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CONSTRUCTION

A · JOURNAL · FOR · THE · ARCHITECTURAL ENGINEERING · AND · CONTRACTING INTERESTS · OF · CANADA

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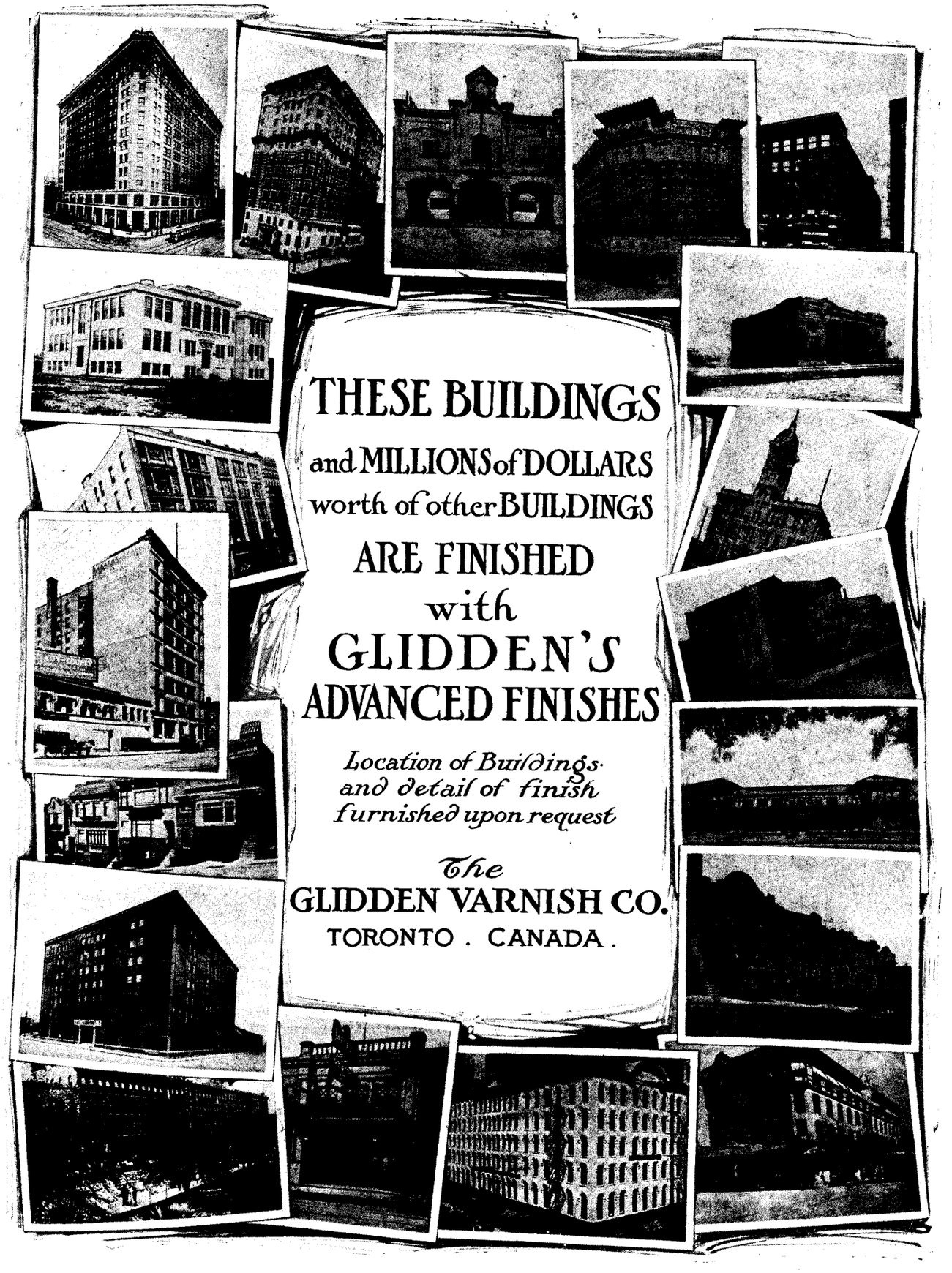
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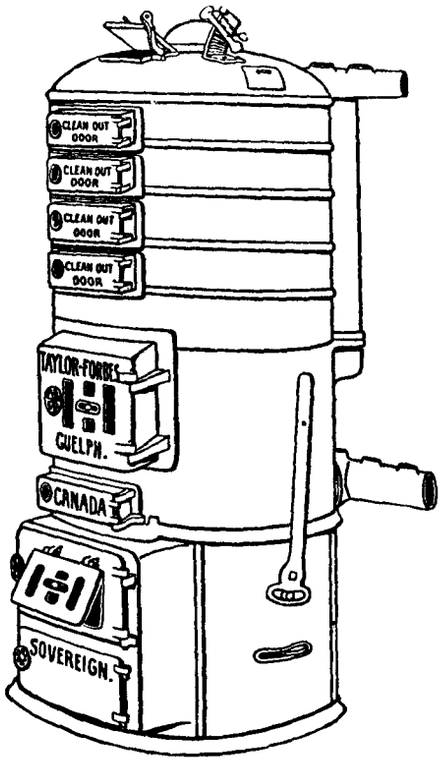

