# ·THE·CANADIAN· ·ARCHITECT·AND· ·BVILDER·

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# INDEX TO ADVERTISEMENTS

## VARIATIONS IN BRICK AND STONE.

Our attention was called a short time since to the remains of what had once been a house dating from the Colonial period. The chimneys had been built supposedly of very excellent brick and their remains had been lying exposed to the weather throughout the whole winter and were now in such condition that hardly a single piece of burnt clay was intact. The query was raised, why brick should disintegrate, and that brought out the very commonly heard statement that our questioner assumed all bricks were alike and that almost any brick is fit to use in a building if laid properly. It is never safe to assume that brick is enduring and suitable for building operations unless we know its composition. The most potent factor which must be guarded against is the presence of salts of magnesia. It is only a question of time when brick in which these salts are present in any appreciable quantity will be badly influenced by the weather, and we have seen brick which, when fresh from the kiln, gave every mechanical evidence of being of best quality, so shattered and disintegrated by the combined effect of moisture, frost, and the chemical action of the magnesia, that a knife could be thrust straight into the heart of the brick with very little effort.

There is a common conception that granite is one of the most enduring stones, but it certainly is not so in our climate, and as a matter of fact most granites would be outlived by thoroughly first quality hard burned brick. A pure syenite, free from iron or mica, constitutes the most enduring of the granites. A granite quarry may have good stone in some portions of the deposit and be utterly worthless in others, and as a general rule it is not safe to use a granite unless the architect knows absolutely its composition and the part of the quarry from which it is taken.

Sandstones, which were formerly so much used in the East, are really the poorest building material in the market. The cementing material in sandstone has a very slight value, and it is probably the poorest material extensively used, as far as resisting the action of frost is concerned, while the presence of iron constitutes an almost fatal defect. It may be said also that very little sandstone is free from iron.—The Brickbuilder.

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Nature has been exceptionally kind in furnishing heat at several points in South Dakota, there being artesian wells which furnish hot water, so that buildings are kept well heated by the water being piped through them, without the use of other heat.

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## British Trade Supplement

The Publishers of "The Canadian Architect and Builder" have arranged to furnish information respecting British Exporters of Building Materials and their goods advertised in this paper, and will keep on file at their offices, Board of Trade Building, Montreal, Confederation Life Building, Toronto, and 720-721 Union Bank Building, Winnipeg, Cataolgues, Price Lists, Etc.

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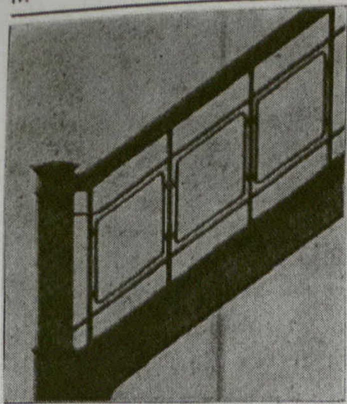

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## DEFINITIONS FOR CEMENT USERS.

The following two important definitions for the use of the trade in the future were developed at the Chicago convention of cement manufacturers:

The term "Concrete" should never be used except when the composition described contains crushed rock pebbles or coarse gravel, combined with sand, and where cement is used as a binder.

Where sand only is used together with cement, you should say a cement mortar block, a cement mortar brick, a cement mortar column, cap or lintel, as the case may be, and either of these may have the term "re-inforced," should there be an iron or steel member inserted for the purpose of giving structural strength in either direction.

# The Canadian Architect and Builder

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## ILLUSTRATIONS.

CANADIAN ARCHITECT AND BUILDER Students' Competition for a Small Suburban House.
Proposed Workingmen's Houses for Toronto Cottage Home Company.

## ADDITIONAL ILLUSTRATIONS IN ARCHITECTS' EDITION.

Prince of Wales Fusiliers Armory, Montreal.
New Physics Building of the University of Toronto.
Grammar School and Guild Chapel, Stratford-on-Avon.

## CONTENTS



**Prosperity or Hard Times.**

Recently much speculation has been rife regarding the possibility of hard times ahead for the man with the dinner pail. At the beginning of the year Mr. John D. Rockefeller essayed to play the prophet's role and predicted "hard times," but the world wouldn't listen then and an optimistic chorus of less prominent financiers pooh-hooed any such possibility. Since that time a two billion dollar slump has occurred in Wall street, followed by a further period of suspense, occasioned by the unseasonable spring and possibility of meagre crops.

Now that the season is well on, we in Canada can make some estimate of the probable effect these conditions will have upon us in the near future. It may be pointed out that while the belated spring contracted trade, the actual result was nothing more serious than followed from an extension of credit obtained against unsold goods. Moreover, the high price of money has been wholesome, inasmuch as it has put a check upon highly speculative enterprise. At present the crops in all parts of Canada are making satisfactory progress, and pessimists have ceased to prophesy serious results. Throughout the entire Dominion expansion in all directions is taking place, but it is on the whole a very sane expansion. The recent warning of trouble ahead from reckless investment has not been lost, and the amount of building in Canada, while on the aggregate not so large perhaps as earlier indications predicted, is satisfactory in the extreme.

**Postal Regulations Necessitate Change.**

Some time ago the publishers of THE ARCHITECT AND BUILDER were notified by the Post-Office authorities at Ottawa that they were violating the postal regulations in that they were sending through the mails the loose illustration sheets, which have been such an attractive feature of this journal. These regulations, it was pointed out, required that only a single undetached sheet might be included in any publication seeking transmission through the mails. The publishers were unwilling to change the form of the paper without a struggle, however, and pointed out to the authorities at Ottawa that foreign journals of a similar nature to THE ARCHITECT AND BUILDER were continually coming into this country without objection being taken and that it was obviously unfair to compel one Canadian publication to comply with a regulation which several foreign journals were continually violating. The fairness of our objection was at that time recognized, and for a time nothing more was heard of the trouble. A few weeks ago, however, when the new postal regulations went into effect, the authorities once more took up the matter, with the result that we shall now be obliged to modify in some degree the form of our illustrations.

Hereafter, the illustration pages, while still being of a superior quality of paper to the rest of the publication, will be bound in, folioed and titled, as are the reading sheets. In this way the publishers hope not only to continue as in the past to assist the architectural profession by these illustrations, but if possible increase that assistance by improved and more varied subjects. This, of course, applies to the Architects' edition only, the regular edition remaining unchanged.

**Institute of Architects of Canada.**

Following the agitation that for so long has been maintained by the architectural profession in Great Britain and the United States anent the question of registration, the time has apparently arrived when Canadian architects are about to take definite steps in the matter of forming what is to be known as "The Institute of Architects of Canada." So much has been written in English and American architectural journals regarding the vexed question of registering architects that scarcely anything new can be said upon the subject that has not hitherto been directly or indirectly referred to. Statistics have been brought forward to prove that in some States of the Union, where there has been put into practice some such system of registration as is now being contemplated in this country, the beneficial results accruing therefrom have been considerable. On the other hand, just as strong testimony has been adduced to show that in places where the registration system has been given a fair trial no good results have been obtained.

Referring to the outline of the project of incorporation for the proposed Institute, with which doubtless most of the profession are by this time familiar, we note that the "Institute of Architects of Canada" has as its object to facilitate the acquirement and interchange of professional knowledge among its members, and more particularly to promote the acquisition of that species of knowledge which has special reference to the profession of architecture, and further to encourage investigation in connection with all branches and departments of knowledge connected with the profession."

Such an ambitious undertaking is certainly worthy of all commendation, and if the formation of the Institute will make for the improvement of the architectural profession in Canada it should undoubtedly be given every possible encouragement.

In the present condition of the country it must be apparent to everyone that the small country town practitioner is afforded very little opportunity of rubbing elbows with his fellows or even of realizing that they and he have interests in common, to the extent of interchanging professional ideas. Will the formation of the Institute better this condition? The membership is intended to comprise architects practising over the entire Dominion—a vast territory. With such wide jurisdiction and scattered membership, it is questionable whether it will ever be possible for the Institute to aid materially in the betterment of the profession without the aid of local chapters, acting in a capacity subordinate to it. While doubtless one great central organization, such as the Institute promises to be, would serve as a means of maintaining the status of those within the pale, legally and professionally, its activity might end there, and what is avowedly the main purpose of the Institute, viz., the interchange of professional knowledge, as quoted above, would be entirely overlooked. In the larger cities there are already chapters or associations which ought to work hand in hand with the central organization, if a complete network of influences are to make for the good of the profession.

The State recognition which the Institute seeks aims at improving the status of those who happen to be within its pale. The part the Canadian architect may be expected to play in the future history of Canada will be no inconsiderable one, and it is undoubtedly an opportune time for him to assume something of the position he merits in the public estimation. It is possible by a proper scheme of registration to materially benefit the profession in its practical as well as in its higher aspects. No one has a better reason for seeking every legitimate protection from the "Charlatan" than the man who, by earnest study and much labor, has proved himself fully qualified to pursue the practice of his profession.

A considerable difficulty arises here, however, by reason of the proposal to limit the word "architect" to members of the Institute only. That the test of an entrance examination should be the means of determining membership is a feature of the new organization that will receive considerable opposition from a large part of the profession. While there is no doubt that anything looking to the better educational preparation of young men entering the architectural profession is highly desirable, it seems scarcely wise to so suddenly institute an innovation in the present procedure, and limit the title "architect" solely to those who have succeeded in passing an examination of the character proposed by the Institute. Good architects are to-day enjoying the confidence of their fellowmen and have risen high in the profession without having passed any examination whatever.

In any profession it is the standard of practice that is the vital question, and it is doubtful if this can be raised by an entrance examination, hastily prepared for and extremely limited in its scope. The fact of his architect having passed such an examination weighs but little with a client, neither does it guarantee for that architect any greater ability to provide for the public safety. On this, particular stress has been laid by some exponents of registration in the United States, not, however, to the welfare of the cause. The opponents of registration point scornfully at the unsavory history attaching to the Pennsylvania Capitol at Harrisburg, and contend that if, as so many claim, one of the strong reasons for registration is to ensure the safety of the public against incompetent architects making mistakes, the sooner that claim is dismissed the better. They contend that if the government is to be urged to license architects, it should also hold a moral and commercial inquest.

However, it must be admitted that there should be a better opportunity afforded students of architecture for preparation at our universities. It is to be regretted that in Canada the existing opportunities for academic training along architectural lines are shockingly inadequate. In Toronto University a 'tacked-on" course at the School of Practical Science is all that Ontario can offer. McGill, of course, offers better facilities. However, if the new Institute will endeavor to secure in Canadian universities more complete and satisfactory courses of study than now exist it will be doing a commendable work. Greater culture for the architect, to be obtained by a good university training, in the humanities as well as in science, will be an infinitely more satisfactory object of attainment than the hasty preparation in the rudiments of heating and ventilating a building that would be the general result of "cramming" for the entrance examination, as outlined in the act of incorporation, for which examination the average student would of necessity prepare himself by private study.

With its many desirable features, the act of incorporation as it now stands will bear some modification. In any case it is unlikely that it will escape criticism at the hands of at least some members of the profession, before it is finally accepted in toto. In the main, however, Canadian architects appear prepared to co-operate in any action that looks to the betterment of the profession.

# Strength of Brick and Brick Piers*

The results of tests of brick and brick piers, which I have the honor to present, are selected from those which have been made in the testing laboratory at the Watertown Arsenal.

In this laboratory various kinds of constructive materials are tested, the results of which are published annually by the Ordnance Department, U. S. Army, in reports entitled "Tests of Metals and Other Materials for Industrial Purposes," Congressional documents for public distribution. Twenty-five volumes have thus far been published.

From these reports and from current tests, which will appear in subsequent volumes, certain results have been brought together, results which are thought to be representative of their respective kinds of material, as qualified by the explanatory remarks relating to them.

Bricks are possessed of those physical properties which are common to other materials of construction. That is, they have strength to sustain loads, elastic properties whereby their dimensions are slightly changed during the period of loading, springing back to their original shapes, or nearly so, when the loads are removed, they expand and contract with

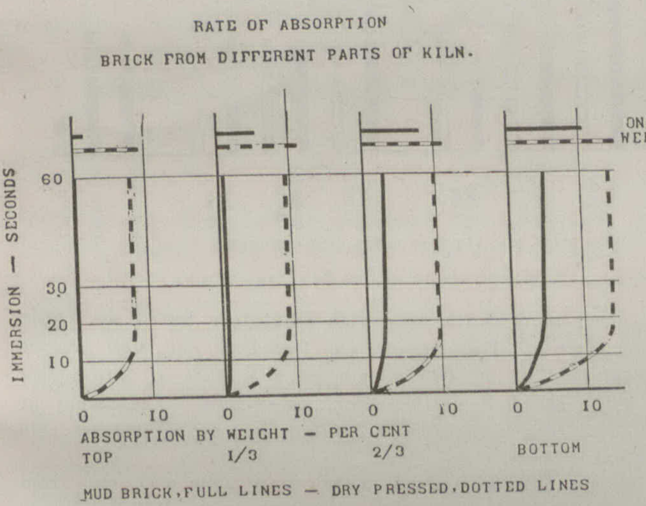



FIG. 1.

changes of temperature, and it appears that their volumes are slightly affected when saturated with water, swelling minutely but perceptibly when wet.

Properties inherent in individual bricks are reproduced in piers constructed therefrom, modified, however, by the properties of the mortar in which the bricks are laid, and mortars vary according to their composition and age. In general, the properties of constructive materials are found to present many variable elements, some of which are under control, and some are not.

Passing at once to the subject of individual brick, values for the co-efficient of expansion by heat have been observed

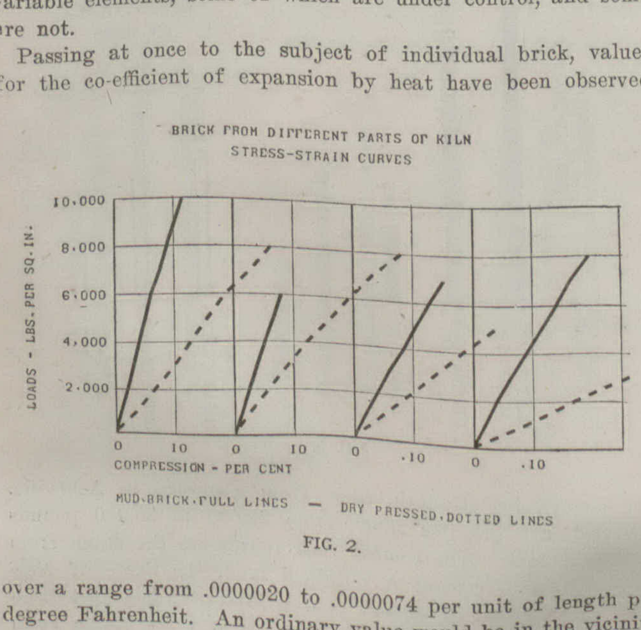



FIG. 2.

over a range from .0000020 to .0000074 per unit of length per degree Fahrenheit. An ordinary value would be in the vicinity of 30 to 40 ten-millionths, that is, somewhat less than steel, which has a value a little above .0000060.

In making these determinations, the bricks were heated in water baths, basing the value of the co-efficients upon the contractions displayed in passing from the bath of boiling water to one at about freezing temperature. It was necessary to use the measurements taken on falling temperatures, to eliminate the effect of the swelling of the bricks due to absorption of water.

The bricks usually swelled and were longer on the gauged lengths when in water at 33 degrees Fahr. than originally, when dry and in the air at 68 degrees. Moreover, after having been through the hot-water bath and returned to the cold one, their lengths were found still further increased.

When a brick saturated with water is frozen, it expands, due to the action of the water within. The amount of such expansion, in going from 33 degrees Fahr. down to, say, 25 degrees, measured on a length of six inches, has been found to range from a few ten-thousandths of an inch to above one-

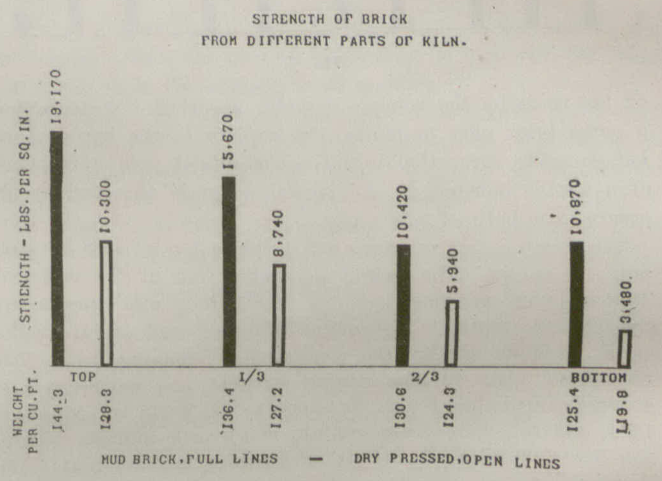



FIG. 3.

half a hundredth of an inch. Not infrequently, freeezing a brick saturated with water is attended with a permanent increase in its length.

The elastic properties of brick have been observed, measuring the compressibility of the material as loads are applied, and determining the permament sets when such have been acquired. Light-hard and salmon brick are most compressible —hard-burnt and vitrified brick are least compressible.

The moduli of elasticity, deducting the permament sets in computing these values, range from less than 1,000,000 to a maximum of 10,000,000 pounds per square inch. Permanent

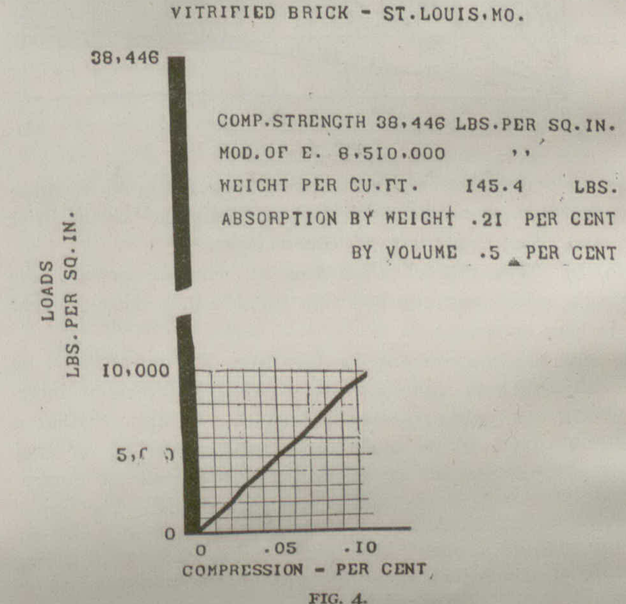



FIG. 4.

sets, when they occur, are usually of small magnitude. From this it follows that the curves of compressibility are nearly straight lines; that is, in individual cases the amount of compression of a brick is nearly proportional to the load which is placed upon it.

