for. As to French, no architect can ever advance in his profession unless he knows it. I have never been able to obtain a notion in any course—except in a few Italian books that I have read—except the French. The French are better grounded in their knowledge of architecture. Their system is one that you cannot lay on one side for a moment. They are scientifically written, in good language, and you get ideas from them that you would not get from any other. I don't know but that there are German works of vast value. Although I could only spell over the words and translate them gradually, I derived some practical information from them. The Germans are more constructive, and they are better educated in a scientific manner. They make the most abstruse calculations on things that we would just look at and sketch, and they lay them down admirably and mathematically to a scale. It is not necessary that you should be a very great linguist to take advantage of the works in these languages. I never could translate French rapidly, but going through gradually I derived great advantage from it.

Mr. Langton: Is it in the discretion of the Council to make any distinction between students who were articulated some time ago and those who are just beginning? I understand it is a provision of the Act that a student should pass the examination, and it does not seem to be possible for the Council to have any variation in the examination so as to admit some students easier than others.

The President: I think it is quite within the province of the Council in their judgment to set up an examination upon any basis they may think proper; and they have set up this year's examination much more liberally than next year's, and the next year much more severe than that again. It is quite within their province to do so. I for one am very much in favor of allowing as we have been obliged to do in regard to those in actual practice.

If we had asked for an Act cutting off any that we thought were not qualified to practice, but who had been in practice for a few years, and established in business, and were making a livelihood out of it, the Government would not have granted it. In the same manner we cannot cut off the amount of time that the students of the present day have spent in preparing themselves under a certain regime that has now passed away; it would not be right and equitable; so that I think our first examinations should be as liberal as it is possible to make them, to bring up gradually the highest standard. Section 24 of the Act refers the matter to the Council, who have to prescribe the examinations.

Mr. Edwards: When these examination items were arranged, the matter of the extent and the breadth of the examination was talked of, and it was deemed that those gentlemen who got up these examination papers from time to time would be then able to say to what extent the examination in any subject should go, and while this brief synopsis of the examination may appear imperfect, I think that would cover the ground which some of the speakers here have desired to cover. That explanation will perhaps account for the brevity and apparent carelessness of this examination paper.

Mr. Darling: I don't want to criticize anything, but I would suggest that it may be wise in a thing like that to state certain books that it would be well students should devote their attention to.

Mr. Edwards: It is under consideration now.

Mr. Darling: I think it would be well to give them wider suggestions as to design, and as to their reading. I don't think we can make that much too wide, if you consider that that will fall into the hands of a student in a small country place whose master has not much opportunity of coming into contact with other members of the profession, and he himself cannot help him very much. He has nobody to look to, and may have no one that he can write to. I would let that be so wide that it might seem disagreeable; but give him all the information he could possibly get—the more information you give him, the more satisfactory it would be all round. A little too much information is a great deal more satisfactory than too little.

Mr. Bousfield: The examinations should not be looked to as bugbears; they are milestones to show a student what he should know at a certain time, and to give him an idea of what he should take up. It is not the intention to get up an examination to hinder the students; the great idea is to help them. As far as the Ottawa students are concerned, I think they make a great mistake in thinking for a moment that they could not pass the examinations. As Mr. Langton said, it is a very great benefit to them and to the society as well. When we are instructing young men we are doing it for the public benefit as well as their own, and if men are to be architects they have got to learn that it will make them proficient. When I was a student in England, I was only too glad when I found I had to

pass an examination, because then I had a definite object of study, and that is just what these preliminary examinations do.

Mr. Billings: I couldn't say that the Ottawa students wanted to dodge any of the examinations. I think, as a rule, they will all want to pass them. The only thing is this, that the objection was made by the members of the Institute to taking away any vested rights which those students might seem to have—when a youth entered on a course of study on a certain understanding, he ought to be allowed to go into the profession on the same understanding as he entered.