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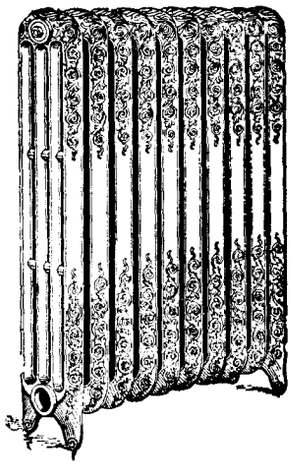

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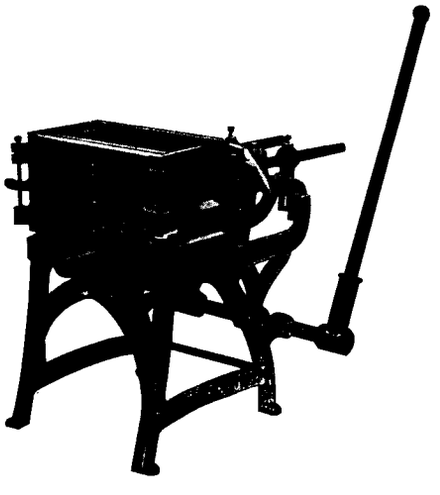
Builders and contractors everywhere should have their own Ideal concrete block machines. It will put them in touch with the latest developments in building construction, enable them to build better, cheaper and quicker, and give them the advantage of being able to move their plant and make their own blocks, wherever they need them. We can also supply Concrete Mixers, Ornamental Molds, Tile Molds, Dimension Stone Machines, Automatic Tampers, Tycrete, Waterproofing, Derricks, etc.



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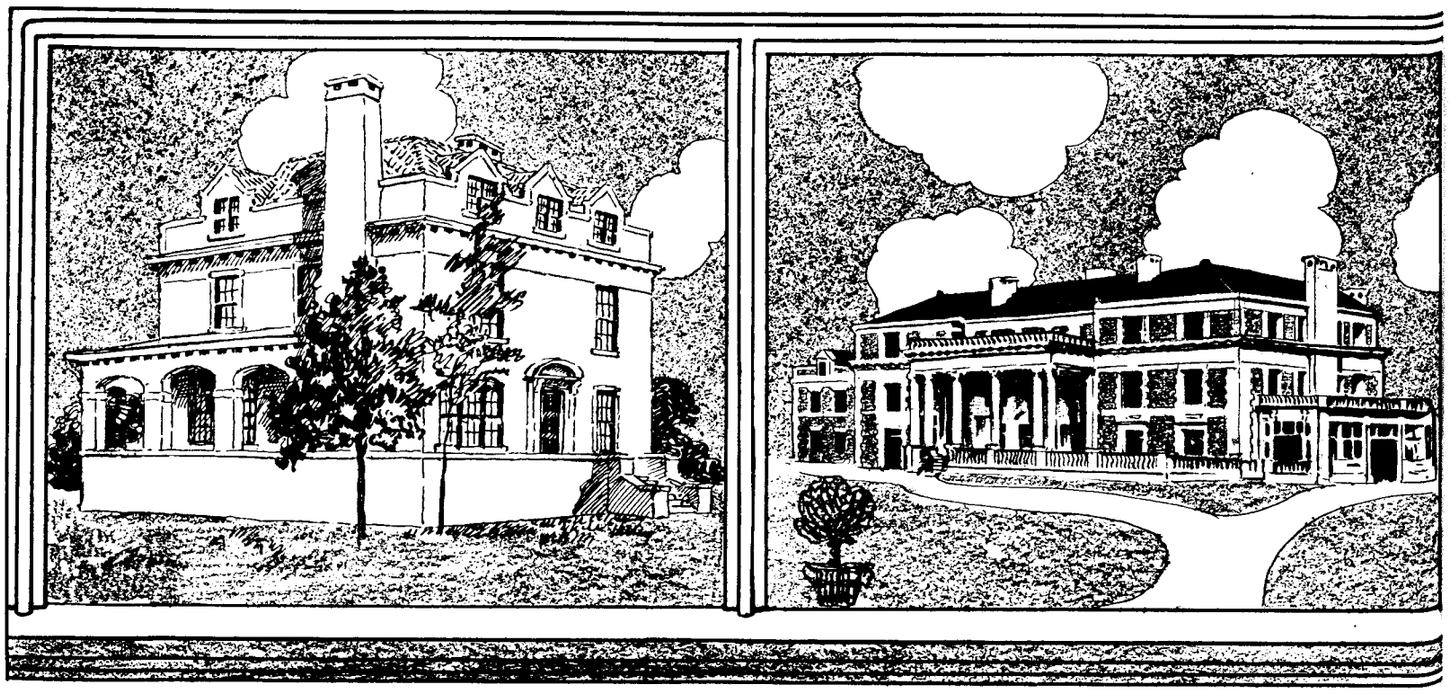

The Modern Architect Looks With Favor Upon Cement

FROM an æsthetic point of view, no less than from its utilitarian aspect, cement is finding increased favor with Canadian architects.