*Paper presented at the Twenty-first Annual Convention of the National Brick Manufacturers' Association, at St. Louis, Mo., February 7, 1907, by James E. Howard.

The compression of the brick, in the direction in which the load is applied, is accompanied by an expansion in a lateral direction, which, as well as the direct compression, is a measurable quantity. The usual ratio of lateral expansion to longitudinal compression falls between the limits of 1-5th and 1-10th.

Density of structure is shown by the amount of water which a brick will absorb. Usually the absorption is reported in percentage by weight. A better method seems to be to judge

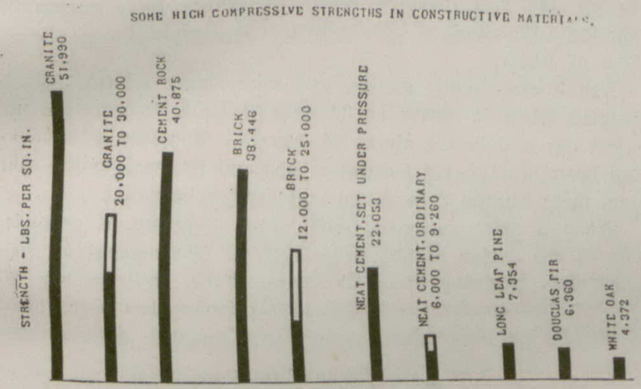



FIG. 5.

of the voids by the volume of water absorbed. Water enters a porus brick very promptly, less rapidly in the harder ones, but complete saturation is not accomplished even at the end of a week's immersion. Additional water is absorbed by exposure in a bath of hot water.

The compressive strength of brick extends over a wide range in values. The weight per cubic foot of the material, its density of structure, modulus of elasticity and compressive strength are mutually dependant features, and all are influenced more or less by the conditions of manufacture. The records of tests on compressive strength are numerous and generally available to all. "Reports of Tests of Metals," 1894, and following years, contain many such results. Nearly 500 State, Territorial and other libraries are designated depositories for Congressional documents, where these volumes may be examined by those who do not have them personally.

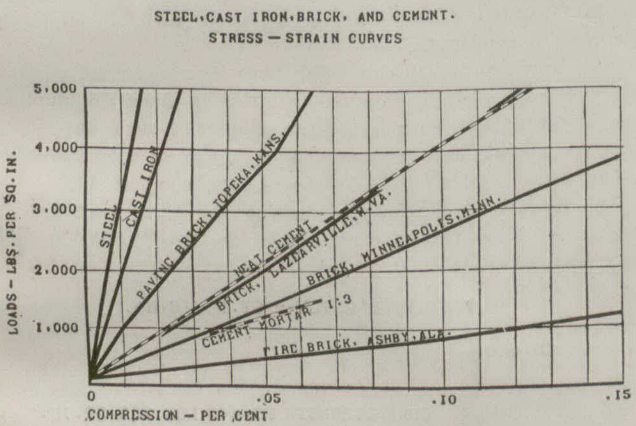



FIG. 6.

The accompanying diagrams have been prepared to illustrate features connected with the properties of brick, brick piers and other materials of construction.

(No. 1) The rate of absorption of some dry-pressed and mud brick, which were burned side by side in a down-draught kiln, is here shown.

The mud bricks are shown by full lines, the dry-presseed by dotted ones. These samples were weighed at frequent intervals during the early stages of immersion. It appears that a considerable part of the water eventually absorbed entered some of the samples during the first fifteen seconds of immersion. After this time absorption went on slowly. The upper horizontal lines indicate the amounts which were absorbed at the expiration of a week's time. The lesser amounts of water absorbed by the bricks from the top of the kiln over those farther down will be noted.

(No. 2) On this diagram are shown the stress-strain curves of the samples of the preceding diagram. The greatest degree of rigidity is displayed by those from the top of the kiln, becoming more compressible as they are taken from the lower parts. The order in which these curves are plotted is the same as in the preceding diagram, with reference to their position in the kiln. It will be noticed that the mud bricks from the bottom of the kiln displayed as much compressibility under a load of 4,000 pounds as the corresponding bricks from the top displayed under twice the load.

(No. 3) The variation in compressive strength is equally pronounced, according to position in the kiln, as shown by this diagram. The weights per cubic foot of the material are entered along the lower edge of the diagram. The highest strength corresponds with the greatest weight. This is characteristic, also, of other materials of construction, high resistance and high density of structure being found in the same samples.

(No. 4) The properties of a remarkable brick are shown on this diagram. So phenomenal was its compressive strength that it is fully deserving of a special diagram of its own. To St. Louis belongs the honor of producing this brick, which far

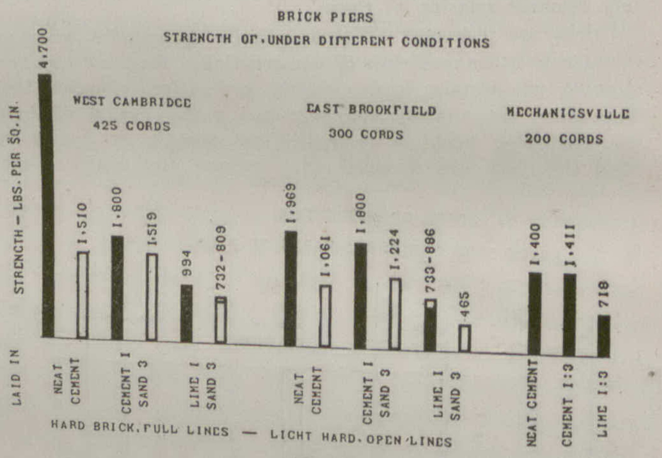



FIG. 7.

exceedeed in strength any brick heretofore tested at Watertown Arsenal. This sample was tested on end, and reached a total load of 367,000 pounds on a surface of 2.45 inches by 3.99 inches in cross-section dimensions. Fragments of this brick have been brought here for inspection, and are held in great respect.

(No. 5) The laboratory records were gone over, and from them were selected the results which appear on Diagram No. 5. These tests represent the highest of their respective classes. They are what have been attained, and are presented as standards of excellence. The granite, of 51,990 pounds per square

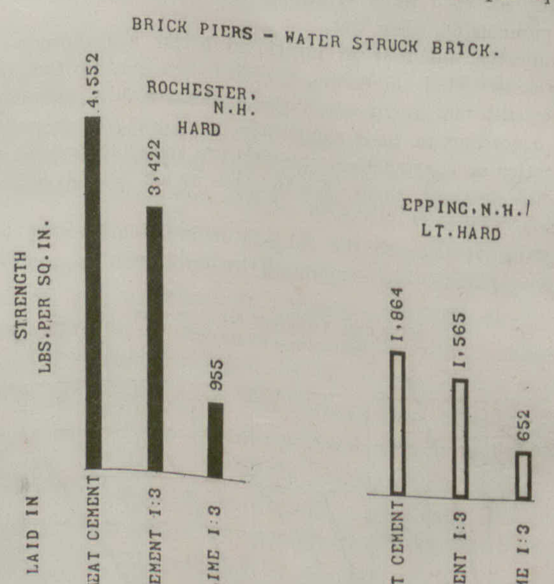



FIG. 8.

inch compressive strength, came from a quarry in Asheville, N.C. Ordinary granites range from 20,000 to 30,000 pounds per square inch. The cement rock represents the stone from which a natural cement is obtained from the State of New York. The brick, of 38,446 pounds strength, has just been described. Ordinary values for hard-burnt brick range from 12,000 to 25,000 pounds per square inch.

Portland cement, set under pressure, attained the maximum strength yet observed in this material. This sample was exposed to an initial pressure of 14,000 pounds per square inch while setting. The strength given on the diagram was displayed by the cement at the age of fifty-seven days. The strength of ordinary Portland cement, tested neat, ranges from 6,000 to 9,260 pounds per square inch.

The strength of the white-oak stick seems low, taken in comparison with the strength of the long-leaf pine and the Douglas-fir wood. In small pieces, white oak has shown a compressive strength of 9,000 pounds per square inch. The figures here given refer to a post of commercial size.

(No. 6) The stress-strain curves of several representative materials are shown on this diagram. Steel and cast-iron are

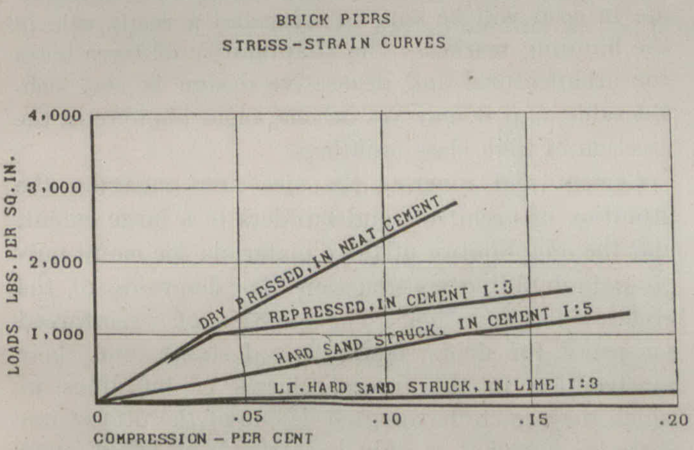



FIG. 9.

here plotted for reference purposes. A paving-brick from Topeka, Kansas, occupies a position next to the cast-iron and steel. Then follow the curves of neat Portland cement, a brick from Lazearville, West Virginia, then a brick from Minneapolis, Minn., and the curve of a cement mortar of one part Portland cement and three parts sand, and at the lower part of the diagram appears the curve of a fire-brick from Ashby, Alabama. This diagram shows the range in compressibility which may be met with ordinarily. The number of curves might be extended, but other grades of material would occupy places between the curves of the paving-brick and the fire-brick.

(No. 7) The strength of brick piers will now be referred to. Diagram No. 7 shows the results with piers made of hard, and light-hard sand-struck brick laid in different kinds of mortar. Brick from three yards are represented, the amount of fuel used being 425 cords, 300 cords and 200 cords, respectively, per million brick. One grade only was received from the yard where the smallest quantity of fuel was used, which was classified as hard.

The range in strength from the hardest brick, laid in neat

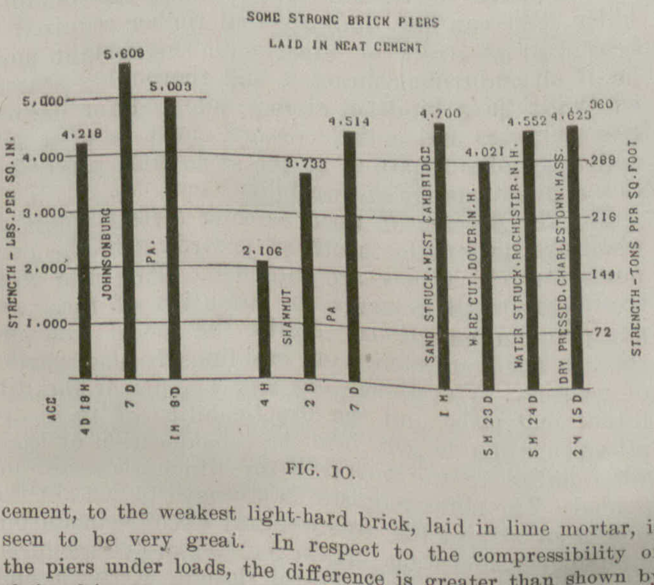



FIG. 10.

cement, to the weakest light-hard brick, laid in lime mortar, is seen to be very great. In respect to the compressibility of the piers under loads, the difference is greater than shown by their ultimate strengths. It is desirable to use neat cement or a strong mortar in laying hard brick, in order to attain maximum strength and rigidity. Rigidity is regarded as an important factor in construction as well as strength.

Lime mortar should not be used, when either of the considerations just mentioned are essential.

Two values are shown for two of the piers. The brick from these yards were panelled on one side, and the higher strength in each of these piers belongs to duplicates in which the panels were filled with neat cement before laying.

(No. 8) Some piers made of water-struck brick appear on Diagram No. 8. One yard furnished the hard, another the light-hard brick. The influence of the mortar on the ultimate strength of the pier is again well shown. It seems a wasteful effort to use a weak mortar in which to lay a pier of hard, strong brick.

(No. 9) The curves of compressibility of some piers are shown in this diagram. An earlier stress-strain diagram (No 6) showed corresponding results on individual bricks and other materials. On the present diagram the most rigid condition pertained to the pier made of dry-pressed brick, laid in neat cement. A pier of re-pressed mud brick appears next in the order of relative rigidity, then a hard sand-struck brick pier laid in less rich mortar than used for the re-pressed brick, and most compressible of the group is the pier of light-hard brick which was laid in lime mortar. The characteristics of these piers depend chiefly upon the quality of the mortar employed.

From this exhibit it may be seeen how unfavorable is the action in a wall, the face of which may be laid with one class of work, while the backing is of another.

(No. 10) In order to illustrate the strength which may readily be attained in brick pier construction, the results of some strong piers have been brought together on the diagram now presented. The four piers represented on the right of the diagram are taken from earlier tests, the results of which are among the published records of the laboratory. The other

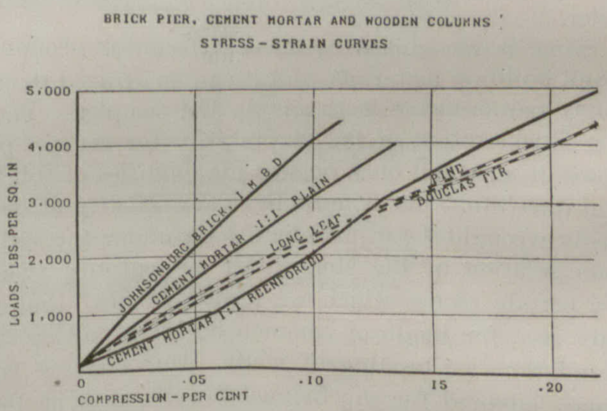



FIG. 11.

six represent piers built and tested just prior to the time of this convention. These later ones were intended to be strong piers, a result which was realized in the tests. They were about 8 feet in height each, nominally 12 inches square; they had hollow cores, and the bricks were laid on edge in neat cement.

The ages of the piers are entered along the lower edge of the diagram. One pier, the youngest of the series, was tested the day it was laid. The test began about one hour after the last brick was in place, and was finished three hours later, or when the pier was four hours old. It developed a compressive strength of 2,106 pounds per square inch. The mortar had not hardened, and unusual compressibility was of course displayed. The total load on the pier reached 118 tons, a load far in excess of any which could be expected to be placed upon it in constructive work, at so early an age.

Horizontal lines represent pounds per square inch on the left of the diagram, and, on the right side, tons per square foot. One pier reached a strength of 360 tons per square foot, another exceeded this load. The allowable load prescribed by the building laws of some cities is understood to range from 15 to 30 tons per square foot, which seems a very low limit in the presence of piers possessing the ultimate strength these displayed.

(No. 11) The stress-strain curves of one brick pier, two mortar columns and two wooden posts are shown on Diagram No. 11. These curves stand for strong examples of their respective kinds. These illustrations and others which have gone before were selected, in many of the cases, to indicate what seems best in constructive materials: examples which could safely be followed where strong and safe construction is needed.

## THE ADAPTABILITY OF MATERIALS

By W. M. Brown, C. E.

(Article written specially for The Canadian Architect and Builder)

In the choice of any material for a special purpose, its adaptability to meet all requirements is the chief consideration. The qualities and quantities of its component parts, its strength and durability, as well as its finished appearance, all regulate its adaptability for the purpose intended. These may not attain the highest standard of excellence, but if they each contain a modicum in their composition, consistent with what is really essential to stability and appearance, they may meet the required desideratum. Materials may be suitable for certain purposes that cannot be utilized for any other, while there are some that can be quite consistently adapted for various requirements, besides that for which they were primarily intended.

There are also several things which affect building materials, both previous to and during construction. The exposure of timber, for instance, to the influences of the weather, and the detrimental use of the material before it is thoroughly seasoned Several other instances might be mentioned, but it is principally the class of materials that are more suitable for certain purposes than others, which we would here consider.

Stone is recognized as one of the most prominent of all building materials, and it can be utilized to meet many requirements, both simple and complex. Yet in the consideration of its adaptability for certain purposes, it must not only possess the qualities of solidity and durability, but it must have that quality of being easily wrought to an artistic design under the skilful manipulation of the stonecutter or sculptor. There are certain stones which we term "rubble" that are only used for rough or common building purposes, as foundations or backing of walls. But the fine freestones, adopted for the facing of walls, may be fashioned into some graceful moulding or floral decoration by the use of the chisel. These are classified under the title of "wrought stones" and may serve the purposes of coursers, moulded beltings, string and label mouldings or dressings of window and door openings.

Again, there are certain kinds of hewn work that produce different effects according to the architectural design. Thus, when the bold effect is required in the Baronial style of architecture, "corbelling" is brought into requisition, as we often see under the projecting windows and circular turrets on the walls of castles. Each order of architecture has a method of manipulation of the stones peculiarly its own, to produce the desired effect, and it is by close study and strict accordance with taste and artistic feeling that a style can be satisfactorily and consistently carried out from beginning to end.

In certain classes of buildings, however, brick takes the precedence of stone, for the purposes required. Thus, for large stores, warehouses, and manufactories, brick is preferable to stone, as in many cases it is less expensive, is a good protective against fire, and by utilizing the different colors and classes of brick manufactured, a very pleasing effect may be produced, besides the essential quality of solidity being maintained.

There is a wide scope for advancement in the manufacture of brick and clay working materials. And it is in the improvement of the necessary machinery now in use, and the invention of new types that are found more suitable and less expensive in their adaptation, at the same time producing more satisfactory results, that we place our hope for still greater development in this department of building material.