The President: I don't think that is a question that we can take up just now, because what is the use of our forming an Association with the idea of elevating our profession and bringing it up to a higher standard than it at present occupies before the public, if we are to allow continuously those who choose to enter as students, and think they have only certain things to do, and who attend offices two or three hours a day, and play the rest of the time? We have started this Association with the view of bringing up in the future a set of men who will be educated in their profession—fully equipped for the battle of life in that profession, more conversant with every branch of it, both scientific and artistic; and if we don't succeed in that, we had better drop the Association entirely. (Hear, hear.) My view is to allow those now in the profession to pass through as liberally as possible; but every student hereafter entering the profession must come through the door of an examination or the qualification as here laid down. An idea has been in the minds of some of the members of forming a circulating library of architectural works that shall be useful for the country students. They shall pay a small fee for the use of the books, which can be sent backward and forward by book post, so as to afford them opportunities of reading up and educating themselves in the different branches of the profession. (Hear, hear, and applause.) Of course, that is hardly necessary in the city. A number of members of the profession have very good libraries of their own, and we have a number of good works in the Public Library, and we have opportunities that do not exist in the country towns; and this library will be almost exclusively for the benefit of the country students and younger members of the profession.

Mr. Gordon: Would it be in order to make a suggestion—somewhat on the line of Mr. Darling's first suggestion—that is, that the artistic element should be more largely represented in the examinations? I notice in the first examination there is nothing upon the question of perspective, which is the first element in designing; and I would suggest that you should have linear perspective added in the first examination; that in the second intermediate examination you add shading, and perhaps color; and then in the final examination add an essay upon the principles of design—something that would to a certain extent meet the great lack which there evidently is in the subjects of the artistic element.

The President: A very good suggestion.

Mr. Knox: I was about to make the same suggestion, and that is, too little attention has been paid to the artistic element. Supposing a young man passed through the various examinations there enumerated, they will become first-rate constructors; but I know the leading designers both on this continent and in England, and I must say that so far as the knowledge of construction goes, it is very small indeed. I therefore hold that the two go sometimes together, but usually they drop pretty widely apart; and I would therefore say that in your examinations you might have it so that a young man could pass an examination as a designer, and come forward as an architectural designer or artist, while the other young men might come out with their construction and become architects in the sense which you have prepared these examinations for. I think it is only fair for both sides of the question.

Mr. Darling: I want to put myself right. Both Mr. Gordon and Mr. Knox said I have been speaking on behalf of a more artistic element. I am not speaking of the artistic element at all. What I did speak of was the lack of the architectural element. (Hear, hear, and applause.) I am down on this running off on the artistic element constantly; there is too much of it; what I want to see is more of the thoroughly architectural element.

Mr. Knox: I want to correct myself; I meant the architectural element—the designing, not the mere drawing—the design. Mr. Gordon: And I may say the same. (Laughter.)

Mr. Bousfield: It shows the necessity of learning how to speak—to say what you mean. (Laughter.)

Mr. Billings: Is it the intention of the Council to award certificates for students who pass well in drawing from life, etc.? Would the Council give them any points on examination?

The President: In answer to what I understand Mr. Billing's question to be, I would say that what he refers to does not come quite within our curriculum. That relates more to an examination in the Royal Academy. (Hear, hear.) There they form classes for drawing from the nude, and so on, and the higher branches of art. It is something we have not taken into consideration as yet.

Mr. Bousfield: It is taken up by students' associations.

The President: I think we have had a very full discussion on this very able paper of Mr. Bousfield's, and I may on behalf of the Council, thank you all for the suggestions that you

have offered. There are some very valuable ones. I think those latterly given by Mr. Gordon are very good, and we shall take them into consideration, and those also from Mr. Darling and others. I thank you very much for the attention you have given to the paper.

ACCIDENT TO THE Y. M. C. A. BUILDING, MONTREAL.

THE accident to the Y.M.C.A. building at Montreal last week has demonstrated the old proverb that the strength of the chain is only equal to that of its weakest link. The experts appointed by the Building Committee are preparing a report upon the condition of the whole building and as to whether the plans and specifications provide adequately for the safe construction of the building. Doubtless they will be found in the main satisfactory, and it is just possible that the late accident may have resulted from a departure from the plans.

The information which has reached us is somewhat meagre as to details, but judging from the cuts which have appeared in the local papers, the construction of the supports of the column which first gave way exhibits an amount of ignorance of the laws of safe building which should relegate the parties responsible to positions calling for a different order of intelligence. Not only was the column set upon the side of the supporting pier, but the column block 32 inches square was only 5 inches thick, while the iron base plate was about 20 inches square and only 1 1/4 inches thick. Possibly if the pier had been very solidly built and central with the weight above, nothing serious would have occurred but there would even then have been the risk of both iron plate and column block splitting in the centre, allowing the column to sink into the heart of the pier; in fact it is quite probable that the trouble first began with the breaking of the iron plate and the bearing stone, upon which the column gouged its way through the brick-work of the pier, crushing off the wedge-shaped piece shown in the illustration.