Originally looked upon as only desirable where strength and durability were the prime considerations, Concrete Construction has won its way to a place of high esteem for architecture that demands the highest form of artistic treatment.

Structurally, concrete has been proved. Architecturally, its wonderful possibilities are, as it were, on the verge of a greater, more complete, appreciation. Offering greater resistance to fire even than the average quarried stone; more waterproof than most of the popular building stones—concrete has the added advantage that it may be reinforced with steel, thereby permitting of great tensile strength.

Ample illustration of the ornamental possibilities of concrete, may be found on any of our city streets—concrete, being so closely akin to stone (the material in which the development of architecture has taken place) permits of artistic expression not possible with wood, steel or other material. In considering the length and breadth of the field of architecture that concrete can be made to cover—the multiplicity of uses to which cement is adapted—too much stress cannot be laid upon the vital importance of **quality** in the cement. Whether used in imitation of granite, limestone, or sandstone—or as a **distinctive** building material with decorative features all its own—the complete success of concrete work depends upon the ability of the builder to secure absolute uniformity. This, it will be understood, can only be accomplished when the cement—the basic concrete aggregate—is of uniform high quality.

Understanding this, you are confronted with a choice between ordinary brands and

CANADA

CEMENT

In the manufacture of "Canada" Cement, we ensure unvarying purity by constant testing under the supervision of a skilled analyst. Having set a high standard as to color, fineness and strength, we rigidly keep our product up to that standard—none that fails in smallest measure to conform, is ever allowed to leave one of our mills.

CANADA CEMENT COMPANY,

Therefore, in specifying "Canada" Cement, the architects and engineers of this country place themselves in a position of security—security in the knowledge that, the cement being right beyond a doubt, any flaw in the resulting concrete work can only be attributed to careless workmanship—and the workmen, therefore, held solely responsible.

Since "Canada" Cement is no more costly than ordinary cement, it would seem the part of wisdom to insist on its use—particularly as we can promise prompt deliveries from any of our eleven mills.

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Woodward Building. Washington, D. C.
"ALCA" Lime used for brick MORTAR

Note Work Done With

"ALCA" LIMES

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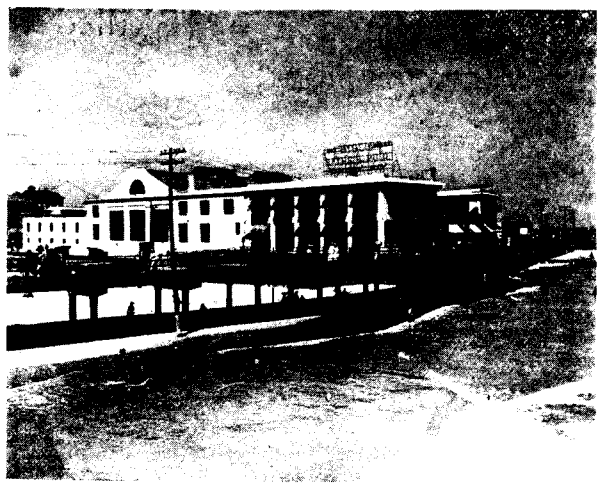

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"ALCA" Lime used exclusively for stucco.

85%
of best LIME
in all "ALCA" LIMES
therefor you are
assured of
Plasticity
Smooth Working and
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Qualities
Durability
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any Coloring Scheme
Feasible in Stuccoing.
Furthermore the
15%
Remaining Makes all
"ALCA" LIMES
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Is "Fenestra" Sash Absolutely Fireproof?

WHEN the plant of the Vera Chemical Co., at Stoneham, Mass., with its contents of 2000 barrels of rosin and turpentine went up in smoke in September this question was again answered emphatically and convincingly.

The photographs tell the story. It will be seen that the small stone building, which was equipped with "FENESTRA" Sash, was almost surrounded by the other buildings, and that when the fire took place it was enveloped by the heat and flames.

As the lower cuts show plainly, though the heat was severe enough to literally melt some of the glass out, the sash itself is entirely intact and uninjured. It has since been reglazed and is to-day in use.

Had this building been equipped with *wood sash*, of what use would its heavy stone walls and metal-clad fire-door have been to protect the highly inflammable contents from the flames?

Even the ordinary so-called "fireproof" hollow-iron window with its big exposed panes would have collapsed five minutes after the flames reached it, leaving the "fireproof" window with its "automatic closing device" little more than a metal rim in a stone opening.

Only a sash of *interlocked solid-steel bars* permitting the use of *small panes* can withstand the ordeal of intense and continued heat like this. Absolute window protection costs no more than the doubtful kind. Remember this in specifying.