The finer processes of brick-making and clay-working are very adaptable for architectural effect, and whatever can be manufactured that will prove durable and at the same time artistic in finish and moderate in cost, will be sure to command a ready sale in the building market. The adaptability of terra cotta for architectural and decorative design is very considerable, and it may yet become more popular in the erection of high class buildings.

Cement and concrete are also now engaging the attention of architects and builders to a large extent, and the adaptability of these materials for many purposes in building construction is deserving of the greatest consideration. The question of "reinforced concrete" for floors, landings and stages, and their construction in the several classes of buildings in which they are to be adopted, is one of the utmost importance. And it is only by strict laws based upon the practical experience of the composition, strength and durability of the materials employed, that measures can be framed to protect the safety of the public, and give satisfaction to the authorities and all concerned. Cement blocks for building purposes, although not yet in general use, are, nevertheless, very adaptable for many requirements, and can be so manufactured as to present very good imitations of "wrought stones."

The adaptability of stucco for decorative effects is very considerable. Its plastic nature can be utilized for many architectural purposes, yet it is not so generally adopted as it might be, owing to the precedence of other materials in building operations. Yet we find it very adaptable for columns, pilasters, cornices, bands, friezes, centre flowers, and other parts of the plasterer's work.

The various kinds of wood and their qualities enter largely into the construction and architectural design of buildings, and it is impossible to enumerate in this limited article the multifarious forms of their adaptability. We can only indicate that timber required to bear a great strain or superincumbent weight must be of an enduring character, and thoroughly seasoned, while those kinds of timber, adopted for decorative purposes and artistic design, must be of a soft and more pliant nature, at the same time possessing the primary quality of durability.

For the process of wood carving certain kinds of wood are preferable to others, according to the purposes for which they are intended. This is a wide study, and well deserves the attention of those engaged in its operations. Again, the use of iron and steel in the construction of buildings is also worthy of mention. The dimensions and weights of the different materials, and the practicability of their application, enter largely into the consideration of their adaptability to the purposes for which they are intended. The chief requisite is strength to sustain the weight or strain, the architectural effect being often a minor consideration. However, the two characteristic features in architectural design, strength and beauty, when combined in nicely adjusted and relative proportions, produce the nearest approach to the acme of accomplishment. Then the crowning effect will be that of a structure, serviceable for the purposes intended, and beautiful to the eye.

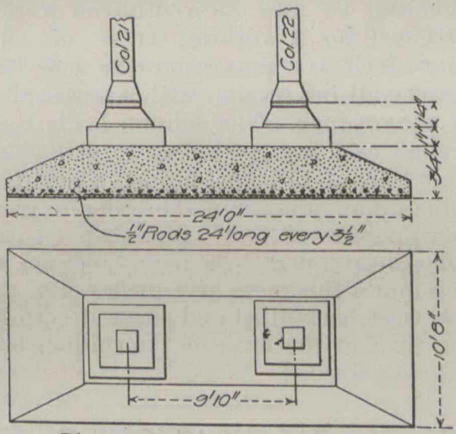
## FOUNDATIONS OF TRADERS BANK BUILDING, TORONTO

When the designs were made for the fifteen storey steel cage building of the Traders Bank of Canada, Toronto, the architects were advised that the site was on a deep stratum of hard clay of great strength with an almost unlimited bearing capacity. They therefore designed separate rectangular concrete piers calculated to reduce the maximum column loads to a pressure of about 10,000 pounds per square foot.

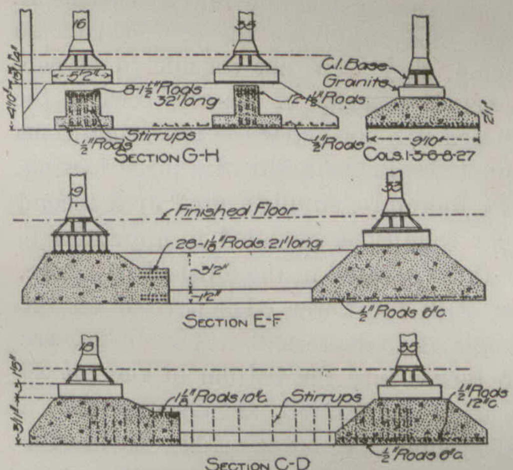
The site of the building has apparently at one time been a part of the lake bottom and consists of a deep sedimentary stratum of clay, the upper portion of which has been solidified into a very hard dry crust, which, as was stated, proved very reliable and satisfactory for the ordinary buildings of 4 to 6 storeys in height, adjacent to the bank building. The footings of these buildings were, however, carried down only about 12 feet below the curb, while those of the bank extend to a depth of about 25 feet.

When the excavation was made it was noted that the clay softened slightly below the surface, until at a depth of 17 feet there was a rapid change noticeable, and the consistency became very soft, like putty. It was, however, moderately dry and tenacious, but evidently could not be depended upon to carry a heavy load after penetrating the upper crust, although, if that were undisturbed for a reasonable thickness above the soft stratum, it was, like that of the analogous stratum in Chicago, competent to carry ordinary loads satisfactorily.

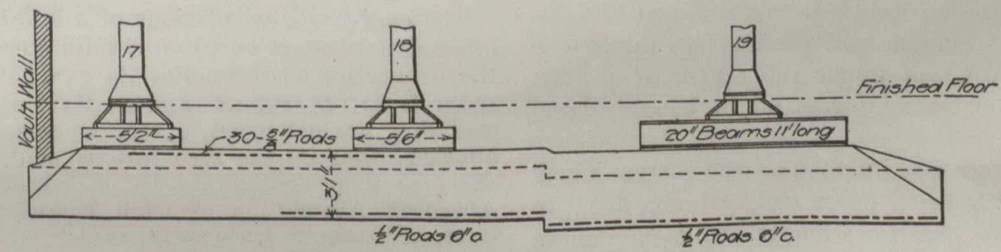
In order to secure an accurate test of its bearing capacity, Mr. Brainard, consulting engineer, New York, had a pit excavated to a depth of 20 feet below the curb and in the centre of the bottom prepared a bearing surface with great care, taking pains to personally dress and scrape it to an exactly uniform horizontal surface with a 14 inch steel straight edge. The ends of a 12 x 12 inch timber about 6 feet long were then cut exactly square and smooth and a horizontal platform about 4 feet square was secured at the upper end. Two pairs of horizontal guide strips at right angles to each other were set across the pit to closely engage the four faces of the 12 x 12 inch post and it was carefully plumbed and lowered through them until its foot rested exactly on the point previously determined by a plumb bob on the prepared surface in the centre of the pit.



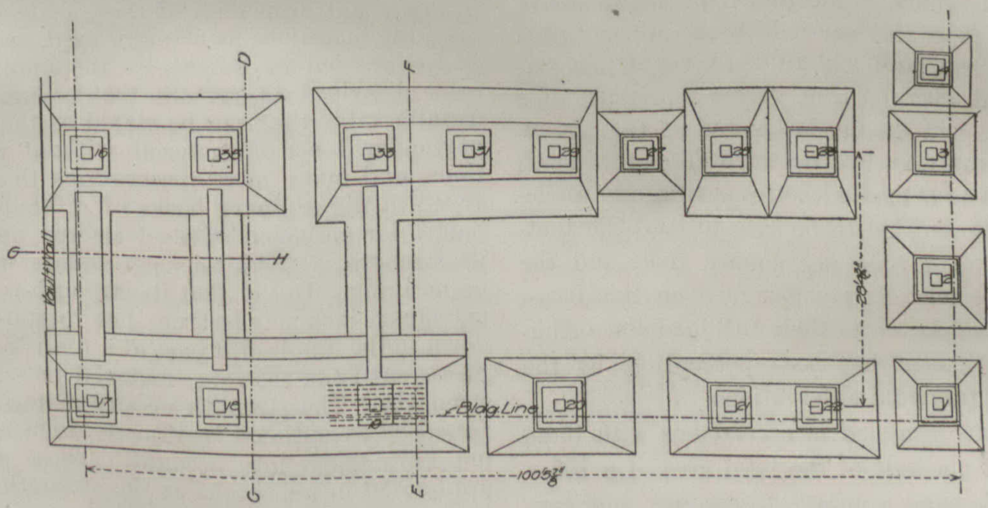

Plan and Section of Footing.




Sections of Footings.




Elevation of Columns and Footings.




Foundation Plan, Traders' Bank of Canada.

It was thus seated accurately with an even bearing and uniform contact over the entire surface. A leveling instrument was sighted on the vertical gauge rod projecting above the platform and the latter was quickly loaded with 2 tons of pig iron. No movement was detected until 2 1-2 tons were placed on the platform, when it settled rapidly for three-eighths of an inch and the loading ceased. During the night the settlement continued and had reached at least 1 1-2 inches on the following morning. There was some upheaval of the clay around the foot of the 12 x 12 inch column and, although the results were considered to entirely eliminate the misleading initial settlement, often due to carelessly applying the test load on an imperfect bearing, they were not considered as conclusive of the actual capacity of the soil, because the isolated area tested was not under the same conditions as a unit of equal size in the midst of a large footing.

This test was, therefore, supplemented by a second one, made under conditions intended to approximate more closely to those realized in the finished structure. A 6 inch pipe, with the lower edge beveled on the outside at an angle of 45 degrees, to a sharp edge, was driven about 8 inches into the bottom of the pit 20 feet below the curb and caused, as was expected, a slight upheaval around the outer side. Inside the clay remained apparently undisturbed, with the upper surface at the original level. It was assumed that the inside clay thus isolated and confined would correspond closely with that under the centre of a large footing when the lateral forces might be considered to be balanced.

In the pipe there was inserted an oak piston, which had a carefully squared lower end and was fitted to the interior of the pipe for a length of 2 inches, above which the diameter was diminished sufficiently to insure absolute clearance. The piston projected above the top of the pipe and carried on its upper end a horizontal platform, properly guided between horizontal struts, loaded with pig iron, giving a pressure of 4 tons per square foot on the lower end of the piston. No settlement whatever was detected from this load; it was increased to 5 tons without causing any settlement, and it was decided to be safe to load the footings uniformly to 4 tons per square foot, and the foundations were accordingly designed on this basis. They have been subjected to their full load since August, and no settlement has been perceptible by the most careful instrumental observations

The foundations designed in accordance with these tests cover about one-half of the total area of a 105 x 95 foot rectangle, and consist of separate and connected concrete piers and continuous concrete footings uniting adjacent piers and serving both to extend the bearing surface and as distributing girders providing for the eccentric location of the columns. In one corner of the building, where the centre line of the wall is outside that of the footing, the condition is one usually met by seating cantilever girders on the grillages with the wall columns supported on their overhang and the opposite ends anchored by interior columns. As this construction would have involved considerable delay for the delivery of the steel girders, a method was devised of securing the same effect with reinforced concrete, which could be made at a smaller cost and without delay.

The piers for the wall columns and for adjacent interior columns were made integral, with footings symmetrical about the centre line of the columns and the latter were provided with centre vertical webs and reinforced full length horizontal steel rods in the upper flange and with vertical stirrups proportioned to the shearing force, thus making a T-shaped beam or girder with a uniformly distributed load on the lower side and two concentrated loads on the upper side. The lower faces of the pedestals and footings were reinforced with single and double tiers of horizontal rods and the outer edges were beveled at about 45 degrees from a height of about 12 inches above the base to the top, 4 feet high. Rods 1-2 inch in diameter and 6 inches apart were used in the pedestals, and 1 1-2 inch rods were used in the girders. The concrete was made 1.2½.5 with Portland cement and broken stone, the latter being 2 inch diameter for walls and 1-2 inch for reinforced work. It was proportioned for a working stress of 300 pounds per square inch in compression, the rods being calculated to carry all the tension with a stress of 18,000 pounds per square inch. The column loads were transmitted through cast iron pedestals to grillages consisting of single tiers of 15 inch I-beams, which distributed them on the upper surface of the concrete pier with a maximum pressure of 30,000 pounds per square foot. The grillages and pedestals were enclosed in concrete of a minimum thickness of 4 inches, and the pits around them were back-filled and covered with the 6 inch concrete floor at the level of the column basis.—The Engineering Record.

## WRONG CALCULATIONS OF STRENGTH

The engineer's calculations of a building, bridge or other structure are based on certain data representing the properties of the materials used. These are derived from experiment, and as it is well recognized that they are not exact, a very large safety factor is allowed; that is, the structure is made many times stronger than necessary. In an address before the Aberdeen Association of Civil Engineers, Professor Barr, of Glasgow University, said:

"The materials used in a structure may not—usually do not—conform to our assumption as to the strength and properties of those materials. In many cases the materials, as actually used, are not so strong as we are led to believe by the application of the tests described in certain text-books. There is no definite value that can be stated as the strength of a particular kind of material without many reservations, and many more reservations than can be conveyed in the ordinary books of reference. To take a particular specimen of steel or iron and to say that its strength is 28.93 tons per square inch has really no meaning. To say that its strength is about 29 tons per square inch may be true; but to state the strength down to the hundredth part of a ton is nonsense. Two pieces cut from the same material may have different strengths. The strength of any material may be affected by exceptional treatment which text-books may not have taken into account. Those strengths that are quoted in text-books as the strengths of materials are strengths that were got by the use of testing machines, when the specimen was pulled gradually and quietly. But if we apply a load to a piece of material and remove the load, and again apply the load and remove it, and so on, we will find that far less than 22 tons per square inch will break a piece of Yorkshire iron. The ordinary formulas that are used to find the intensity of the stress in pieces of material are usually very far wrong. Engineers should avoid discontinuity of form as far as possible. If they apparently strengthen a piece of material they often weaken it. Engineers should be careful to make things not only strong enough, but not too strong. It is dangerous to trust any formula without thinking out carefully what is implied in the formula, and considering in what way the practical conditions with which we are dealing differ from the practical conditions laid down in the formula."

## WOOD FOR INTERIOR WALL DECORATION.

Some examples of a mode of decorating the walls of rooms by the use of elaborately finished woods are given by the "Architect's and Builders' Journal." While the fashion is yet in its infancy and limited to those with ample means, there is reason to believe that it may yet attain some degree of popularity.

Heretofore only a very few of the highest priced house decorators included in their establishments rooms or sections of rooms illustrating special designs. In most cases persons up against the always puzzling task of selecting wall decorations for a particular style of house arrived at a decision chiefly by the aid of photographs and samples of wood, paper and brocade.

It is not like that now. In New York there are establishments where rooms of many characters—dining rooms, drawing rooms, sleeping rooms, libraries, foyer halls—fresh from the decorator's hands and exhibiting many grades of cost and the materials and designs now most in fashion, are offered for inspection as freely as a furniture dealer displays his newest models of tables and chairs.

In most cases the quantity of wood in evidence bears out the statement of a well-known decorator that the present demand for wood fittings and trimmings in private dwellings exceeds anything he has encountered in a business experience of two decades, and that the varieties of wood in use are even more surprising than the quantity demanded.

"Dull finished woods," he continued, "have gone ahead of polished woods in most cases. Everybody is clamoring for natural oak, chestnut, mahogany, walnut, etc., and there are a dozen different ways of treating these woods.

"For the time being few persons who come here will look at polished walnut or mahogany or rosewood for wall paneling. Everything and anything of dull finish, with the grain of the wood much in evidence, leads in popularity, and the brighter browns have given place to ash browns and grays. Let me illustrate."

The decorator led the way to one of the show rooms, a library, whose walls to a height of nearly six feet from the floor were covered with wood divided into panels two and one-half feet wide by strips of the same wood four inches wide. Both panels and dividing strips were perfectly flat and plain without carving or mouldings of any description.

The decorator said the wood was oak. To a novice it looked quite unlike oak. In color it suggested a two-toned, mottled arrangement of dull gray and grayish green, and the natural grain of the wood, every appearance of grain at all in fact, had been obliterated.

The oak, it was explained, had been treated with a solution of lead rubbed well into the pores and then finished with a dull stain only. It is conceivable that an old-fashioned woman might prefer the natural oak. New-fashioned housekeepers, though, rave over the oak in its new dress and will have no other.

In another room, a dining room, the walls to a height of seven and a half feet were lined with oak of a dull gray, showing little or no grain and as smooth as wallpaper. Across the bottom was a seven inch baseboard and a few inches from the top the surface was ornamented with medallions, perhaps a little more than three inches in diameter, placed about a foot apart. These were carved in the wood. It was the color, though, which most attracted.

A second dining room was wainscoted to within three feet of the ceiling with chestnut wood of a drab or putty color, the conspicuous black brown large grain of the wood showing up in a more antique effect, describing an inverted V. This was done by piecing the panels down the centre and cutting the wood on the bias, matching the grain as perfectly where the halves joined as a dressmaker would match the stripes in a silk gown. In this room the same effect was carried out in the heavy mantel, the door and the window panels.

Red mahogany, treated to accentuate the warmer tints, was the feature in a third dining room. There was no wainscoting here. The wood was applied in a baseboard ten inches deep, in a fifteen inch cornice and frieze, in a narrow moulding dividing the room into an upper and a lower section of one-third and two-thirds, the lower wall being treated plainly, the upper in conventional figure design.

All the woodwork in the room, including the mantel, was of red mahogany, and the novel features were the tint of the wood and the cornice. In all the rooms mentioned the wood cornice and frieze took the place of a beamed ceiling, and this, the decorator declared, was a variation which is now finding much favor in spite of the fact that it is in direct contrast to the fashion taken up a few years ago of omitting the wooden moulding near the ceiling.

In some of the smartest dining rooms, and also in some of the less expensive, a wood cornice and frieze from fifteen to twenty inches wide is now an admired feature, the ceiling being plain. In a room of this type finished the other day for a New Yorker and done in gray toned oak and a German renaissance design, a wood cornice of eight inches was joined to a twelve inch wood frieze, which, like the wainscoting rising to a height of six feet, the capitals of the doors and windows and the great caryatides upholding the high mantel, was heavily carved in a scroll and grape design.

In a colonial dining room designed for the country house of a New Yorker, a cornice and frieze fifteen inches wide of white enameled wood topped a plain delft blue burlap covered space, which in turn topped a seven foot high wainscoting of white enameled wood. There may be a question as to the gracefulness of the wooden cornice, but no difference of opinion, the decorator thought, as to its good style for the time being.