No stone bearing heavy weight should be less in thickness than 1 1/2 times its projection beyond the bearing of the weight above it, and an iron plate of the above thickness should have been stiffened by iron ribs or brackets.

RED EXUDATIONS FROM BRICK.

HAMILTON, Ont., April 6th, 1891.

Editor CANADIAN ARCHITECT AND BUILDER.

DEAR SIR,—I see by your weekly CONTRACT RECORD of the 4th inst. that the National Association of Brickmakers of Memphis have been discussing the above question, and a chemist proposes several remedies. From observations of my own for several years I have come to the conclusion that the best remedy for the above is to let it alone. It appears only on new buildings, and only on those which are built in the latter part of the season, or fall of the year. Let any one examine the brick work before or at the time this efflorescence is upon the face of the brick, and he will find, perhaps, finger marks, specks of mortar and other dirt, but on examination a year later it will be found to be without specks or marks, and clean as a new pin.

I regard it, therefore, as a benefit rather than a detriment, and think it must be the result of the action of some substance of the nature of soda.

I have not written the above from a scientific or chemical standpoint, but from actual experience and observation of results in this locality.

Yours truly,

WM. HANCOCK,
Contractor, Brickmaker, &c.

TEST OF FIRE-PROOFING MATERIALS.

AN interesting and instructive series of tests of fire-proofing materials was recently made under the direction of Messrs. Andrews, Jacques and Rantone, architects, of Denver, Colorado, in connection with the erection of the new Equitable building in that city. Three tenders were received for the fireproofing of the building. In the case of the two lowest tenderers the material proposed to be used was fire-clay. The third tenderer proposed to use porous terra cotta, and put in the claim that this material was of superior quality to that offered by his competitors, and consequently that it deserved to be accepted at the extra price. In order to establish the truth of this claim, he requested that a test of the materials be made. This suggestion was acted upon with the consent of the other tenderers.

The tests were conducted under the following heads:

(1) A still load increased until the arch breaks down; (2) Shocks, repeated until the arch breaks down; (3) Fire and water, alternating until the arch breaks down; (4) Continuous fire of high heat until the arch is destroyed.

Following is a summary of the results:

STILL LOAD TEST.—Arch built by the Pioneer Fireproof Co., of dense fire-clay: common method of construction, broke at 5,429 pounds of pig-iron.

Arch built by Thomas A. Lee, of porous terra-cotta and with the end-method of construction. Carried 15,145 pounds of pig-iron for two hours without breaking. Afterwards, broken by three blows from a ram weighing 134 pounds and dropped from a height of ten feet.

Arch built by Wight Fireproofing Company, of dense fire-clay: common method of construction, broke at 8,574 pounds of pig-iron.

DROPPING TEST.—Arch built by Pioneer Company, of dense fire-clay: common method of construction. Broke at the first blow from a ram weighing 134 pounds, dropped from a height of six feet.

Arch built by Thomas A. Lee, of porous terra-cotta: end-method of construction. Same ram dropped on it from a height of six feet four times; same ram dropped on it from a height of eight feet seven times. Arch went down at the eleventh blow.

Arch built by the Wight Fireproofing Company, of dense fire-clay: common method of construction, broke at the first blow from the same ram, dropped from a height of six feet.

FIRE AND WATER TEST.—Arch built by Pioneer Company, of dense fire-clay: common method of construction. Three applications of the water destroyed this arch. When the brick furnace was removed from under it, this arch collapsed.

Arch built by Thomas A. Lee, of porous terra-cotta, on the end-method of construction.

This arch was given eleven applications of the water, and at the end of twenty-three hours was practically uninjured, as it required eleven blows from the ram used in the dropping-test to break the arch down after the furnace was removed from under it.