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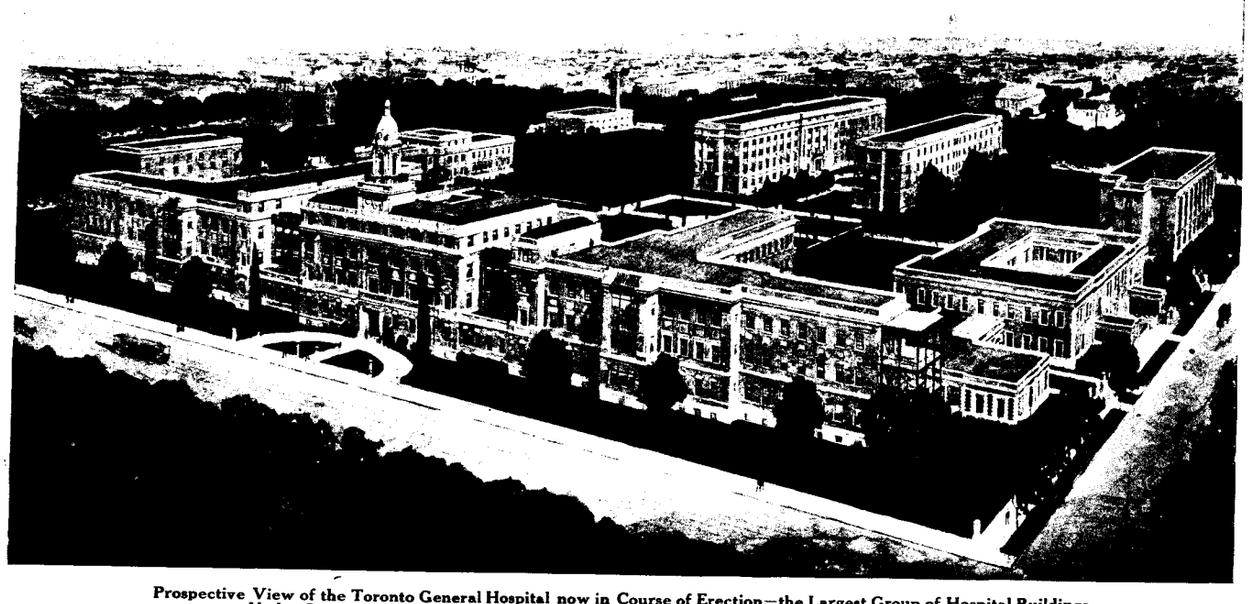

Prospective View of the Toronto General Hospital now in Course of Erection—the Largest Group of Hospital Buildings Under One Management on the American Continent. Messrs. Darling & Pearson, Architects.

Including

J.A.P. Don Valley Semi-Vitreous Facing Bricks

are being used in this one huge building undertaking.

¶ A record order, to say the least, yet the significance attached to it lies not so much in the magnitude of the contract itself, as it does in the fact that DON VALLEY BRICKS were selected in competition with samples submitted by the foremost brick manufacturers in Canada and the United States. In other words, the architectural importance of this vast project demanded bricks of QUALITY, possessing texture, color and strength—and DON VALLEY PRODUCTS were found superior in every point of comparison.

¶ To-day the erection of the main buildings of this imposing group has reached an advanced stage, and the texture and beauty of effect of J.A.P. DON VALLEY SEMI-VITREOUS FACING BRICKS as laid up in the walls is a matter of general comment. These bricks are made in a special length with oriental face, and have a pronounced contrast in colors, with tones ranging from flecked golden to deep bronze and purple. They are universally recognized as the "sine qua non of architectural expression," and are being adopted by Canada's foremost designers for their more important work.

¶ In addition to these bricks, all the POROUS TERRA COTTA FIREPROOFING used in the hospital group is of DON VALLEY manufacture, thus making this vast undertaking not only a project of Canadian enterprise and benevolence, but one in which only Canadian materials are used.