Dull finished walnut, quite unlike the walnut of our grandmother's day, is in great demand for lofty foyer halls, where dark effects are desired, its gloom being relieved with touches of gold leaf on capitals and columns.

But it is in the drawing room, perhaps, that the growing popularity of wood and vagaries of color are most noticeable. Interiors solely of wood, excepting the ceiling, are more and more asked for, and enameled woods, cream, pure white and of many tones of color, are the favorites.

White mahogany, really a pale ecru in color, is much admired for the same purpose, but because of its higher cost is less frequently ordered. By way of illustration, the specialist cited the drawing room of an uptown New York dwelling just completed.

The color scheme is French gray and white, done in enameled wood panels of varying widths and carved in a leaf and vine Louis XV. design. The wider gray panels are bordered with carving, the six inch wide white panels are almost covered with the same decoration, and the windows, doors and mantel, in which gray and white wood are combined, are similarly treated.

There is no gold ornamentation to detract from the simple effect, the ceiling of the room, too, being of cream white plaster.

## OUR ILLUSTRATIONS.

PRINCE OF WALES FUSILIERS ARMORY, MONTREAL. MACVICAR & HERIOT, MONTREAL, ARCHITECTS.

The building is being constructed of buff pressed brick, with sandstone trimmings, in the Elizabethan style. The main entrance will face on Esplanade ave., the front and rear portions of the building being two storeys high, the front containing the officers' quarters, mess rooms, etc. The rear will contain the various company rooms. The central portion is devoted to a drill hall 100 feet x 102 feet, spanned by steel trusses, and provided with ample light from the roof, the entrance to the hall being from Rachel street. In the basement will be placed the heating apparatus, lavatories, store room, bowling alley and shooting gallery for target practice.

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NEW PHYSICS BUILDING OF THE UNIVERSITY OF TORONTO. DARLING AND PEARSON, TORONTO, ARCHITECTS.

The new Physics Building, now nearing completion, is situated just south of the recently opened Convocation Hall. The exterior is designed simply and broadly in a free treatment of classic architecture. The base of the building is richly rusticated, and the upper portion is built of light buff brick with stone trimmings.

The central feature of the front is the large circular Lecture Theatre. The high windows and coupled Ionic columns, which extend from the base to the cornice, indicate the interior arrangement of the room. At the north and south ends, flanking this circular bay, are two pavilions, one storey lower than the main building. The one to the north, marked by pilasters, contains the smaller lecture hall, while the one at the south has the library above, and also a small lecture room below. The library front is ornamented with a large French window with a circular pediment.

These three features, which admit of elaboration, have been placed as advantageously as possible. The remainder of the building has been treated very simply with large window openings to provide the best possible facilities for laboratory work.

The addition of this building to the University of Toronto will give the city the most fully equipped physical laboratory on the continent.

Ground Floor.—The building is planned on the unit basis, so that the brick partitions between the various rooms can be taken down and rebuilt to suit any future extension that the faculty may require. All floors, with the exception of corridors, which are of concrete, are semi-fireproof, slow-burning mill construction. The outside walls are built with a 2 inch air space, and with the exception of the two lecture rooms, which are plastered, the brick lining forms the interior finish.

On entering the building through the two main entrances, which are situated in the north and south of the circular bay, two wide marble stairways and an elevator give access to the various floors.

On this floor is the large lecture room (No. 126). In order that there may be no delay in clearing this room after a lecture, three outside entrances have been provided, in addition to openings from the central corridor. Seating accommodation has been provided for about five hundred. Across the corridor, Room No. 123 will be arranged with cases to exhibit the various apparatus.

In the northeast corner is the smaller lecture room, which will seat about two hundred students.

First Floor.—On this floor two entrances to the large lecture room gallery have been provided. This gallery is supported on cantilevers, so that there is nothing to obstruct the view of the experimental table.

The library is placed in the southeast corner, and the remaining floor area is mainly devoted to research laboratories.

Second Floor.—The second floor is given up to elementary physics and research work. The possibility of a future addition to the present building has been provided for in the two rear wings, which are planned so that they can be extended westward as many units as may be necessary.

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CANADIAN ARCHITECT AND BUILDER STUDENTS' COMPETITION FOR A SMALL SUBURBAN HOUSE, TO COST $3,000. DESIGN BY "CRAFTSMAN" (FIFTH IN COMPETITION).

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PROPOSED WORKINGMEN'S HOUSES, ABOUT TO BE ERECTED BY THE TORONTO COTTAGE HOME COMPANY, LIMITED. PLANS BY MR. J. P. HYNES AND MESSRS. WICKSON & GREGG, ARCHITECTS, TORONTO.

The aim of the Toronto Cottage Home Company is to secure buildings, modern in construction, and, while substantially built, possible of erection at a figure which will make possible their purchase by the ordinary workingman.

(1) Double frame cottages, with clapboard siding, having cellar, kitchen, scullery, three bedrooms and bathroom. Original plan revised by Messrs. Wickson & Gregg.

(2) Brick veneer, semi-detached houses, with cellar, three bedrooms and bathroom. Original plan revised by Mr. J. P. Hynes.

The general plan of the Toronto Cottage Home Company is to build houses in different parts of the city for sale to purchasers at a price not exceeding $1,400. These houses, it is estimated, would sell in the ordinary way for from $1,800 to $2,000. It is proposed that the terms of payment for each house will include a cash payment of not less than $100, and monthly payments thereafter sufficient to pay the purchase money in full, with interest at 4 per cent., in twelve years. The company proposes to hold the title in each case until the purchase money is paid in full. The company are of opinion that they will be able within four years to build 1,000 houses.

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THE GRAMMAR SCHOOL AND GUILD CHAPEL AT STRATFORD-ON-AVON, SHAKESPEARE'S BIRTHPLACE. SKETCHED BY E. STANLEY MITTON, ARCHITECT, VANCOUVER, B.C.

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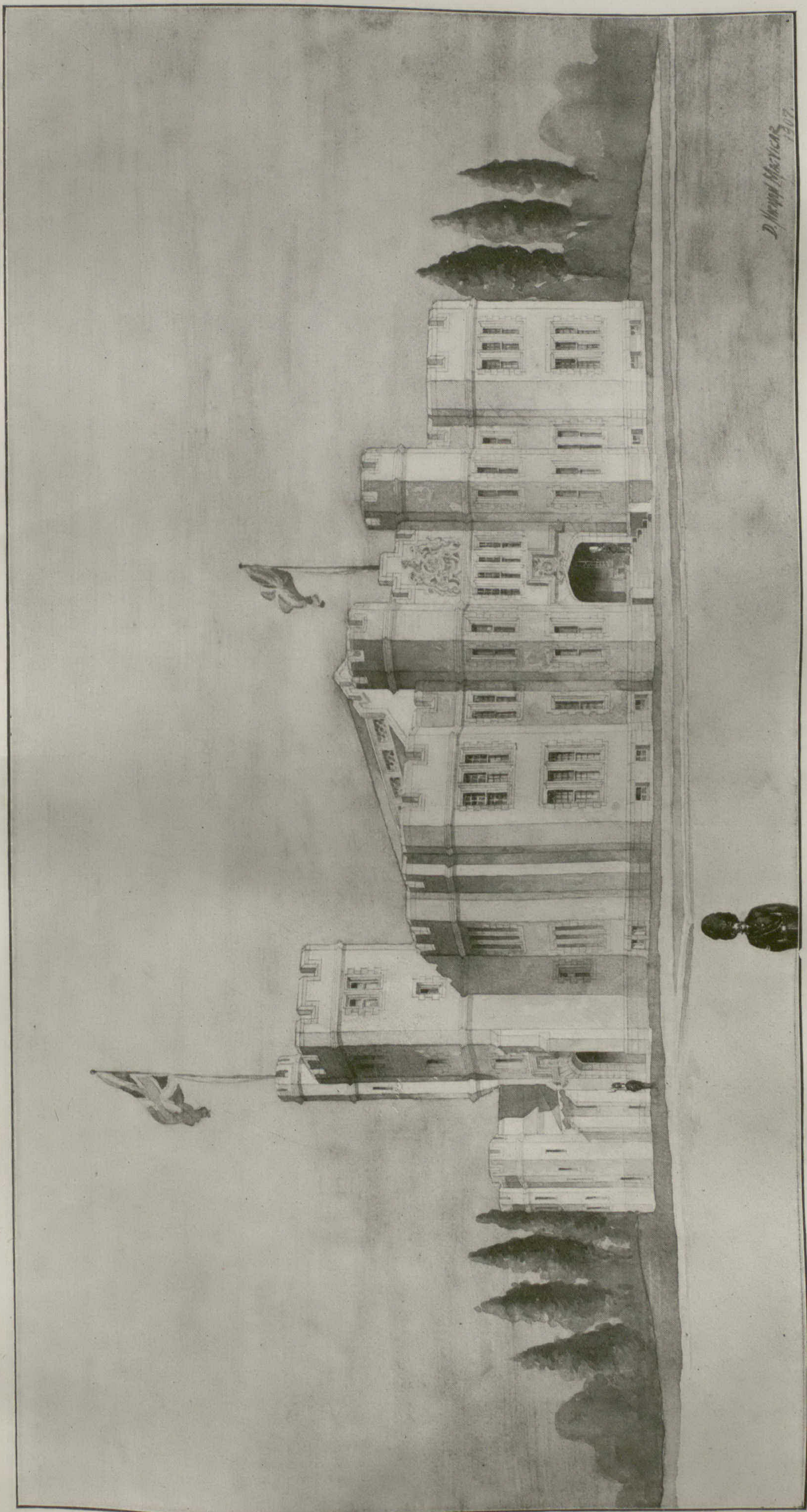
## ARCHITECTURAL LEAGUE OF AMERICA'S PERMANENT HEADQUARTERS.

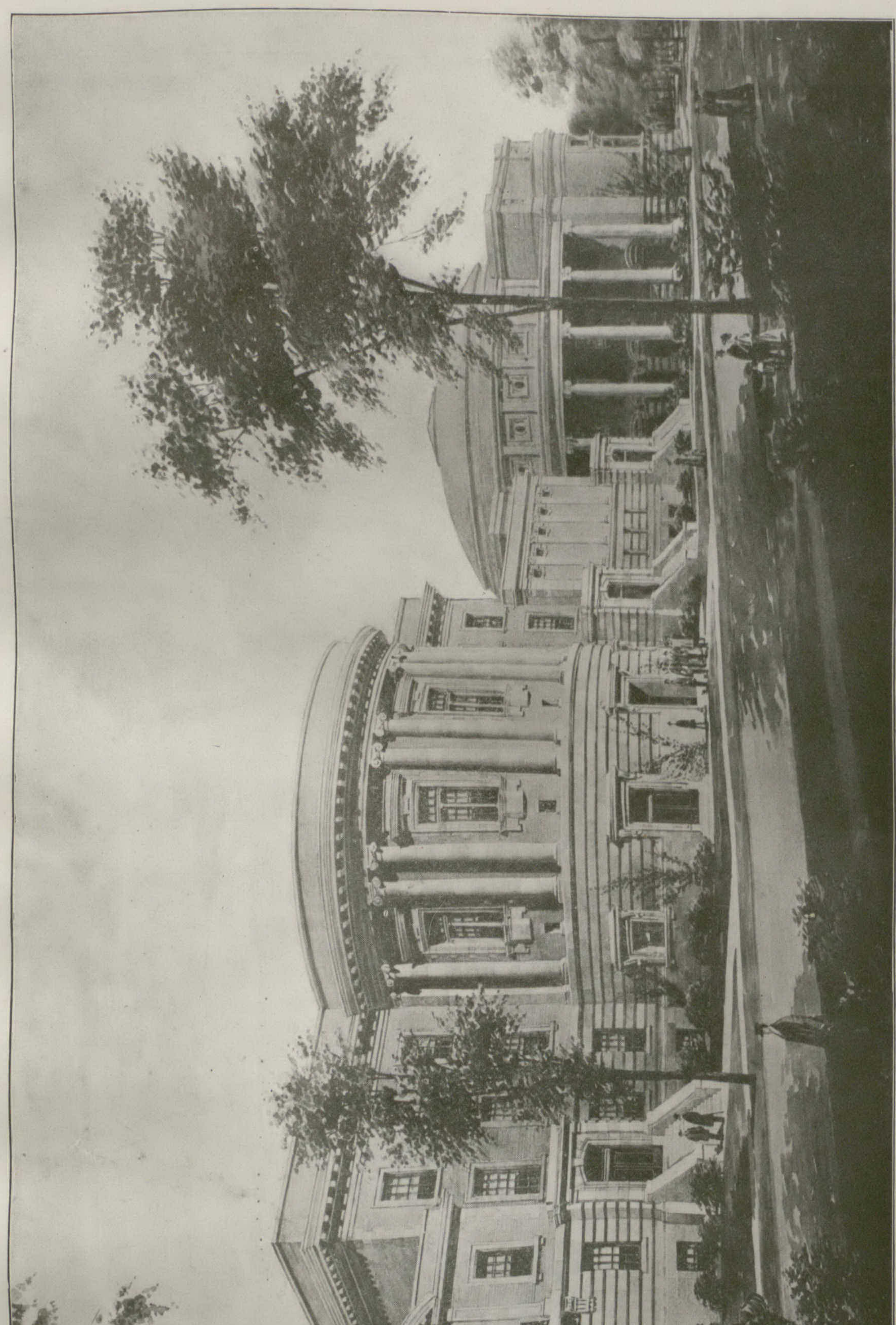
At the Executive Board meeting of the Architectural League of America, held in Toronto on June 19th, the permanent headquarters of the Architectural League were established at No. 729 Fifteenth street, N. W. Washington, D.C., and Mr. H. S. McAllister, the ex-secretary of the Washington Architectural Club, and now vice-president of the same, was appointed permanent secretary of the League.

The Executive wishes to announce that all communications with the League may henceforth be directed to Mr. McAllister at the above address.

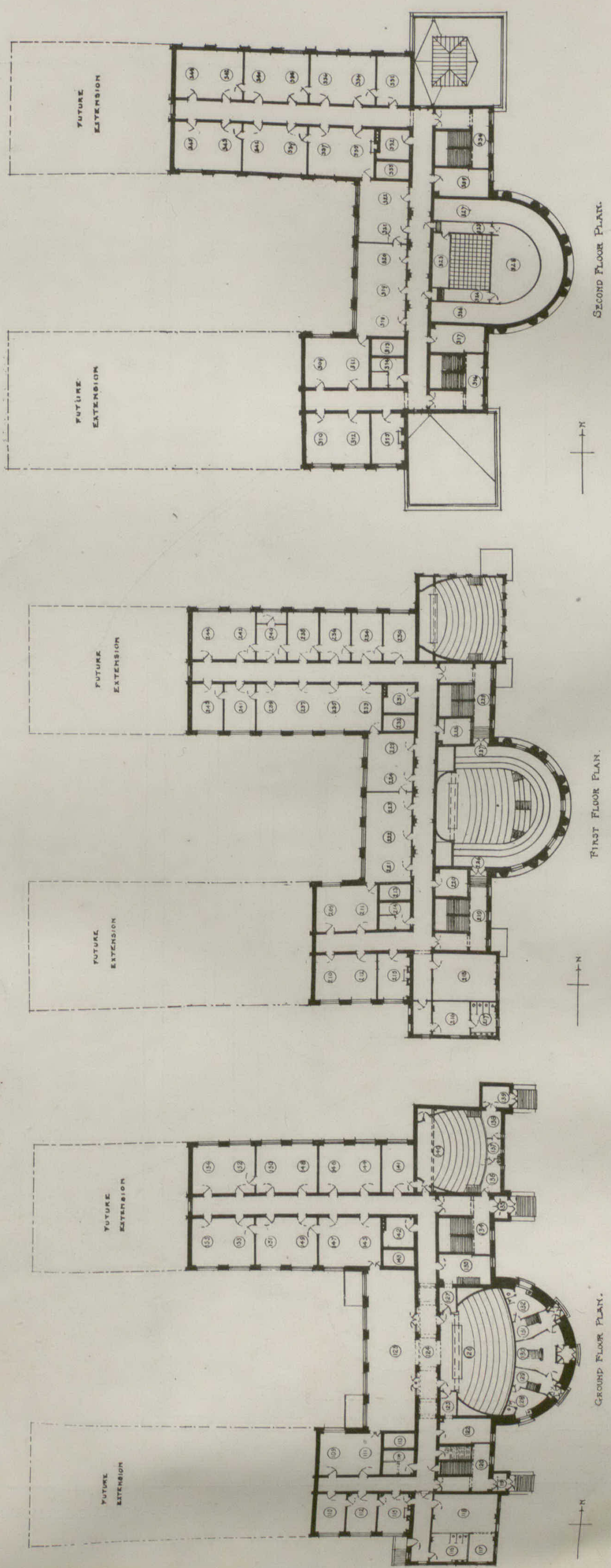


ARMORY OF THE PRINCE OF WALES FUSILIERS, MONTREAL.

MACVICAR & HERIOT, Architects.