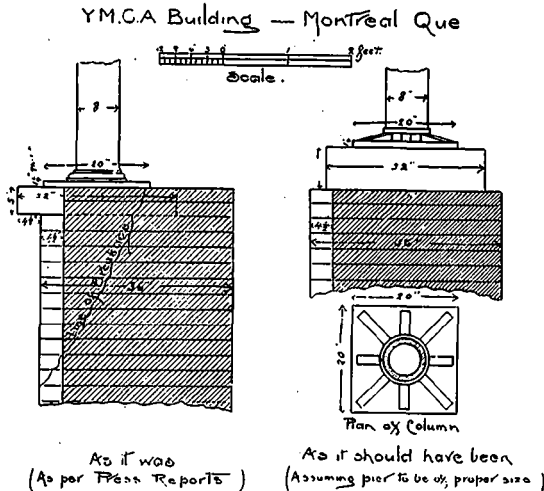
Arch built by the Wight Company, of dense fire-clay: common method of construction. This arch was given fourteen applications of the water, and after twenty-three hours very little of the arch was left, and it collapsed as soon as the brick furnace was removed from under it.

CONTINUOUS FIRE TEST.—Arch built by Pioneer Company, of dense fire-clay: common method of construction. This arch, after having a continuous fire under it for twenty-four hours, was destroyed, as it collapsed as soon as the brick furnace was removed from under it.

Arch built by Thomas A. Lee, of porous terra-cotta: end-method of construction. This arch, after having a continuous fire under it for twenty-four hours, was practically uninjured, as, after its furnace was removed from under it, it supported a weight of bricks of 12,500 pounds on a space three feet wide in the middle of the arch.

Arch built by Wight Company, of dense fire-clay: common method of construction. This arch, after having fire under it for twenty-four hours, was unable to carry its load of 300 pounds per square foot, and collapsed as soon as the brick setting was removed from under it.

In painting ironwork exposed to wind and rain, take, says the *Mechanical World*, red oxide of iron, ground in oil, and mix it with equal parts of boiled linseed oil and turpentine, add 1 ounce patent dryers to the pound. This is said to be a good paint for the purpose.



OUR ILLUSTRATIONS.

RESIDENCE OF MR. P. LYALL, MONTREAL.—MR. JOHN JAMES BROWN, ARCHITECT, MONTREAL.

ST. GEORGE'S CATHEDRAL, KINGSTON, ONT.—MESSRS. POWER & SON, ARCHITECTS.

CLUB HOUSE FOR THE ATHENÆUM CLUB, TORONTO.—MESSRS. DENISON & KING, ARCHITECTS.

PROVINCE OF QUEBEC ASSOCIATION OF ARCHITECTS.

At a meeting of Council held on March 16th, there were present: Messrs. J. W. Hopkins, President, in the chair; V. Roy, 2nd Vice-President; A. C. Hutchison; A. F. Dunlop; A. T. Taylor; W. E. Doran, Treasurer; C. Clift, Secretary.

The minutes of last meeting were read and confirmed.

A letter dated Jan. 31st, 1891, from M. Ouellette, was read. The Secretary was instructed to answer questions contained therein as follows:—

1. In a competition for plans of a building, is it right that one of the competitors sign his plan?

Provided there was no conditions to the contrary, it would remain optional with the competitor.

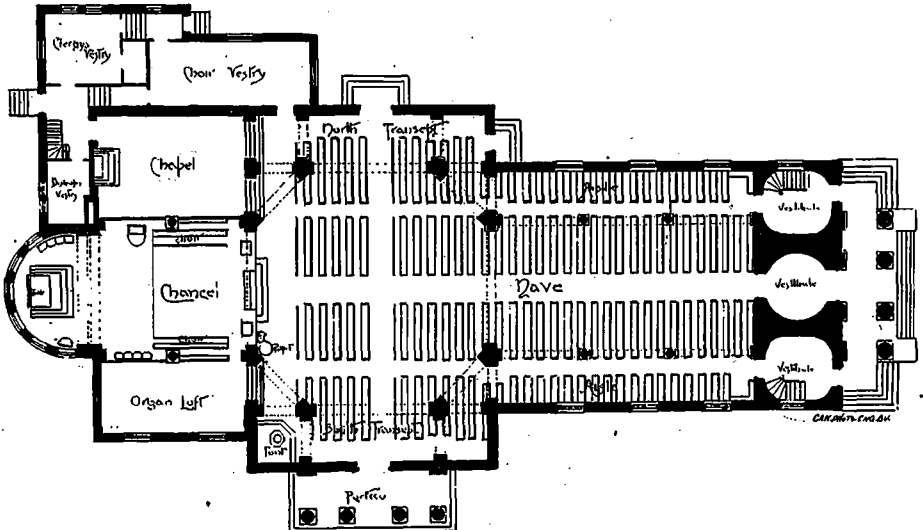
2. In that case, is it right to choose only one judge, when this judge knows well every competitor?