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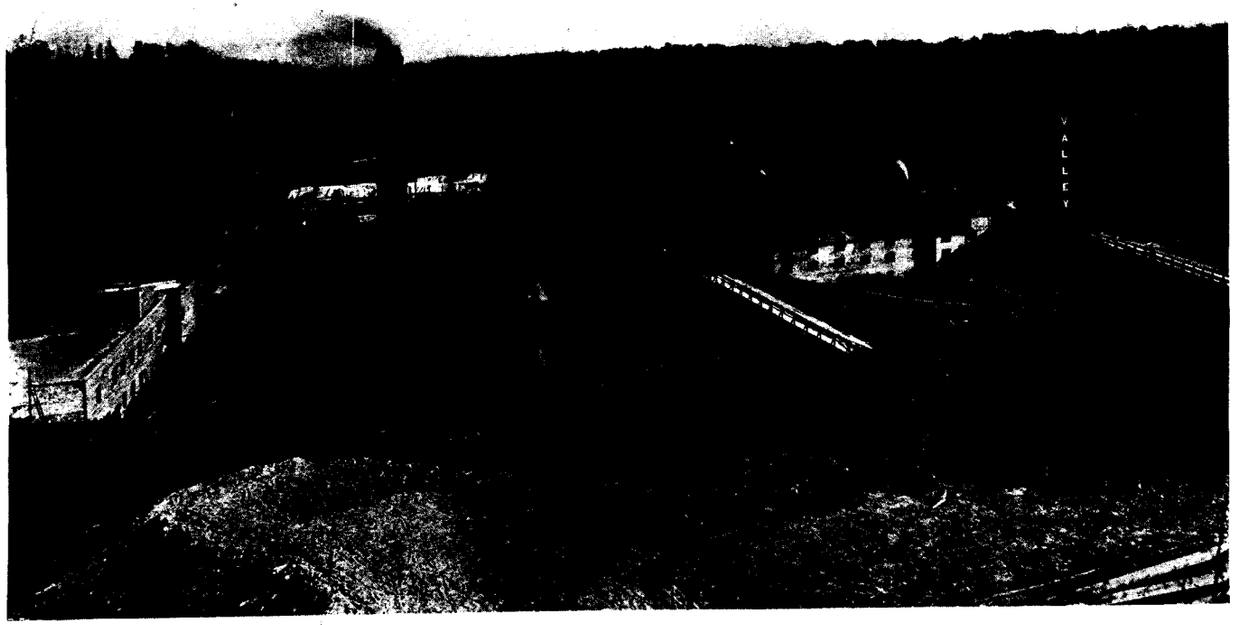
We have an advantage over competitors in that

Don Valley Products

are made from a special grade of clay and shale whose chemical properties are peculiar to that portion of the Don Valley comprising our deposits alone.



Birds' Eye View of Our Brick Works Which is Op-rated by Expert Workmen, and the Largest and Most Modernly Equipped Industrial of its Kind in the World. Direct Shipping Facilities Enable us to Fill all Orders Promptly.

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UNITED STEEL SASH are made of specially rolled steel sections, which are combined by powerful presses into sash of maximum strength, and attractive appearance. The muntins are deep and narrow, offering a minimum obstruction to the light. The joints are not weakened in any way by cutting or punching.

UNITED STEEL SASH are inexpensive and compare favorably in cost with unsatisfactory wooden sash, which are short-lived and inflamable Ventilators of UNITED STEEL SASH extend the full width of each unit and are made absolutely weather proof around the openings by double circular contact joints. Special spring clips save labor in glazing and hold the glass firmly in place.

UNITED STEEL SASH are made in many standard types to meet all conditions of window opening. Size of glass, 10 to 14 inches in width and 16 to 24 inches in height.

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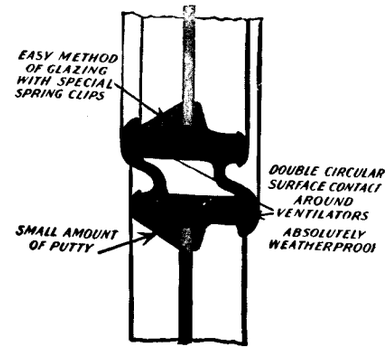