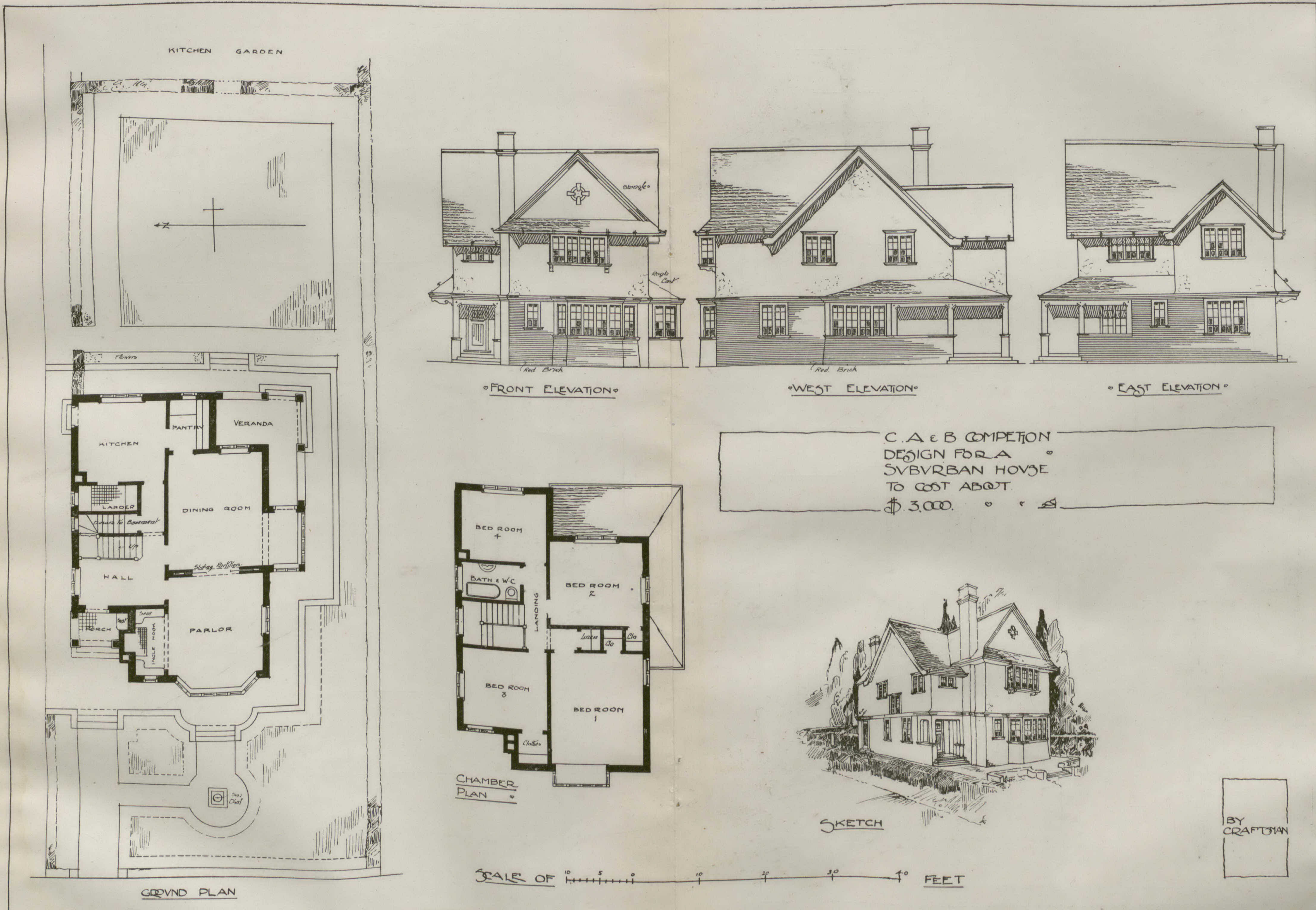


New Physics Building, University of Toronto.
Darling & Pearson, Architects.



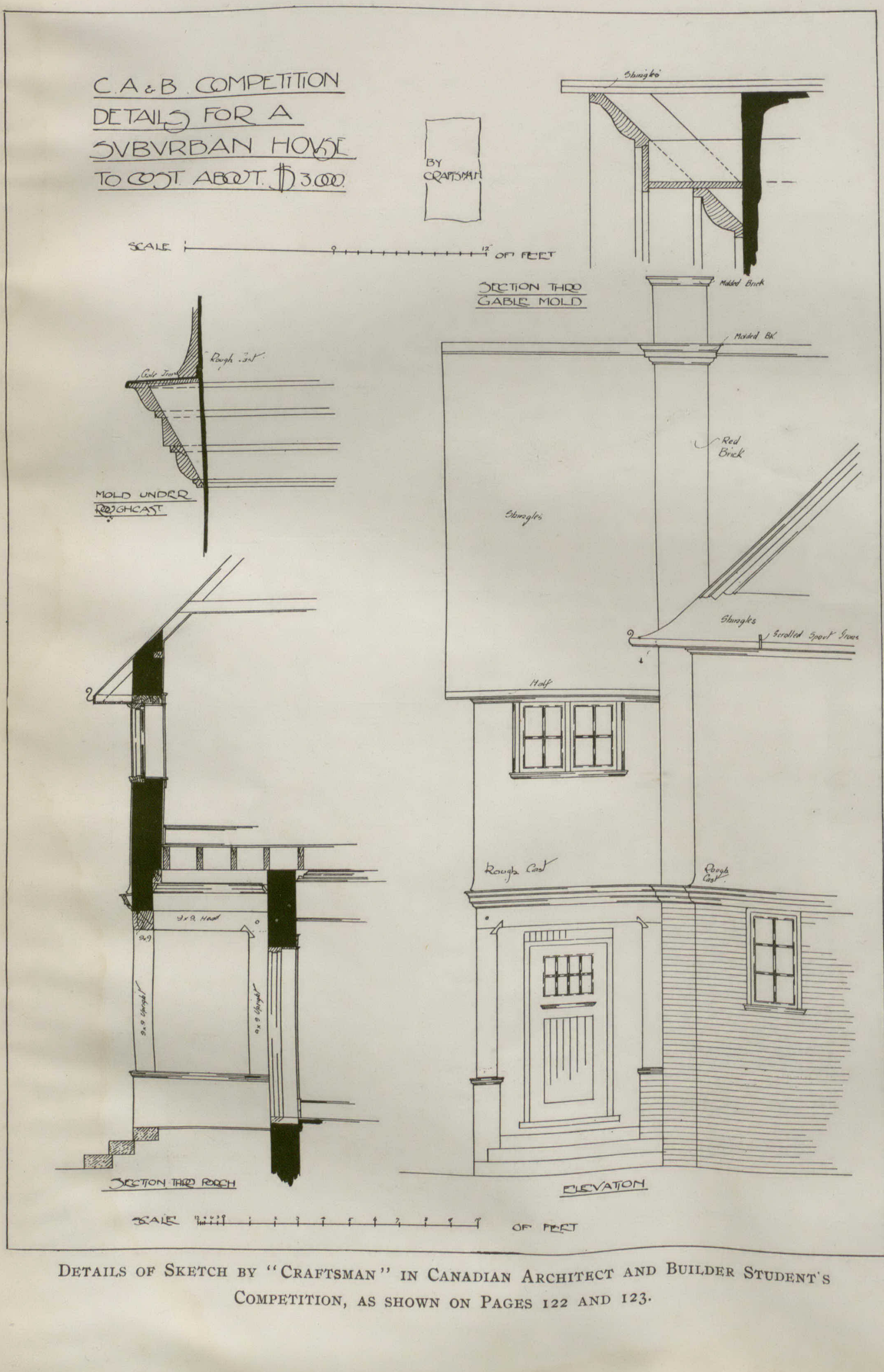

New Physics Building, University of Toronto, (Convocation Hall to the right in elevation drawing).

Darling & Pearson, Toronto, Architects.



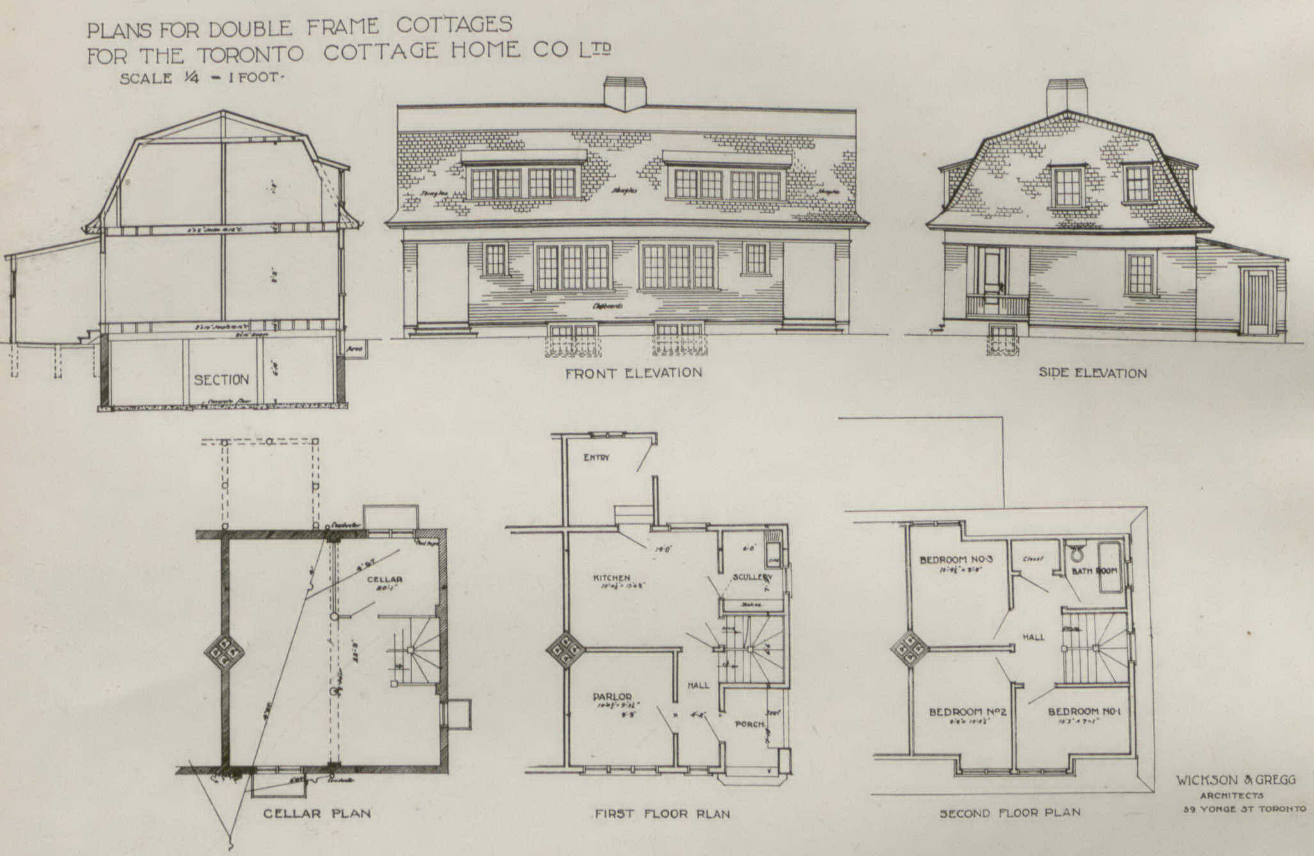

Canadian Architect and Builder Student's Competition for a Small Suburban House to Cost $3,000.

Design by "Craftsman," (Fifth in Competition).




DETAILS OF SKETCH BY "CRAFTSMAN" IN CANADIAN ARCHITECT AND BUILDER STUDENT'S COMPETITION, AS SHOWN ON PAGES 122 AND 123.

(1)

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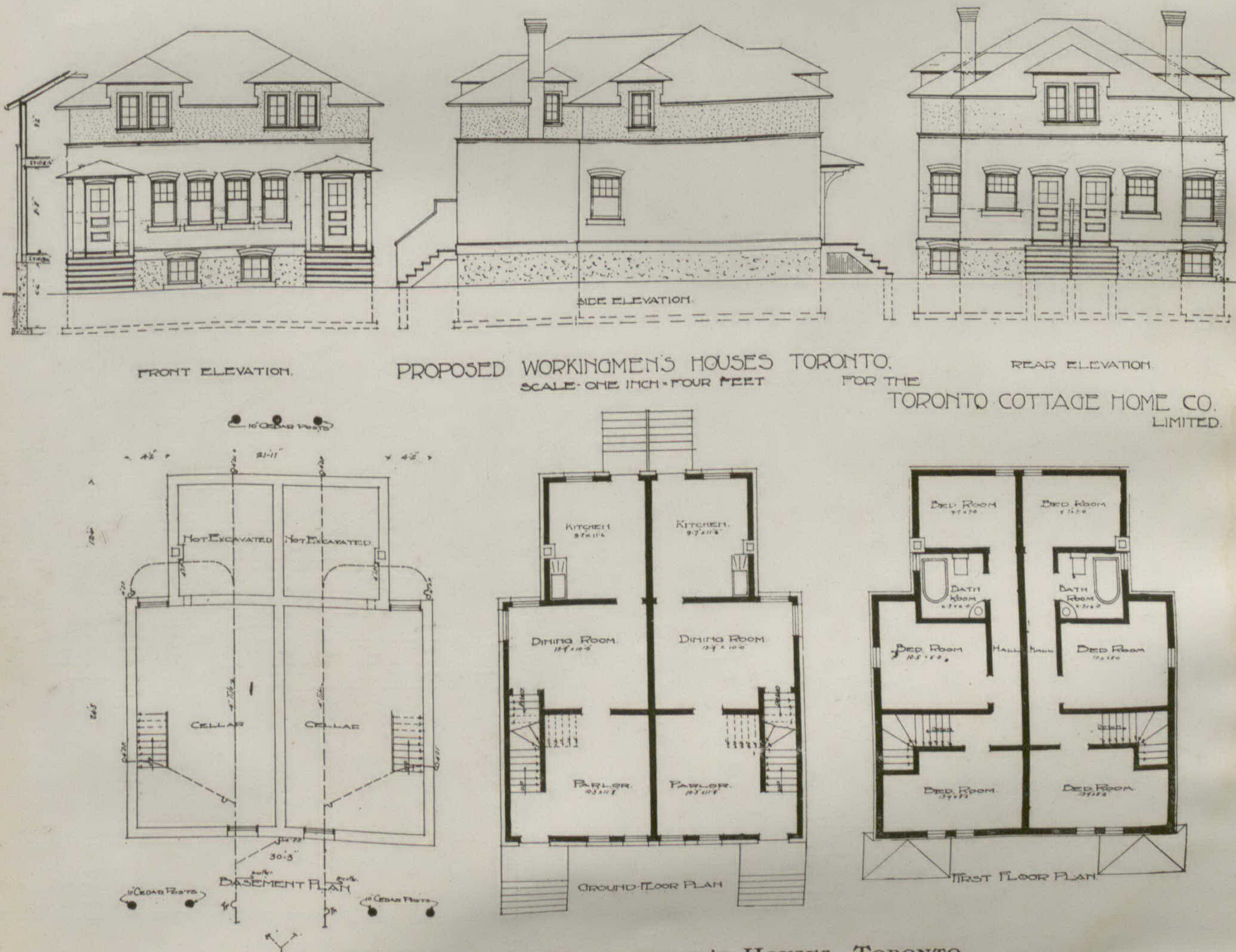
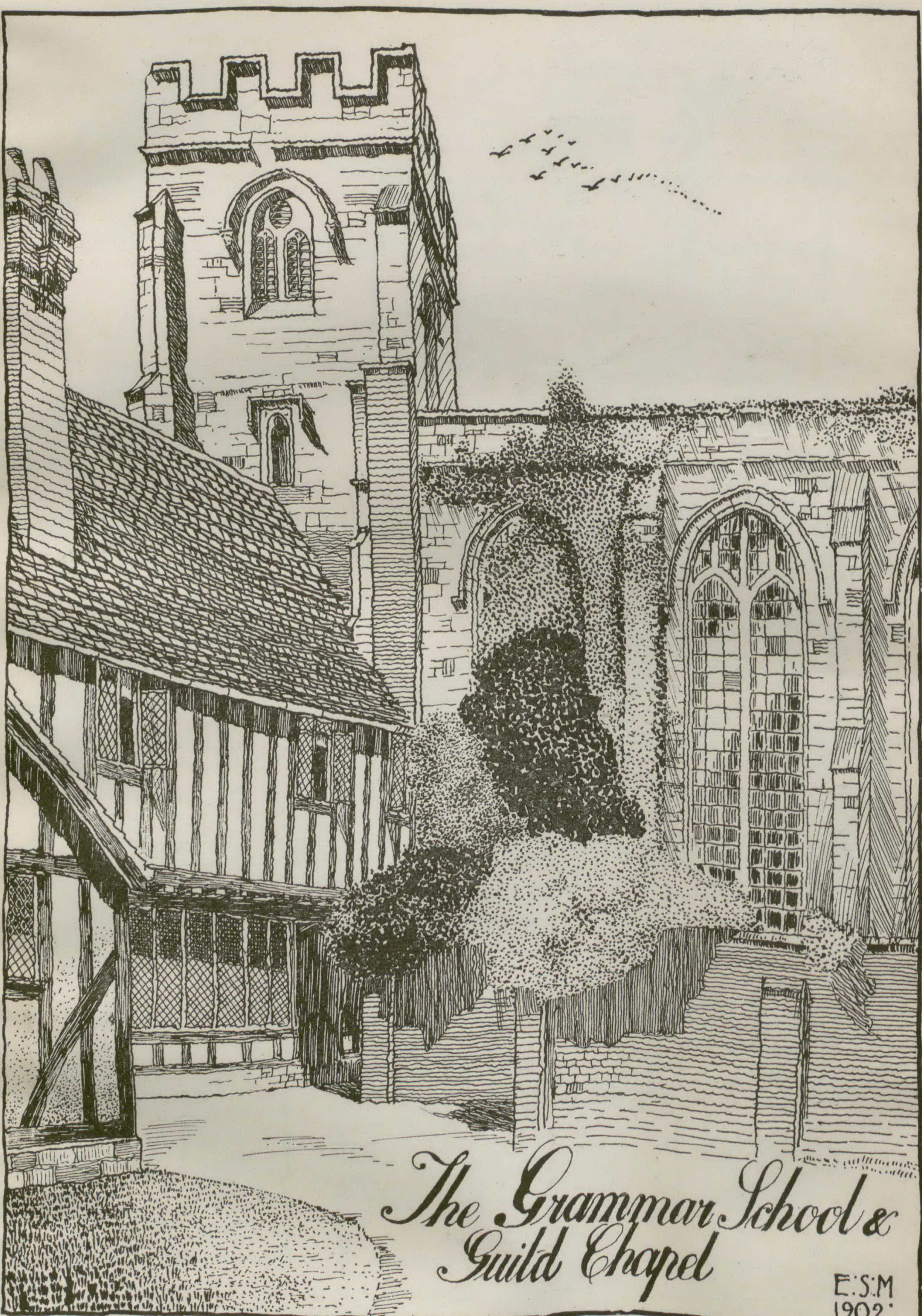



Plans for Proposed Workingmen's Houses, Toronto.