Mr. H. Robert Talbot applied to become a member, but the Council decided he did not come under the meaning of the Act, *i. e.*, practising architect, he not having supervised work on his own account previous to the passing of the Act of Incorporation. The Council strongly recommended that he come up for the final examination in July next, being thoroughly satisfied with the term of studentship. This decision was arrived at after Mr. Talbot had been given a hearing. To the question put to him by the Secretary, whether at any time before the 30th of December last he had superintended buildings on his own account, he distinctly answered, "No." The Council at the same time did not question his ability to supervise work, but it was not in their power to discuss the point, as the Act is very plain on the point at issue.

The Committee elected to look into by-laws laid them before the meeting; after some discussion they were further and finally amended and adopted. Copies were ordered to be sent down to Quebec for approval or comment, and then printed with the Act in French and English in pamphlet form, to be distributed among the members as soon as possible.

It was decided to hold a general meeting as early as possible to lay before the members the business done by the Council up to present time.

The matter of the Board of Trade competition was brought



PLAN OF ST. GEORGE'S CATHEDRAL, KINGSTON, ONT.

3. Do you think that a judgment in that case ought to be a final one?

Questions 2 and 3. The Council thought that on these points the judge should be governed by the conditions of the competition.

4. Do you think in a case like this a judge ought to accept this position, or else put aside the plan signed as aforesaid?

In the absence of the conditions of the competition, the Council cannot answer as they would wish, and before answering finally, would like a copy of such conditions.

The Secretary was also instructed to write the Quebec Local Association to the effect that the Council were about to prepare a guide to govern competitions, and that when completed, copies would be sent them.

A letter from J. B. O'Hroux, of Feb. 5th, 1891, was read, and the Secretary instructed to write him, saying it was necessary for him to serve one year in an architect's office, after a course of four years study, but a preliminary examination in his case would not be necessary.

The following members were duly elected: Messrs. E. Colonna, Montreal; J. E. Dore, Montreal; G. Simard, Montreal; J. R. Rhind, Montreal; Chas. Chaussé, Montreal; A. Flockton, Montreal; A. H. Larochelle, Quebec; J. B. Bertrand, Quebec.

before the Council by Mr. Taylor, who said the Board would have a meeting on the morrow to arrange for a general meeting of the members to discuss the competition on proposed new building, and he thought at that meeting the Association should lay before the members the reason for not competing. Mr. Taylor was supported by the Council, and was requested with Mr. Dunlop to attend the general meeting of the Board of Trade and explain the objections found in the conditions prepared governing the competition.

PUBLICATIONS.

We are indebted to Messrs. Simpson & Peel, the well-known contractors, of Montreal, for a handsomely printed and illustrated description in book form of the New York Life building in that city.

We have received from Messrs. Merchant & Co., Philadelphia, the well-known importers of roofing plaid, a sketch illustrating the greatest engineering achievements of the century, *viz.*, the Forth Bridge, entire length, 8,296 feet, length, 5,349 feet 9 in., approaches, 1,779 feet Queen's Ferry side; Brooklyn Bridge, entire length, 5,989 feet, span, 1,599 feet 6 in., height of towers, 278 feet, roadway, 135 feet; Eiffel Tower, entire height, 984 feet 3 in., to first landing 184 feet, to second landing 371 feet 3 in.; Statue of Liberty, entire height, 301 feet 3 in., pedestal 149 feet 10 in., statue, 151 ft. 6 in.; Washington Bridge, entire length, 2,375 feet, span, 310 feet, height, 151 ft.; Washington Monument, entire height 555 ft. 5 1/2 in.; Paughkeepsie Bridge, length, 1 1/2 miles, double track bridge. The sketch is an artistic reproduction of water colors on "egg-shell" paper.

THE TORONTO ARCHITECTURAL SKETCH CLUB.

Owing to the indisposition of Mr. R. J. Hovenden on Monday, March 23rd, his talk on "Decoration" had to be postponed. A large number of valuable colored plates lent by him were examined with much interest by the members, and an open discussion on the subject was taken part in by Messrs. Frank Darling, Sam Jones and others, Mr. Darling urging the necessity of architects keeping unbroken the main lines inside a building, for if this is not attended to, it is very difficult to carry out any decorative scheme in a satisfactory manner.