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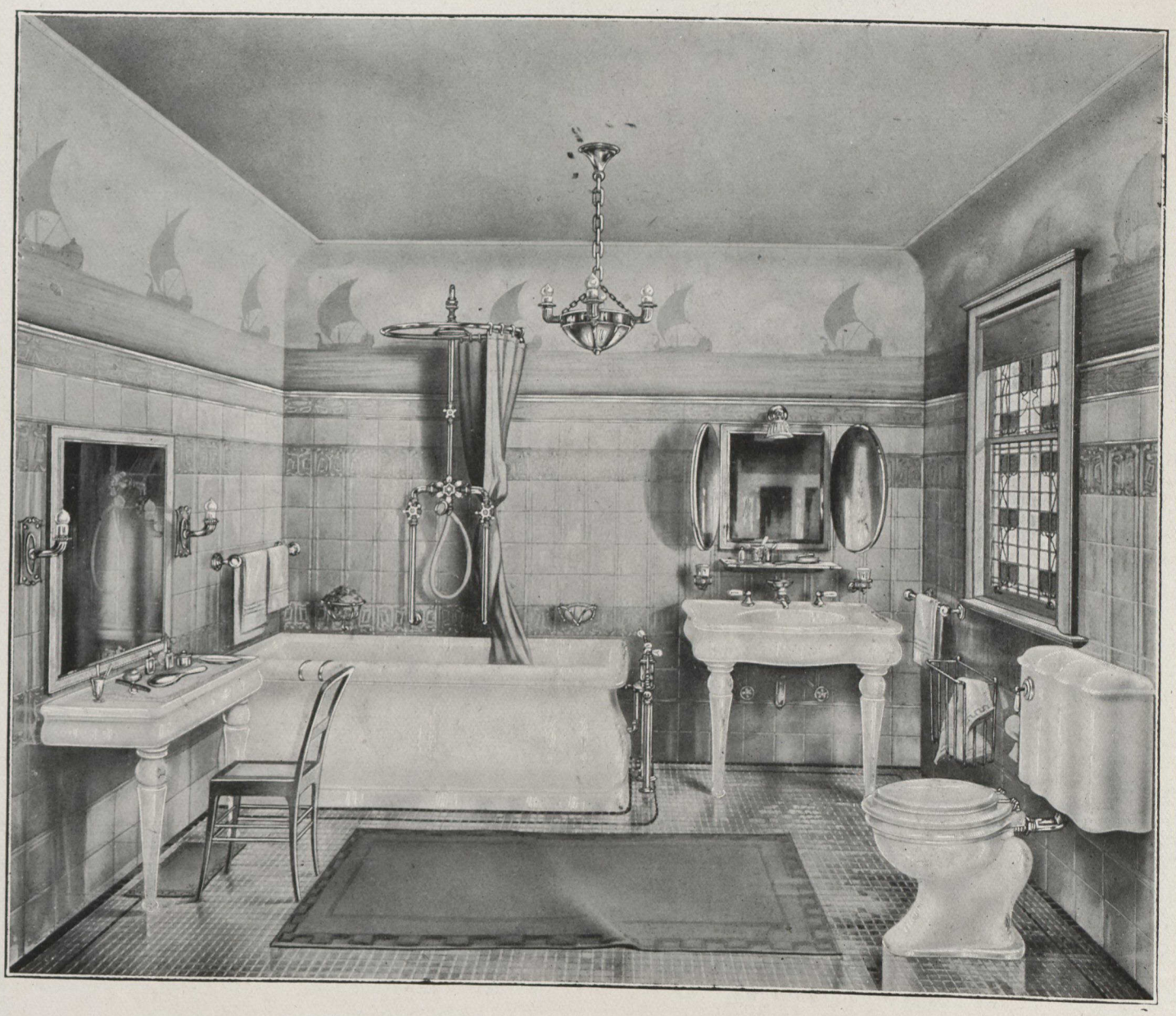


The above is an illustration of an "Alexandra" Bathroom. The richness of this equipment, combined with its simplicity and good taste, will meet the requirements of the most exacting connoisseur. We have many other styles of equipment as complete as this, but suited for bathrooms of different sizes.

ALEXANDRA WARE

Ideal

Enderton Block, Winnipeg, Man.
Architect, Wm. Fingland. Plumbers, The James Ballantyne Co., Ltd.

IN the buildings pictured on these pages, the bathroom, plumbing, and sanitary fixtures are all of the celebrated "Alexandra" Ware. You will notice that they include many different types of modern buildings. Stores and offices, a large apartment house, and several residences of the better class. The importance of first-class plumbing fixtures is now so generally recognized in the building trade that it is with pride we are able to point to the work of Canada's leading architects and builders as the class of buildings for which Alexandra Ware has been specified.

Duplex House, Corner of Spence and Broadway, Winnipeg.
Do'mer & Bonnette, Contractors.
The John Plaxton Co., Ltd., Plumbers.
Chas. S. Bridgeman, 20 Canada Life Bldg., Winnipeg, Architect.

Riverview Mansions, Winnipeg.
R. H. Lear, Plumber. A. Simmons & Co., Contractors.
Chas. S. Bridgeman, 20 Canada Life Building, Winnipeg, Architect.

The Ideal Company

Residence of A. W. Chapman, Armstrong's Point, Winnipeg, Man.
Architect, Wm. Fingland. Plumbers, Randall & Bell. Contractors, Randall & Whyard.

ALEXANDRA WARE has marked a distinct epoch in modern sanitation. Its beauty of design, its snowy whiteness, its durability and economy of service commend it to the builder who is considering his plumbing fixtures in regard to the increased value they will give to his building. Alexandra Ware is adapted to every purpose—whether used to fit out a luxurious bathroom for a high class residence or for the extensive bathroom installation of a public or semi-public building. In every case it gives lasting and adequate service. Specify "Alexandra" Ware for your next high class installation.

Residence of Mr. R. T. Riley, Armstrong Point, Winnipeg.
The John Flaxton Co., Ltd., Plumbers.
A. Simmons & Co., Contractors.
Chas. S. Bridgeman, 20 Canada Life Building, Architect.

R. H. Metcalfe's Residence, "Norwood," Winnipeg.
William Fingland, Architect. Winder & Bowes, Plumbers.
Bailey, Starr & Bird, Contractors.

CONSTRUCTION

VOL. V NO. 1

CONTENTS FOR DECEMBER, 1911

ILLUSTRATIONS

View of Main Façade on Boulevard Langelier.
Quebec Technical School, Quebec, P.Q. Rene P. Lemay, Architect.