(1) Double Frame Cottages—Wickson & Gregg, Architects.

(2) Brick Veneer Semi-Detached—J. P. Hynes, Architect.




THE GRAMMAR SCHOOL AND GUILD CHAPEL, STRATFORD-ON-AVON.
SKETCHED BY E. STANLEY MITTON, Architect, Vancouver, B.C.

## CONGRESS OF CANADIAN ARCHITECTS.

The first Congress of Canadian Architects and first annual meeting of the Institute of Architects of Canada will be held in Montreal, August 19 to 23 next. At this meeting the project of the act of incorporation of the proposed Institute will be discussed. The provisional or temporary board of organization is composed of the following: President, A. F. Dunlop, R.C.A., P.Q.A.A., Montreal; vice-presidents, Edmund Burke, Toronto; Maurice Perrault, P.Q.A.A., Montreal; S. Frank Peters, Winnipeg; secretary, Alcide Chausse, R.I.A., M.L.A., Montreal; treasurer, J. W. H. Watts, R.C.A., Ottawa; council, Wm. H. Archer, F.A.I.A., Vancouver; C. D. Chappell, Charlottetown, P.E.I.; F. Deggendorfer, Edmonton, Alberta; David Ewart, I.S.O., O.A.A., Ottawa; G. E. Fairweather, St. John, N.B.; H. E. Gates, Halifax, N.S.; H. B. Gordon, Toronto; W. H. Hilton, Regina, Sask.; R. P. Le May, Quebec; H. C. McBride, O.A.A., London; L. Munro, O.A.A., M.S.A., Hamilton; P. B. Pratt, M.A.A., A.R.E., H.W.A., Winnipeg; Eden Smith, Toronto; Joseph Venne, Montreal. It will be noted that the personnel of this provisional board is composed of architects from every province of the Dominion.

The meetings of the Congress will be held in the assembly hall of the Canadian Society of Civil Engineers, 413 Dorchester street west. Addresses of welcome will be given by Mayor A. H Ekers of Montreal and Hon. W. A. Weir, Minister of Public Works for Quebec Province. The following subjects will be discussed in the order named:

1. Organization of the Institute of Architects of Canada. Revising proposed Act of Incorporation, etc.
2. Representation of Architectural interests in the Royal Canadian Academy's Membership.
3. Uniformity of Building Laws.
4. Public Architectural Competitions.
5. Duty on Plan from Foreign Architects.
6. Responsibilities of Governments in the Conservation of Historical Monuments.
7. Architectural Copyright.
8. International Congress of Architects, Vienna, 1908.

All members, whether in attendance at the Congress or not, are invited to take part in these discussions in writing, and their contributions will be presented at the meetings. It is requested that all discussions be brief and to the point, the time limit for each discussion having been fixed at ten minutes.

The general program of entertainment has not yet been completed, but comprises the following:

A reception by the Mayor and City Council of the City of Montreal.

The directors of the Dominion Builders' and Contractors' Exhibition have kindly offered to issue invitations to visit the Exhibition in Victoria Rink during the Congress week.

An all-day drive will be arranged to visit works of building interest in Montreal.

Invitations have been received to visit the Montreal Terra Cotta Lumber Works, at Maisonneuve, and the Dominion Bridge Company's Works at Lachine.

A reception by the President and Council of the I.A.C.

The Board of the Engineers' Club, Beaver Hall Square, have kindly elected all delegates to the Congress honorary members of the club, from the 19th to 23rd of August. Delegates are requested to show their card of identity on entering the club.

The Dominion Park Company, Limited, have kindly offered admission to their amusement park on Tuesday evening, August the 20th, to all delegates and ladies.

## COMPETITION FOR DOMINION GOVERNMENT BUILDINGS.

In response to the request for designs in the competition for the proposed new Government Departmental Building opposite Major Hill Park, Ottawa, some thirty designs have been received from architects in various parts of Canada. The competition closed July 1, and the judges who have been chosen to decide the winner in the competition are already at their task and will shortly announce their decision.

In consideration of the vast amount of building now going on in the larger cities of the Dominion, and the consequent demand made upon the time of architects, the number of plans submitted is encouraging in the extreme. Four Toronto firms are said to be competing. The time and money necessary for making a complete set of specifications tends to debar many who might otherwise stand a chance of securing first place.

The prizes are as follows: First, $8,000; second, $4,000; third, $2,000, and fourth, $1,000. These prizes are scarcely commensurate with the vast amount of work involved in getting out plans for such an expensive building as the one contemplated by the Government, but the honor of winning in such a contest is the primary consideration. As the buildings are to cost between $3,000,000 and $4,000,000, an architect executing a design at the regular charge of one per cent. would be entitled to between $30,000 and $40,-000.

The conditions governing the competition provide that the use to be made of the premiated plan is for suggestion only, so that there is no guarantee that the successful architect will be permitted to take charge of the actual building. The Government has its own large staff of engineers and architects, and may simply put some of these to work on the successful plans. If, however, the successful author were to be entrusted with the execution of the building, the ordinary commission of four per cent. would net him about $150,-000.

The new buildings are to be composed of two groups, one for the Department of Justice, including the Supreme Court, Exchequer Court and Railway Commission, and the other a five storey structure of 360,000 superficial feet. They will be situated on the east side of Major Hill Park, and will be of Gothic type, so as to harmonize with the existing buildings. The plans will also include the laying out of avenues and roads and the connecting of Parliament Hill with Major Hill Park by a footbridge of monumental design.

### TORONTO ARCHITECTS FORM PARTNERSHIP.

Mr. Charles G. Langley and Mr. W. Ford Howland, architects, announce that they have formed a partnership under the firm name of Langley & Howland, with offices in the Continental Life Building, corner Bay and Richmond streets, Toronto.

## ARCHITECT'S RIGHT TO COMPENSATION FOR DRAWING PLANS.

By John Edson Brady, of the New York Bar.
(In Architects' and Builders' Magazine.)

The right of an architect to recover compensation for plans which he has drawn is always based upon contract. If any of the essential elements of a contract are missing from the transaction, upon which the architect's claim rests, then he is not legally entitled to payment, no matter how much time and labor he may have expended, or how great expense he may have incurred in the work.

An illustration is found in the case of Allan vs. Bowman, 7 Mo. App. 29. There an architect, having learned that a certain person was about to build a house, solicited from him the superintendence of the work. The architect called upon and interviewed the owner several times and, on one occasion, the latter went to see the architect in his office, but no definite agreement was entered into. The architect, however, made sketches of a ground plan and a front elevation, which he exhibited to the owner at the latter's residence, where a number of suggestions for improvements were offered by the owner's wife and made note of by the architect. The owner then decided to drop the matter, but told the architect that he would appoint him superintendent of the work if he later determined to build. The owner thereafter commenced to build, but engaged a different superintendent and the architect rendered his bill for the plans which he had drawn, on the non-payment of which he brought suit. There was, of course, no right of recovery for the reason that there was no evidence of a promise to pay, either expressed or implied, and therefore, no contract. The plaintiff was in the position of having made an offer which had never been accepted. A person cannot officiously do work in the expectation of an engagement and then, when the expectation fails, sue for the price of the work done. The burden is upon the plaintiff in every case to show that he did his work under a promise, expressed or implied, by the other party to pay for the work.

The case of Tilley vs. County of Cook, 103 U. S., 154, presents an instance of an architect, disappointed in the collection of his fees upon somewhat similar grounds. Cook County, Ill., and the city of Chicago, having decided to erect certain public buildings, invited by newspaper advertisement the submission of plans in competition and jointly offered premiums for the three best plans entered. The plaintiff was awarded the third prize of $1,000 and later the County Commissioners passed a resolution adopting his plan as the one after which to build the Court House and City Hall. The plaintiff then started an action to recover 5 per cent. of the estimated cost of the buildings as compensation. But here again recovery was denied because there was no contract. By the payment to the plaintiff of the amount of the prize won by him the defendants discharged every obligation which they owed him arising out of the preparation of the plans for the proposed buildings. If the plaintiff had any right whatever to compensation, it was necessarily based upon the resolution of the County Commissioners adopting his plans. But the resolution was not passed at the instance or suggestion of the plaintiff. It was not in itself a contract, but a mere voluntary expression of intention, which might have been reconsidered and rescinded the following day. It was no more a contract than if a private person should announce his intention of erecting a house in accordance with a design which he had seen in an architect's office, and should change his mind before beginning the execution of his purpose without even calling for or using the plans. The plaintiff in the Cook County case offered to prove a custom of architects, that, when prizes are offered for the plans of a building, the successful competitor remains the owner of his designs and is entitled to compensation in addition to the prize money, if the plan is adopted. The court answered this by saying that, if it were the custom and usage among Chicago architects, who enter into a competition for prizes offered for plans, to expect compensation based upon a percentage of the estimated cost as well as the prize, irrespective of whether the plans are used or the building erected, the custom is unreasonable and absurd, and, therefore, not binding in law.

Ordinarily it is necessary that there be a delivery or tender of the plans contracted for in order to justify a judgment for the services rendered in the preparation of the plans. The question of what constitutes a sufficient delivery or tender often arises. In Kutts vs. Pelby, 37 Mass. 65, the plaintiff, at the request of the defendant, drew for him a sketch of and Egyptian front for a theatre, which the defendant took and retained for a period of a week. The defendant expressed himself as pleased with the sketch and told the plaintiff to go ahead with the plans for the theatre. When the plans were completed the defendant's master builder called for them and kept them for a week, for the purpose of making an estimate of the cost of construction. The plans were then turned over to the defendant, who lated decided not to use them in building. The plaintiff was allowed to recover, it being held that there had been a sufficient delivery; it was also held that the defendant's determination not to use the plans, after they had been delivered, did not preclude a recovery.

It is not, however, always necessary that plans actually be delivered in order that the architect who drew them may be entitled to recover for his services. Thus, where it was agreed between the parties that the architect would notify the owner, for whom he had contracted to prepare plans, when the plans were ready and that the later would then call and examine them, the architect was given a verdict for the amount of his compensation under the contract upon showing that he had completed the plans and had sent word to the owner, who had failed to call for the purpose of inspecting them. Wandelt vs. Cohen, 36 N. Y. Supp. 811.

Where an architect is employed to furnish plans and specifications for a building with an estimate of the probable cost of the work, he is not entitled to pay for his services unless the building can be erected at a cost reasonably approximating that state in the estimate. In Feltham vs. Sharp, 25 S. E. 619, an architect brought an action to recover 3 1-2 per cent. of $4,300, the estimated cost of a building for which he had drawn plans. Upon the testimony of the defendant that he had submitted plans furnished to two firms of contractors and that the lower of the two bids made thereon was $7,800, it was held that the architect was not entitled to the compensation claimed.

## TECHNICAL EDUCATION.

More and more the necessity for the establishment of State Technical Schools is making itself manifest, not simply because of the better mechanics that are the product of these institutions, but because of their effect in elevating the moral tone of the great bulk of the population of our growing cities. The combination of manual with mental training in Canadian High Schools and Collegiate Institutes has been productive of good results thus far, and a healthy channel has been afforded for the exhaustion of boyish exuberance in the handling of tools. If this latter purpose alone were served, a sufficient raison d'etre for the manual training department of the secondary schools would have been advanced, but more than that can assuredly be said of the so-called Technical or Trade Schools. They have opened new avenues of usefulness and culture to many a lad, and have enabled the graduates to choose their occupations more wisely, either in the direction of industrial arts or in other fields.

The object of manual training is mastery—mastery of the external world, mastery of tools, mastery of materials, mastery of processes. Only recently have the mechanical arts been studied, analyzed and arranged in logical order for the purpose of being taught. It was formerly assumed without argument that the only way to learn to use tools and to master material and mechanical processes was to go into a shop as an apprentice, or to associate one's self with workmen engaged in the execution of ordinary commercial work. The idea of putting the mechanical arts into a school and teaching them step by step was a new thought, just as it was a new thought when law, medical, naval and military schools took the place of the court room, the doctor's office, the ship's deck and the military camp. The world has made progress in the past fifty years, and in no direction more markedly than in this one item of teaching the mechanical arts.

It must be borne in mind by critics of the Technical School that a "preparation for complete living" is much more the ultimate end of any education, whether mental or manual, than the mere thought of fitting a child for an occupation by which he may with the greater satisfaction earn his daily bread. Wherever manual training has been adopted it has been invariably noticed that boys will more willingly remain in school through the higher grades.

Psychologists tell us that manual training is essential to the full development of the brain, and therefore is indispensable to intellectual culture. President Eliot of Harvard University says: "Manual training not only trains the eye and hand, but develops the habit of accuracy and thoroughness in any kind of work. It develops the mental faculties of some boys better than books do." Professor James, of the same University, made the statement that "The most colossal improvement which recent years have seen in secondary education lies in the introduction of manual training," while Dr. Stanley Hall is credited with the statement that "No kind of education so demonstrably develops the brain as hand training."

It has been well said that the finest fruit of education is character, and have we not here a probable solution for the problem that is to-day paramount in the industrial world, the differences between labor and capital? As noted last month in our editorial columns, on the other side of the line an educational campaign is to be commenced with a view to enlightening the laboring masses. It is questionable whether the methods to be adopted will fulfill their mission. It might be pointed out, however, that if it is the intention of the Manufacturers' Association to utilize a portion of their fund of $1,500,000 for the endowment of Technical Schools, the hoped for results may be looked for. In the proper education of the laborer—education being interpreted in its fullest sense—must lie the ultimate solution of the labor problem. Technical education gives a more complete development, versatility and adaptability to circumstances. No technically trained workman can be a slave to a method, or depend upon the demand for a particular article or kind of labor. It is only the uneducated, unintelligent mechanic who suffers from the invention of a new tool. The thoroughly trained mechanic enjoys the extraordinary advantage of being able, like the well-taught mathematician, to apply his skill to every problem; with every new tool and new process he rises to new usefulness and worth.

The leaders of mobs are not illiterate, but they are narrow, the victims of a one-sided education, and their followers are the victims of no education. Give them a liberal training, and you emancipate them alike from the tyranny of unworthy leaders and the slavery of a vocation. The sense of hardship and wrong will never come and riots will cease when workingmen shall have such intellectual, mechanical, and moral culture that new tools, new processes, and new machines will only furnish opportunities for more culture, and add new dignity and respect to their calling.

At a recent convention of the Minnesota State Association of Builders' Exchanges, the subject of State schools for the teaching of the mechanical arts was discussed. It was made apparent by various speakers that few of their workingmen had ever had the advantages of the training such institutions would afford.

W. A. Stromme, secretary of the Builders' and Traders' Exchange of Faribault, in the course of the discussion, declared that the contractors and builders of the northwest were seriously handicapped in their work because of the fact that so many of their workmen did not understand their trade sufficiently to allow of their being left to work by themselves unless under the constant supervision of a boss.

He further pointed out that very few of the ordinary carpenters, masons and steel workers are familiar with blue prints, and in this respect the skilled workers in building trades in America are far behind the members of their respective trades in most of the countries of Europe, and for that reason foreign carpenters, blacksmiths and masons are able to earn more money here than can those who have worked in America all their lives, and have just as great natural ability as their fellow-workers from across the sea.

"Schools for the teaching of the mechanical arts," said Mr. Stromme, "have for years past been established and in running order in nearly all of the European countries, and in these schools all of the apprentices are given their first instructions. A young man who enters these schools will not secure a certificate as being a chartered workman in his trade till he can prove his ability before the State officials of the school.

"When he has finished his course he is ready to draw full pay and to do the work of an all around good man in his trade. He not only understands the blue prints and can follow them out, but he knows somewhat of the science of building, the tensile strength of material, and is an unbiased judge of construction methods. Such schools as that should be maintained by every State in the Union if the State cares for the equal benefit of all of its citizens.

A possible remedy is here hinted at for the injustice to which employers are subjected in being compelled by trade unions to pay a uniform wage to mechanics of all degrees of competency. Manifestly, a graduate of a Technical School should and would be eligible for a larger remuneration than his fellow-mechanic, who could boast of no training beyond a limited experience under a working employer. Here, undoubtedly, should be found a basis for a re-adjustment of the scale of wages at present indiscriminately demanded from employers by the unclassified members of our trades unions.

## MODEL TENEMENT IN ROME.

A model tenement for workingmen has been built in Rome.

In the building are seventy-three three and four room flats, renting at an average of $3.20 a month. One of the most unique features of the tenements is a school on the ground floor for children of the tenants.

The school is visited each day by a physician, who looks after the health of the little ones. By this arrangement mothers can send the children to school and go out working.

There is a laundry in the house; electric lights were installed and pure filtered water is supplied. The tenement is in the San Lorenzo section of the city.—Architects' and Builders' Journal.

## COLOR IN ARCHITECTURE.

In acknowledging the presentation of the gold medal of the Incorporated Institute of British Decorators, "in recognition of his great work of the decoration of the choir of St. Paul's Cathedral," described as the most important decorative work executed in England in modern times, Sir William B. Richmond delivered an interesting address. The profession of the architect, he said, was now so complicated, and the demands upon his energy as well as invention were so various and numerous, that it was impossible under such a strain as circumstances imposed upon them that they should be masters of all the crafts. Failure must result if they attempted to be. It was quite enough for the architect if he was a supreme master of construction either in stone, marble, wood, or iron. Stability must be his first consideration. Proportion came so nearly in touch with stability, and fitness was in so close a league with beauty, that the three dicta were so closely bound up together that one was evidently the result of another. Where there was perfect stability there was certain to be good proportion, and where there was good proportion there was certain to be beauty. He was thinking of architecture in the abstract—thinking of it, as it were, in black and white, or as an anatomist thinks of the human frame, forgetting the color of the skin, the eyes, the lips, and the hair.

The study of color was in itself so difficult, so involved, that for its success, he was going to say, a lifetime of experience was demanded. Color played so many tricks, was such a subject for them, because of the effect produced by light, or its absence, reflected or direct, and the general environment of tone, that no one who was not constantly employed in the use of color upon buildings could gain sufficient experience to achieve good results. For the attainment of success in color the architect had no time. When he tried he almost invariably failed. The great architects of the past were not specialists; some of them were painters and sculptors. The times did not ask of them to be business men; but it was otherwise now, and they were severely handicapped. Hence it too often happened that the use of marble—one of the most difficult of all materials, and one demanding an acute color sense—was often found to be detrimental to what otherwise might be a restrained and fine building.