The drawings for an "Entrance to a Park" were then criticized, and many practical suggestions made by Mr. Burke. Mr. T. R. Johnson was awarded first place and Mr. A. H. Gregg second place.

On Monday, 13th inst., Mr. Hovenden gave his postponed talk, and again had a number of colored plates on exhibition. The many valuable hints thrown out during the talk, combined with his clever criticisms on the plates, made a very profitable evening for those present, who showed their appreciation of his efforts in a very hearty way.

TESTING THE VALUE OF PAVING STONES.

The following plan of testing the comparative value of paving stones is adopted at the Paris Laboratory for Testing Materials, says the *Engineer*. A sample of the rock of regular form is placed upon a horizontal plate, rotating round a vertical axis and pressed against it by suitable contrivances. The wear is then compared with that of a standard material under the same conditions. The coefficient of wear is the proportion between the volumes worn, which can easily be ascertained by weighing the specimens, and determining the volume from this weight, and the specific gravity of the material in question. The rotating surface is cast iron. The two specimens, viz., test piece and standard, are placed at opposite ends of a diameter of the rotating plate, against which they are pressed by equal weights. The standard used is Yvette sandstone, and first-class materials have a coefficient of from 1 to 1'40, while with second-rate materials the coefficient is between 1'40 to 2'40; if the wear is greater than that represented by the latter figure, the material is rejected. An additional test is made by placing specimens of the stones to be tested in a cylinder, which, like those used in clearing scrap iron from rust, is mounted and rotates on an axis which does not coincide with its centre of figure. The amount of detritus pro-

duced after the material has been treated for a certain time in this machine is compared with that from a standard rock under the same conditions.

FOUNDATIONS IN WATER.

In works which are exposed to the action of the sea or the currents of rivers Rennie adopted the plan of bedding the outside joints, for about an inch deep in the face, with Roman cement of the best quality. The interior part of the stones was bedded in mortar, composed of two parts of well burnt, stone-lime, one part of ground puzzolano, or calcined pounded iron-stone, and two parts of clean sharp river sand, not too fine. The lime was used hot, for which purpose it was necessary that it should be burnt adjoining the works and mixed at once with its due proportion of sand and puzzolano or iron-stone, previous to being slaked. It was afterwards covered over with sand so as to prevent the access of the air; water was then poured on the heap, and in this state it was left for a day or two until completely slaked; after which it was taken from the heap as wanted. The unslaked particles were separated, and the other ingredients well mixed by being passed through a screen, after which the mixture was made into mortar, with the least possible quantity of water, by means of a pug-mill prepared for the purpose. That part of it required for the day's use being taken away, the remainder was immediately covered up with sand, to prevent the action of the air upon it.

There is no excuse for building underground apartments in the country says the *Sanitary News*. They are never wholesome anywhere, and if families are compelled by stringent reasons to live in the city, where basement dining rooms and underground kitchens are the rule, they should endeavor to have an upper sitting room and live in it as much as possible. The very placing of a house on any ground and living in it under ordinary circumstances causes suction into its interior of impure soil air, because the air of the house is warmer than the air beneath it, and this induces a rush of cold air to the warmer house atmosphere. The concreted floor will, in a great measure, do away with this difficulty, but not altogether. Ventilation of cellars must, therefore, be attended to, no matter how clean and perfectly built they may be, in town or country. Annual lime white-washing, an old custom, is decidedly a wholesome precaution, and every cellar should be thus treated, especially in the autumn, as the cellar will be kept closed more in spring and summer.

A large bridge is to be moved on the Grand Trunk Ry., near Kingston, Ont., where the main line is being double tracked. A new double track steel span, 170 feet long over all, 30 feet in width between truss centres, and containing 176,600 lbs. of steel, has been erected alongside its intended location, and is to be rolled into place between trains.

It is sometimes necessary to locate the position of the centre of gravity of the section of an angle or T iron. The following rule may in such cases be found useful in the case of equal-sided angles and T's: Let B = breadth of side and t = thickness of metal. Then distance of centre of gravity from the outer surface of one flange of the angle iron or of the table of the T iron is $\frac{1}{2}(B + 3t)$. This rule is a very close approximation.—*Engineering*.



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