¶ *Three thousand school children in Toronto housed in temporary quarters a menace to the future welfare of the city.*

THE RAPID expansion of the city of Toronto in population and the consequent crowding and other inconveniences that always mark a city unprepared for such increase is nowhere so marked nor the necessity for relief so acute as in the schools. The school population in most cities is apt to run ahead of the buildings available at a given period, but it is probable that no other city can "boast?" of "three thousand children now housed in temporary quarters, such as portable buildings, mission and other halls, playsheds and basement rooms." It is our province to discuss the design of school buildings and also their sanitary equipment, and this lack of buildings affects both. It will, if not carefully managed, bring into existence a number of semi-temporary structures to relieve the congestion. This is not necessary, as good architecture and correct planning takes no more time to construct than the other kind which CONSTRUCTION has called attention to. But this congestion must be relieved. The trouble seems to be, not so much the lack of money, but because the system of school control is wrong and obsolete. The school boards of all progressive cities are independent bodies and only answerable to the people who elect them. Their funds are gathered through a direct share in the taxes and their responsibility to the people is also direct. A city council knows about as much regarding school regulation as it does of international commerce. Sometimes the politically elected school board is in the same position, but it can learn. A wise people and a wise government will see that the school, which means child culture, is the basic principle of the nation. That the loss of health, which is so inevitable in a basement schoolroom, has a serious effect upon the next generation, while an epidemic started in unhealthy schools threatens this. If the school board of Toronto is trustworthy, it should have all the money its estimates call for, and that immediately. If it is not, a better should take its place. But a council should not have the power to hold up the necessary appropriations the school board asks for or have control of school matters in any particular.

¶ *Committee of the Royal Architectural Institute waits upon the Premier and presents suggestions in accordance with the resolution*

ACCORDING TO the resolution passed unanimously at the late convention of the Royal Architectural Institute of Canada in regard to Dominion architectural needs, a representative committee waited on Premier Borden on Nov. 24. The committee representing the Institute included F. S. Baker, Toronto, president of the Royal Architectural Institute of Canada; A. Frank Wickson, Toronto, president of the Ontario Association of Architects; H. B. Gordon, Toronto; J. P. Hynes, Toronto; Alphonse Venn, Montreal; J. R. Gardiner, Montreal, president of the Quebec Association of Architects. The three distinct propositions which the convention decided were in pressing need of Governmental attention, and upon the lines presented by the concensus of opinion of the architects of the Dominion, were presented in clear and concise form by the members of the delegation. These include a definite civic plan for the capital city of Ottawa so that all improvements may be made in the direction of placing Ottawa in an equal rank with the capital cities of other countries; an entire remodelling of the method by which the designing of public buildings by the Federal Government is conducted; and Government assistance in establishing architectural schools as departments of universities. As there is nothing which touches on party politics in these measures, but are suggested to the Government as things that belong to all the people and outlined by those best qualified to know, it is probable that the Premier will endeavor to put them into effect as suggested by the committee of architects, and at once.

¶ *A competent Chief Architect and representative Government buildings the most pressing need in Canada's advancement.*

THE SIGNIFICANCE of the call of a committee from the representative architectural organizations of Canada on Premier Borden opens up not only the situation in regard to present conditions and future plan of public improve-

ments and the simplifying of utilities in Ottawa, but what is more important from a national standpoint, the entire situation of public architecture in Canada. As in the United States until the last fifteen years, the design of public buildings in Canada, instead of being representative of the architectural talent and advancement in constructive art have been, and still are, mediocre in the extreme. It is conceded that the Premier is a veritable Martha, but Marthas should devote time and attention to those things that make for advancement and are for the permanent good, as against the details of measures that can, and probably are, changed with each successive administration. Public architecture is one of those things that once completed future administrations must accept. Outside the indifference or lack of initiative by the Government, a responsibility vested in the Premier and the Minister of Public Works, the condition of public architecture in the Dominion today is directly owing to the inadequacy, to use no stronger term, of the head of the architectural department. We do not wish to make any personal attack upon the present incumbent of the supervising architect's office. Mr. Fuller was a man of both talent and experience, as the works he has left in Canada, and his former labors upon the New York State Capitol, attest. His successor who took his place as chief architect has not filled that position, so far as CONSTRUCTION can ascertain, in the last twenty years. He is responsible for all architectural work, and, therefore, for the falling of the tower to west block departmental buildings, the subsidence of the tower to the New Museum, as well as for the nondescript design of public buildings erected during his incumbency. The venerable chief architect is well esteemed by his professional friends and they do not like to point out that the chief architect, as we are informed, has neither made drawings or wrote specifications during the period of his incumbency, but has devoted his attention to the clerical work of his office. The fault is not in the chief architect, but in the system. The architectural associations that represent the profession in Canada have repeatedly urged that Canadian public buildings should be designed by competent architects, and suggested competitions open to architects in the Dominion. This was particularly true in regard to the new Government Buildings, but neither Minister of Public Works or Premier would entertain the matter. Hence the vast sums spent on permanent construction that even before erected are inadequate in construction and commonplace or worse in design. Good architecture is not more expensive than bad, and when paid for is an asset instead of a liability to the country. Until a supervising architect of acknowledged ability can be procured, the Minister of Public Works should see that all Government buildings be designed by the best architectural talent in Canada. The new Minister will be wise, and he certainly will be congratulated, if he orders a thorough cleaning up of the department, finds out where he stands, and instead of consulting political friends, calls to his aid the best talent through an advisory consultation with the Royal Architectural Institute. While CONSTRUCTION is offering suggestions, a most pertinent one is that it is none too soon for Canada to establish a permanent office of Supervising Architect, with full control. His authority should be a little less, perhaps, than that of a Minister, but greater than a departmental chief. The head of this office should be selected from the best known talent in Canada, with a compensation that would attract such a man, and his office run strictly upon a Civil Service basis.