As things were now, in the majority of cases an architect had better leave color alone, unless at the initiation of his design he was supported by the experience of a colorist. The divorce of color from architecture appeared to be surrendering to a closer bond between the painter and the builder. When it had entirely ceased, and the arts again became one—as they were one, three minds being better than one, those of the architect, sculptor, and painter—there was no reason why the modern building should not be as interesting, as stately, as unique in the perfection of all its parts as it was once, when men collaborated, when each learned from the other, and they worked together in a harmonious concord, desirous for perfection in all the various arts and crafts which a perfect building included.

## BOOK REVIEW.

Under the title, "Essentials in Architecture," by John Belcher, the author has attempted in brief form and by means of copious illustrations to furnish a manual by which the general public may be enabled to form some intelligent estimate of the architectural worth of contemporary buildings. Not only to the public in general, but also to the professional reader, will Mr. Belcher's work be of considerable value.

The plan of the volume, as might be gathered from its purpose, is designed on popular rather than on scientific or technical lines, and aims to lay down certain underlying principles so that even the layman may be enabled to recognize and distinguish the varying elements of beauty in buildings that can boast of architectural features. In his preface the author states that "In the eighteenth century a discriminating taste in architecture, and a knowledge of its first principles, were accounted an essential part of the equipment of a gentleman, but such knowledge and interest as exist among us to-day, outside of professional circles, are for the most part of the historical and antiquarian rather than of the practical order." A perusal of Mr. Belcher's work shows that he has made an admirable attempt to rectify this state of affairs.

"Essentials in Architecture," by John Belcher. Publishers, B. T. Batsford, 84 High Holborn, London, E.C. Price 5s. net.

Under the title "Specifications for Street Roadway Pavements," by S. Whinery, M. Am. Soc. C.E., the Engineering News Publishing Company, of New York, have issued a booklet containing much useful information for city engineers and municipal authorities. The book deals with the subject under the following heads: Specifications, Foundations, Bituminous Pavement, Granite, Brick and Wood Block Pavements. The aim of the publishers has been to treat as completely as possible the question of pavements, from the preliminary stage of drawing up the written specification, through the details of construction, inspection, etc., to the completion of the contract. In addition to their value as memoranda and aids in preparing specifications for particular projects, the work aims to bring about correct standards for such specifications. Without appearing to dogmatize upon the correct practice in any particular case, the author is at all times clear as to what he considers the best method to adopt and has succeeded in compiling in handy compass a fund of exceedingly useful information.

"Specifications for Street Roadway Pavement," by S. Whinery, M. Am. Soc. C.E. Publishers, Engineering News Publishing Company, New York. Price, 50 cents.

For the purpose of showing the effect of fire and earthquake on different fireproof materials, the Brick Construction Association have issued a book, entitled "Burnt Clay Products in Fire and Earthquake." By means of ninety-six pages of halftone cuts a pretty clear idea of the condition of type buildings, immediately after the San Francisco disaster, is given. "Burnt Clay Products in Fire and Earthquake," published by the Brick Construction Association, 707 Lankershim Building, Los Angeles, Cal. Price, $1.

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Ventilation through iron columns is practiced in a mill belonging to the Pulketh Company, at Preston, England, according to a report recently published by the United States Bureau of Manufacturers. The air is drawn in at the ground level and forced by a fan through a water spray, and then heated by coils in the usual manner. The air is next distributed from sub-ducts below the basement level through the iron columns of the building into the different rooms, the columns being fitted with openings near the top which are provided with suitable registers. The air is exhausted from these rooms through flues built in the brick walls.

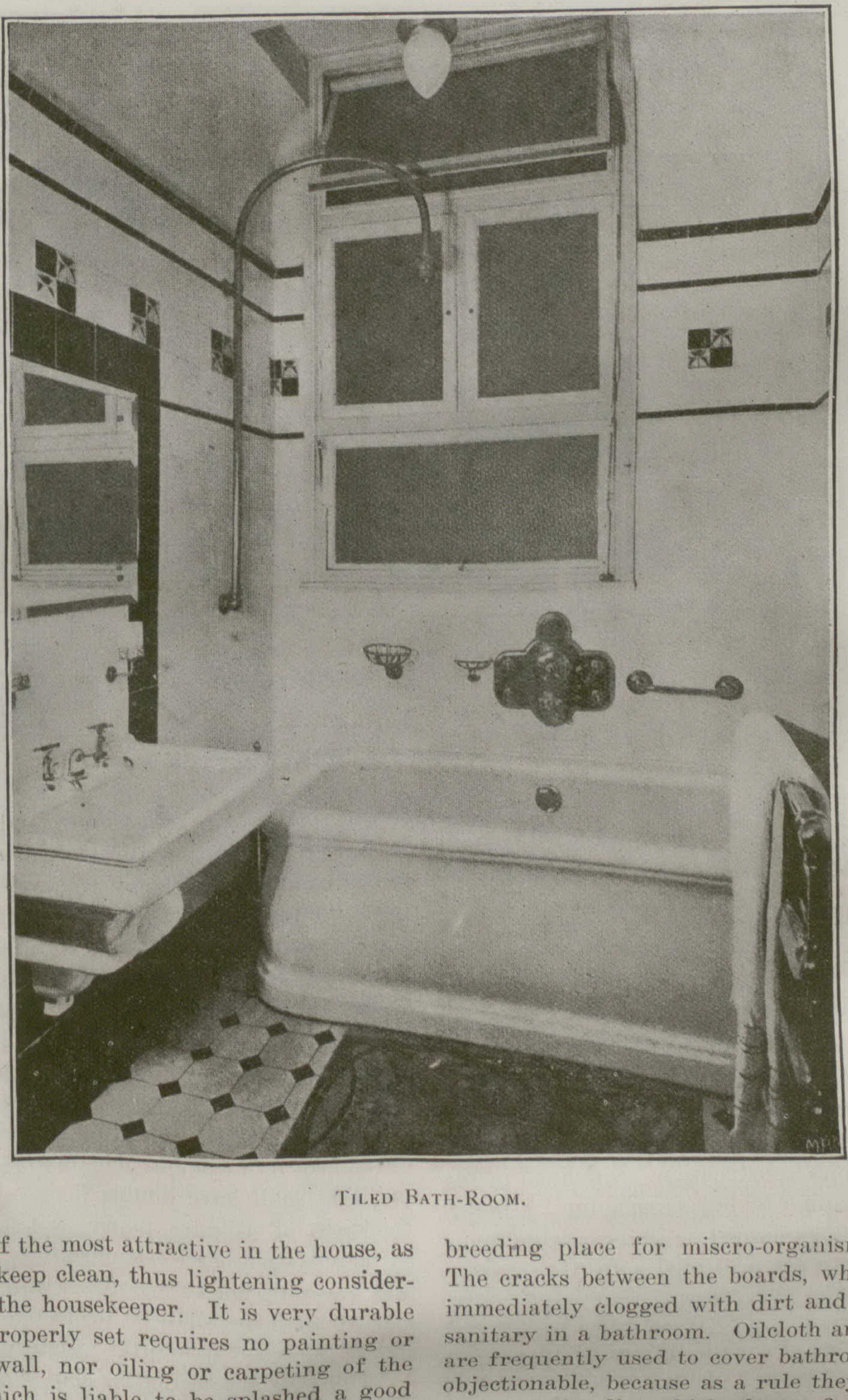
# CANADIAN PLUMBER HEATING AND LIGHTING ENGINEER

[ NOTE.—Contributions suitable for publication in this Department are invited from subscribers and readers. ]

## THE TILED BATHROOM.

B. C. J. FOX, PH. D.

Tile is coming into more popular use as a covering for the floors and walls of the modern bathroom. The tiles are set on a rigid concrete foundation, or, in the case of wall tile, on metal lath. A room so covered can be made one of the most attractive in the house, as it is very easy to keep clean, thus lightening considerably the work of the housekeeper. It is very durable and when once properly set requires no painting or papering of the wall, nor oiling or carpeting of the floor. Water, which is liable to be splashed a good deal about the bathroom, has no effect upon clay tile, whose attractiveness, durability and economy are important considerations. However, the fact that the clay tile is germ proof and, consequently, quite sanitary, is one of its most important recommendations as a good bathroom covering. Organic and porous flooring materials, such as wood, are apt to absorb moisture and other foreign matter which is deposited upon them, and this in decomposing becomes the breeding place for misero-organisms of every kind. The cracks between the boards, which become almost immediately clogged with dirt and dust, are also unsanitary in a bathroom. Oilcloth and linoleum, which are frequently used to cover bathroom floors, are also objectionable, because as a rule they merely hide and cover up the dirt which always finds its way underneath them.



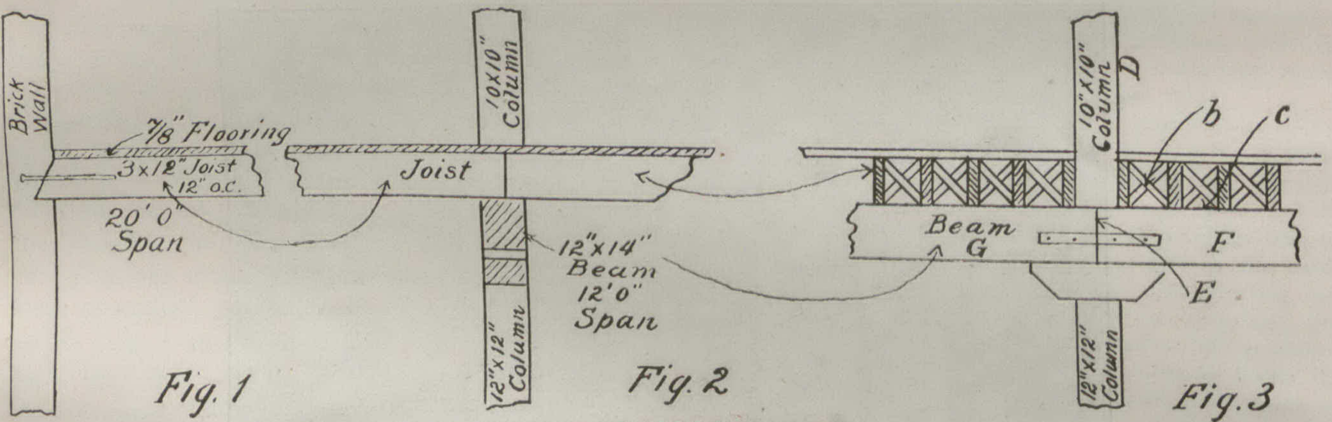
TILED BATH-ROOM.

In a completely tiled bathroom the sharp corners and angles formed by the union of the floor and wall are about the only places from which it is not easy to remove all dirt by the most superficial washing. This slight difficulty has been remedied by the adoption of the so-called "cove base," or hospital tile. With this tile along the baseboard, the angles and corners formed by the floor and wall are rounded out so that there is not the slightest recess in which dirt can be concealed.

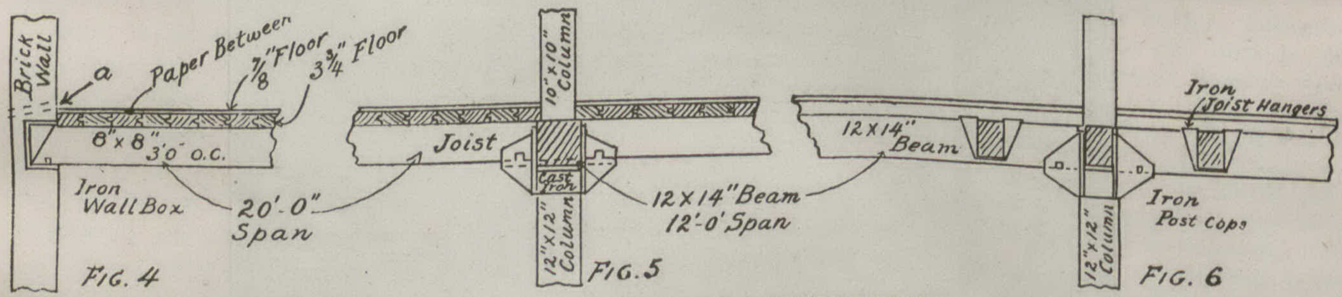
When tiling first came into general use in bathrooms, it was the white tile that was nearly always adopted. To-day, however, advantage is taken of the decorative possibilities of the colored tile, which are just as durable and sanitary as the white variety. Everyone who has seen a tiled bathroom in which there is some artistic color effect, realizes at a glance

tional area of not less than 60 square inches and above the joists of which there is laid a solid timber floor of not less than 2 3-4 inches in thickness. All such floors shall be dressed and tongued and grooved." Wood posts used in buildings of this class shall not be of smaller sectional area than 100 square inches, except the posts in the top storey, which shall not be of smaller sectional area than 64 square inches.

"Elevator enclosures and other partitions in buildings of this class must either be made entirely of incombustible material or with not less than 2 3-4 inch spliced wood forming partion, and the use of wood furring or wood lath will not be permitted. The roof of mill constructed buildings must be covered with incombustible material and be made similar in all respects to the roof specified for ordinary construction.




ORDINARY CONSTRUCTION.




MILL OR SLOW-BURNING CONSTRUCTION

the advisability of relieving at least to a certain extent the glaring monotony of all white floors and walls.

## WAREHOUSE BUILDINGS.

In building a modern warehouse attention must be paid to the three classes of construction, commonly known as "ordinary," "mill" and "slow-burning" construction. All are intended to safely sustain a load of 100 pounds per square foot of floor space, although this capacity may be indefinitely increased as the purposes for which the building is intended vary.

The term "ordinary construction" is defined in the revised Toronto building by-law as meaning "a building with wood joists and wood or iron posts, columns and beams, which are not protected with fire-resisting coverings, but having the external and party walls constructed of brick, stone or some other incombustible material, the roof of such buildings being covered with tin, iron, copper, slate, tile, felt and gravel or other material of an incombustible nature."

On the other hand, "mill construction" is defined as meaning a "building in which all the wooden girders and joists, supporting floors and roof, have a sec-

Where planks are set on edge and are not over two inches thick, with a matched wearing floor above, the tongue and groove or splice may be omitted; in such cases the planks shall be well spiked at intervals of 15 inches with spikes of sufficient length to penetrate two-thirds the thickness of the adjoining plank.

The term "slow-burning construction," according to the by-law, "shall apply to all buildings in which mill construction is used and in which the structural members, which carry the loads and strains which come upon the floors and roofs thereof, are entirely enveloped in incombustible material. This class of building shall have double floors and roof, with one thickness of asbestos paper, weighing not less than 14 pounds each per 100 square feet, between the upper and lower thicknesses of floors and roof. The under side of all floors shall be protected in the same manner as the wood structural members.

Ordinarily the two latter classes of construction are regarded as practically the same, distinction being generally made between the first two only. The joists in all cases have a span of 20 feet from one bearing to the other and in ordinary construction are 3 x 12 inches, spaced 12 inches centre to centre, while those employed in mill construction are 8 x 8 inches, spaced 3 feet centre to centre. The beams carrying joists are 12 x 14 inches and have a span of 12 feet. The columns are 12 x 12 inches and 10 x 10 inches in both cases. This is done both for the securing of ample strength in case of damage by trucking and also because building laws will not allow columns in this class of buildings with a sectional area less than 100 square inches.

The Toronto by-law indicates that the main difference between mill and slow-burning construction is that the floors in the latter are of two thicknesses with water and fireproof paper between. This extra flooring is put in for three reasons: In the first place, it is made heavy and tight so that fire has but little chance to damage it; secondly, the paper is put between the floors so that there will be no airholes between the flooring in case of shrinkage, and also that, in case of fire above, the water will not run through so easily, but will run out of the holes in the wall, as shown at A. The top floor is usually birch or maple, having exceptional wearing qualities and serving to protect the heavy flooring. The floor must also be made heavy in order to carry the superimposed load, as the joists are farther apart in "mill" and "slow-burning" construction than in "ordinary."

From the sketches (reproduced from "The Woodworker") may be seen some of the more marked differences between the two. In "ordinary construction," dust can lodge in many places, as at b and c, but in "mill construction" there is absolutely no place for dust to lodge at the ceilings. The timbers are all large, so that they will not ignite easily in case of fire; and should they burn, they would be a long time in falling. The building laws in most cities require that floor joists for "mill construction" must be at least 72 square inches in sectional area.

It will also be noticed that there is a very marked difference in construction in the sketches. In "ordinary construction," if floor beams burn and fall with the weight upon them, they, as a rule, pull some other portion of the building down or out of place, as would be the case with column D, if F and G were to fall and act as a lever at E. This is not the case in the "mill construction" sketch, for in such construction any part of a floor and beams could burn and fall and yet not disturb any other part of the structure.

Figs. 1 and 4 show part of a wall with joists in place. Figs 2 and 5 show parts of columns, cross-sectional parts of beams, and longitudinal parts of joists in place. Figs. 3 and 6 show parts of columns, longitudinal parts of beams and cross-sectional parts of joists in place. In "mill construction" the first or heavy floor is put down diagonally to the walls of the building, while the upper or finished floor is laid at right angles to the joists.

The reason for taking 100 pounds for the live load or load per square foot of area which might be put upon the floor is the least the building laws will generally permit. In other cases, and for concentrated loads,' these laws demand special construction, sometimes as high as 450 pounds per square foot carrying capacity being the minimum.


New Zealand Summer Cottage.

## A NEW ZEALAND SUMMER COTTAGE.

The illustration on this page shows a cosy little summer cottage at Island Bay, Wellington, N.Z. We reproduce it not only as an architectural model from that far-off land, but also because it possesses features which must commend it to Canadian architects and builders who undertake work of a similar nature.

It will be at once noticed that the design of this cottage is both unique and handsome. But a closer study will reveal the fact that the construction is as inexpensive as it is attractive. In fact, the whole purpose of a summer residence is well served, at a very moderate cost.

Additional interest will attach to this cottage when it is known that the metal shingles and siding were manufactured by a Canadian firm—the Metal Shingle & Siding Company, Limited, of Preston, Montreal and Toronto.

# CEMENT AND CONCRETE

[NOTE.—Contributions suitable for publication in this Department are invited from subscribers and readers]

## FORMS FOR CONCRETE CONSTRUCTION

By SANFORD E. THOMPSON, M. AM. S.C E.

The selection of the lumber for forms for concrete construction must be governed by the character of the proposed work and the local market. Although white pine is best for fine face work, and quite essential for ornamental construction cast in wooden forms, for ordinary work, and even for panels, white pine is too expensive, and spruce, fir, Norway pine or the softer qualities of southern pine, especially North Carolina pine, may be substituted. Some of these woods are more liable to warp than white pine, but they are generally stiffer and thus better adapted for struts and braces.

Kiln dried lumber is not suitable for form construction, because of its tendency to swell when the wet concrete touches it. Very green lumber, on the other hand, especially southern pine, which does not close up quickly when wet, may give trouble by joints opening. Therefore, the middle ground, or in other words partially dry stuff, is usually best.

Either tongued and grooved or bevel edged stuff will give good results for floor and wall panel forms, and is preferable to square edged stuff. A smoother surface may be attained at first with the tongued and grooved stock, and there is less trouble with opening joints, but it is more expensive than bevel edge because of the waste in dressing, and if the forms are used many times there is greater tendency to wear at the joints. Even for rough forms, plank planed one side may be economical or cheapen the cost of cleaning. Studs should always be planed on one side to bring to size.

The thickness of the lumber varies with different contractors, some using 1 inch, others 1 1-2 inch, while a few employ 2 inch stuff even for panels. (These are commercial thicknesses measured before planing.) For ordinary walls 1 1-2 inch stuff is good, although for heavy construction, where derricks are used, 2 inch is preferable. For floor panels, 1 inch boards are most common, although, if the building is 8 storeys high or over, 1 inch stuff is likely to be pretty well worn out before the top of the building is reached, and the under surface of the concrete may show the wear badly. For sides of girders either 1 inch or 1 1-2 inch is sufficient, while 2 inch is preferable for the bottoms. Column forms are generally made of 2 inch plank.

Certain general rules are applicable to all kinds of forms. Strength, simplicity and symmetry are three fundamental principles of design. The necessity for strength is obvious, while economy in concrete construction consists in quickly erecting and moving the forms and in using them over and over again.

In building construction the forms must be designed so that the column moulds and also the bottom of beam moulds are all independent of the slabs. The forms may thus be left a longer time upon members subjected to the greater stress.

The sides of the beam moulds should be held tightly together by wedges or clamps, to prevent the pressure of the concrete springing them away from the bottom boards. At top or bottom of each strut hardwood wedges are useful when setting and removing it, while they also permit testing to make sure that there is no deflection of the beam or slab. For this purpose some contractors loosen the wedges twenty-four hours in advance of the struts. In general it is preferable to use comparatively light joists, such as 2 x 8 inches or 2 x 10 inches, with frequent shores, rather than to use lumber which is heavier to handle.

If forms are to be used but once or must be taken apart when removed, it is sometimes practicable to use only a few partially driven nails so that they can be withdrawn without injury to the lumber. It is very difficult to convince house carpenters that the pressure of the concrete will hold temporary panel boards in place with scarcely any nailing.

Forms for facework should be tightly put together, it being advisable in some cases to close the joints and holes by mortar, putty, plaster of Paris, sheathing paper or thin metal. This is not, as is commonly supposed, to prevent loss of strength by the cement which flows out with the water, but rather to prevent the formation of voids or stone pockets in the finished surface.

Crude oil is one of the best materials to prevent adhesion of the concrete to the forms, though linseed oil, soft soap and various other greasy substances are also employed for this purpose. The oil or grease should be thin enough to flow and fill the grain of the wood.

If the forms are to be left until the concrete is hard, there is little danger of the concrete sticking to them if instead of being greased they are wet thoroughly with water before the concrete is laid. In any case, if concrete adheres to the forms it should be thoroughly cleaned off before resetting; even then it is apt to stick again in the same place.

"Rule of thumb" layout of forms in the field is being superseded by design in the drawing room. In building construction where the forms form a large percentage of the cost of the building and where a failure in the forms may cause loss of life, it is especially necessary to treat this question from an engineering standpoint, and many of the best concrete contractors now design their forms as carefully as the dimensions of the concrete members.

In ordinary walls, where the concrete is placed in layers, general experience has shown that maximum spacing for 1 inch boards is 2 feet, for 1 1-2 inch plank is 4 feet, and for 2 inch plank is 5 feet. Studding generally varies from 2 x 4 inch to 4 x 6 inch, according to the character of the work and the distance between the horizontal braces or walling.

The best contractors have definite rules for the minimum time during which the forms must be left in ordinary weather, and then these times are lengthened for changes in conditions according to the judgment of the foreman. As a guide to practice, the following rules are suggested:—Walls in mass work: one to three days, or until the concrete will bear pressure of the thumb without indentation.

Thin walls in summer, two days; in cold weather, five days.

Slabs up to 6 feet span: in summer, six days; in cold weather, two weeks.

Beams and girders and long span slabs: in summer, ten days or two weeks; in cold weather. three weeks to one month. If shores are left without disturbing them, the time of removal of the sheeting in summer may be reduced to one week.

Column forms: in summer, two days; in cold weather, four days, provided girders are shored to prevent appreciable weight reaching columns.

Conduits: two to three days, provided there is not a heavy fill upon them.

Arches; of small size, one week; for large arches with heavy dead load, one month.

All of these periods are, of course, simply approximate, the exact time varying with the temperature and moisture of the air, and the character of the construction. Even in summer, during a damp cloudy period, wall forms sometimes cannot be removed inside of five days with other members in proportion. Occasionally, too, batches of concrete will set abnormally slow either because of slow setting cement or impurities in the sand, and the foreman and inspector must watch very carefully to see that the forms are not removed too soon. Trial with a pick may assist in reaching a decision.

Beams and arches of long span must be supported for a longer time than short spans because the dead load is proportionaly large, and therefore the compression in the concrete is large even before the live load comes upon it.

The general uncertainty and the personal element which enters into this item emphasize the necessity for some more definite plan for insuring safety. The suggestion has been made that two or three times a day a sample of concrete be taken from the mixer and allowed to set on the ground under the same conditions as the construction until the date when the forms should be moved. These sample specimens may be then put in a testing machine to determine whether the actual strength of the concrete is sufficient to carry the dead and construction loads. Even this plan does not provide for the possibility of an occasional poor batch of concrete, so that watchfulness and good judgment must also be exercised.

## PRODUCING POLISHED EFFECTS ON CONCRETE WORK

Concrete slabs and brick are now being produced in Europe, that are as fine in grain and structure as high grade porcelain, showing an equally fine polish. The secret of the progress consists in grinding the aggregates to as fine a powder as the cement. The mixture, one of cement to as high as twelve of aggregate, is then dampened just sufficient to pack well when pressed in the hand. It is then subjected to high pressure in strong iron moulds, up to 5,000 pounds per square inch. The best results are obtained in slabs or plates slightly under one inch thick. The pressure is applied in four or more strokes. After each stroke the pressure plate is removed to permit the air to escape. After each stroke the pressure is increased. The object of grinding the aggregates to the same fineness as the cement is to prevent forming an arch in the stone, which always takes place where high pressure and coarse aggregates are employed. Then again if the pressure applied to the concrete exceeds the crushing strength of the aggregates, the aggregates will grind at the contact point in the mass, leaving powdered contact points which weakens the concrete. This defect is entirely overcome by using a fine powdered aggregate. It will be seen that high pressure and coarse aggregates are inconsistent for fine work. Coarse aggregates can, however, be used where the mould produces forms in the shape of an arch, and the pressure applied is below the crushing strength of the aggregates. It is extremely bad practice to use high pressure in moulding concrete blocks over 4 inches high on account of the danger of the arching of the aggregates. Tamping square or hollow concrete blocks is always to be preferred for sound work.—Cement and Engineering News.

## CLINKER CONCRETE BUILDING

A description has been published recently of some blocks of workmen's dwellings erected in Liverpool to the designs of the City Engineer, Mr. J. A. Brodie, M. Inst. C.E. These buildings are three storeys high and are built entirely of clinker concrete slabs, made in sizes up to 16 feet by 11 feet. The outer walls and party walls are 14 inches thick throughout, with steel reinforcement strips in both directions, so that no areas equal to a square yard are left without reinforcement. Mr Brodie wished originally to make these slabs only 7 inches thick, but the authorities failed to support him, and consequently the buildings were far more costly than they need have been. The interior walls were made of similar slabs, 6 inches and 4 inches thick, and up to 16 feet by 11 feet. Mr. Brodie states that the cost of making these large slabs, 7 inches thick, is under 3s. per square yard, exclusive of subsequent handling. This is under 15s. 6d. per cubic yard. The reinforcement is put in chiefly to facilitate handling without damage, and is not relied upon to support loads, although it does, no doubt, stiffen the structure.

The economy of using these large blocks of concrete (weighing from 4 to 10 tons) depends upon the total amount of work to be done, being sufficient to justify the provision of powerful plant to erect them. In large blocks of buildings or long rows of small ones, there would be a great saving over brickwork, but for a few small cottages it would not pay, and in such cases 9 inch brickwork with ferro-concrete bond courses will be hard to beat. In tall steel frame buildings big slabs of concrete could be used without any serious difficulty, and the rapidity of erection would astonish most people.

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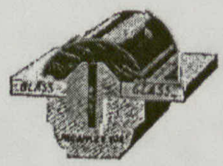

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## HOW GLASS DECAYS.

Glass is not popularly regarded as subject to decay, but that is because the alterations in it take place very slowly. Old glass, such as that in windows that have stood for centuries, may show marked signs of disintegration. It has been shown by Noel Heaton, an English authority, in a paper on the decay of medieval stained glass, read before the Society of Arts, that the manner of this disintegration may reveal the composition of the glass and the method by which it was made. An abstract of Mr. Heaton's address in "Nature" says:

"There are reasons for thinking that the making of window glass was not handed down from the Romans, but was rediscovered in the middle ages, and the author thinks it most probable (although evidence is too scanty to justify this as a statement of fact) that the glass of the earliest stained glass windows, that is, those of the ninth and tenth centuries, was made in the same way as the cast window glass most generally employed by the Romans, this being the method that would most naturally suggest itself in the first place.

"The composition of the glass described by Theophilus was quite different from that of the Romans, being produced, according to the treatise referred to, by heating a mixture of sand and the ashes of beechwood. It is probable, however, that the glass varied very considerably in composition at different times and in different places, owing to the impurity of the sand used and the varying nature of the wood ashes, which would in all probability be obtained by burning whatever species of timber came nearest to hand."

Mediaeval glass, the author tells us, decays characteristically, commonly becoming covered with pits, like worm-holes in an old oak cabinet. The process seems to reproduce on a small scale the action of time and weather on geological formations, such as chalk and sandstone—a combination of corrosion and internal change. To quote again:

"Corrosion of the surface of glass is produced by the long-continued action of moisture, which gradually extracts the soluble silicates, leaving the insoluble silica in a thin film, the glass thereby becoming iridescent. Owing to the large proportion of lime it contains, however, medieval glass does not become





iridescent as the result of corrosion. On the extraction of the alkali by water this lime is left behind with the silica, and forms with it a hard, insoluble silicate of lime, which adheres to the corroded surface of the glass, forming an opaque scum or patina. In some cases this is so marked that the glass appears to be covered with a coat of cement.

"The peculiar pitting of old stained glass is not, however, in the author's opinion, due to corrosion at all, but to a change in the constitution of the glass. As is well known, glass changes its constitution and becomes crystalline if kept at a red heat for a length of time. What happens in a few hours when the glass is hot tends to take place on prolonged exposure to the atmosphere, with this difference: that when the glass is molten its molecules can freely move about, whereas when it is cold and rigid such freedom of movement is impossible; in consequence the definite formation of crystals can not take place, and the result of the change is different. What happens is this: In the first place, molecules of the same kind tend to separate out from the homogeneous mixture and collect round a point forming a centre of decomposition. Proceeding from this centre the glass is found decomposing into definite compounds in an ever-enlarging circle until it reaches a point at which the strain set up in the glass by this molecular movement results in a crack forming round the area of decomposition, and then the whole mass comes away, leaving behind it a little hole or pit in the surface of the glass."



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## MONTREAL STREET RAILWAY TO HANDLE FREIGHT.

Because of the increasing difficulty in securing carters to expeditiously handle freight in Montreal, the question of extending to the street railway the privilege of handling freight has recently been mooted in that city and has behind it the influence of many shipping houses as well as prominent builders and contractors. A resolution bearing on this subject was adopted a short time ago by the Montreal Builders' Exchange and was presented to the City Council. It read as follows:

"Whereas, it has been stated in the press that at the recent Council meeting on June 26 last, a petition was presented on behalf of leading city merchants, asking that the Council consider the desirability of permitting the Montreal Street Railway Company to handle freight throughout its city lines and connected systems;

"And whereas, the fact is indisputable that the congestion of freight, owing to lack of sufficient cartage facilities, offers a serious menace to the commercial interests of this city; and furthermore, that owing to climatic conditions, there is little probability of seeing any substantial increase in the present cartage facilities;

"Be it resolved, that this association, representing the important public interests involved in the building industry of Montreal, cordially endorses the proposal to relieve the constantly recurring congestion of freight traffic, and respectfully asks the City Council to make the matter one of urgency at its next Council meeting, in order that an amelioration of the present state of affairs may be inaugurated without delay."

Furthermore, the directors of the Builders' Exchange, in view of the fact that the matter of granting such a privilege to the street railway involved considerable difficulty, suggested:

"1.—Extending to builders and other large handlers of heavy freight, the privilege of having temporary sidings laid wherever the building or material is of sufficient importance to warrant it, thus avoiding all obstruction to passenger traffic. On smaller, or only temporary jobs, the the use could be met by unloading on skids by means of air compressors, derricks or other rapid devices. It should be borne in mind that for its own construction needs the street railway is already using large construction cars for handling heavy freight, such as sand, crushed stone, bricks, lumber, cement and structural iron, without hindrance to the passenger service, as the latter cars always have the right of way. This committee is not advocating the handling of small packages, as these properly come under the sphere of the express companies. After careful investigation, the committee doubts if the exclusive handling of heavy freight at night, as has been suggested in some quarters, is feasible or desirable, owing to the impossibility of securing night working gangs, and to the increased risk of accidents.

"2.—The maximum freight rates not to exceed the current rate for carload quantities charged presently by chartered cartage companies.

"3.—A fixed percentage of the gross freight receipts to accrue to the civic revenue."

In response to the efforts being put forth by the Building Exchange and the city merchants, Alderman Lariviere has stated that he will in the course of a couple of weeks present a by-law authorizing tramway companies to carry freight in Montreal.

## SURVEYING AND DRAWING INSTRUMENTS.

We are in receipt of a very complete and well-illustrated catalog of the surveying instruments manufactured by W. F. Stanley & Company, Limited, of London, England. The firm announces increased facilities for the manufacture of drawing instruments by reason of recent improvements in machinery, which have also rendered possible correspondingly reduced prices. The firm's comprehensive stock embraces every known article for use in office or field for the architect, engineer and draughtsman. Over 2,500 of such articles are catalogued.

## FORGED STEEL PIPE FLANGES.

Under the title "Forged Steel Pipe Flanges," the management of the "American Spiral Pipe Works," Chicago, have issued a very tastily printed and illustrated catalog, descriptive of their manufactures. Their idea has been to place before the public not only a complete list of the standard flanges and a partial list of the various forgings that they manufacture, but also a short description of the more important features of the forged steel flange.

## A SUBSTITUTE FOR MARBLE.

The lack of marble in Denmark has in the past led to many attempts to produce a substitute which would equal in decorative effect the natural product, and at the same time would not exceed it in cost. Some success has been achieved in the manufacture of a substitute in Sweden, but the thin slabs would not keep their shape. The veins were stiff and angular, and the soft transitions of color which made variegated marble a thing of beauty were lacking. An important advance, has, however, been made in the industry by a Danish master builder who is producing a stone which is claimed to be of such delicate transition of tints and play of color that it is almost impossible to distinguish it from real marble. The claim is made that the article can be produced in any form and that it appears to have the durability of genuine marble, while the cost is about one-tenth.

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Collapsible revolving doors differ from the ordinary revolving doors in the fact that instead of requiring operation by an attendant or other person to fold the wings of the revolving door together and leave an open exist space, the wings of the collapsible doors fold simply by the unusual pressure of a crowd of persons seeking exist. The circular walls are in hinged sections, the outer and the inner sections being also displaced by the unusual pressure.

THE CROOKED HOUSE.

On the estate of Earl Dudley, at Himley Staffs, there is a curious habitation known as "the crooked house." It is altogether out of the perpendicular and slants toward the south end, which is heavily shored up with thick red brick buttresses. These peculiarities are the result of mining operations, the under stratum of the earth in these parts being completely honeycombed. The clocks on the walls, although absolutely perpendicular, as their pendulums testify, appear to be hanging sideways at a pronounced angle. A short glass shelf, one end of which appears to be a foot higher than the other, proves to be absolutely level, while in the tap-room is a table which is apparently slanting, but on which if round marbles are placed at the seemingly lower end they roll to all appearances up-hill to the top of the table and fall over with a bump.

TOOK 1,600 YEARS TO COMPLETE CHURCH.

At Troyes, in France, was solemnly inaugurated a church which has taken sixteen centuries to build, as it was begun in the third century, and was completed but recently.

This is St. Urban's Church, built by order of Pope Urban on the site of the house in which he was born. Only the foundations were laid during Pope Urban's lifetime, and though the building has long been consecrated the last remaining stones were laid this year. The church is a gem of Gothic architecture.

A RARE COLLECTION OF FURNITURE.

It is reported that J. Pierpont Morgan has acquired for $1,200,000 the unique collection of Jules Van Den Poreboom, which comprises furniture, pictures, arms, brasses, ancient engravings and chimney pieces. The collection is installed in the sixteenth century Dutch house at Anderlecht, Belgium, a replica of which will be constructed in New York State under the superintendence of Francois Malfait, an architect.

PAGES

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