¶ *Responsibility for delay in "Plaza" improvement at Ottawa probably due to inadequate architectural supervision and control.*

IT IS DIFFICULT to discover, not only who is responsible for the carrying out of the work upon the "Plaza," but when it will be completed. The name of Mr. Ewart, chief architect for the Government, appears in connection with it, and it is possible that the Public Works Engineer, Mr. Lafleur, may have a hand in the steel construction, but there is no doubt that there is an unwarranted delay in the completion of the "Plaza" and the consequent closing of one of Ottawa's principal streets, and the main street leading to the Parliament buildings. It may be interesting to architects, as it certainly is to the public at Ottawa, to know what date has been assigned for the completion of this contract on the "Plaza" construction as signed by the contractor. Is there any penalty clause in that contract to provide for rebates in case of delay? Have any mistakes been discovered in the plans of the chief architect, or changes made by the Public Works Department that will excuse the contractor for the delay, and if extra work has been ordered, is the amount sufficient to "justify the delay?" We do not know the tenor of the report a commission would make if one was appointed to investigate the working of the department up to the time of his appointment by the new Minister of Public Works, but it is probable that the answer to all these questions will be found an inadequate supervising architect and the absence of a general plan for the city and detail plans for public buildings and improvements designed by competent architects and engineers. CONSTRUCTION recommends the appointment of such an investigating committee composed of competent persons and the establishment of a logical basis of ability in the appointment of future servants in the Works Department.

¶ *A broad policy of improvement and development by real investors necessary to the proper growth of subdivisions.*

IN CONSIDERING the suburban environs of Toronto and their transformation from fields and farms into beauty spots of residential refinement CONSTRUCTION wishes to see these improvements grow along artistic and utilitarian lines.

In order that this may be accomplished, the original purchaser of the farm and the organizer of the suburb must be a broad-minded business man who wishes to make a fair return upon his investment, and who also considers the project from a standpoint of civic advancement. He must be able also to see that through making his improvements substantial and his suburb permanently livable that he is giving to his investment a permanency and a value that can be established in no other way. The environs of the city are being continually exploited by the speculative real estate dealer and the speculative builder who buys cheap and sells dear to the householder who is attracted by the natural surroundings. Fortunately, there are here and there real estate investors who are broad in their views and enthusiastic in their desires to make the subject of their care and investment a model of its kind. Lawrence Park, which CONSTRUCTION illustrated and described last month, was selected because it illustrated how such a suburb could be planned and made not only beautiful but valuable from an investment standpoint. Here a landscape architect of ability was employed, the plat laid out and large sums were invested in preparing the physical surroundings before lots were offered for sale. An official architect was engaged, whose advice in regard to designs of proposed residences ensured that those of creditable design would be erected. It is natural that property in locations like that at Lawrence Park should be high priced, as where large sums have been invested in improvements in advance of the sale of lots and the construction of houses this is justified. But there are too many plats around Toronto that are placed upon the market with no improvements and at a price that is prohibitive to the man of moderate means. This is against public policy and we think poor business judgment. It will lead to congestion in the city and tie up large tracts of surrounding property that should be utilized in providing homes for the people. The remedy as we see it is a liberal extension of municipal street car service that will open up many remote sections, and this extension conditional upon the owners of property improving it before it is sold. This is next to the best plan upon which the city can work for its growth along proper lines. The best plan is that of New Zealand, where the Government makes the investment and sells at a reasonable rate to the man of moderate means on time payments. Suburbs like Lawrence Park will be developed without municipal aid, but at best their population will be comparatively small. It is the duty of the civic authorities as well as the individual to aid the people of the city in every effort toward securing better and more healthful surroundings. The development of residence suburbs is in this direction. "Town planning pays," says Prof. Mawson, "and pays handsomely over and over again in hard cash, quite apart from all other considerations, such as the added prosperity, or better still, the low death rate and increased well-being."

¶ *Charter of organization procured by heating and plumbing trades and reorganization as a Provincial Association.*

ORGANIZATION by charter is fundamental in establishing any trade or professional association. It gives authority to the members and copyright protection. But it does not ensure the public against crude service unless the members of the association are men of ability, both executive and practical. Probably the most dangerous and also the most healthful and comfortable evolution in domestic economy is related to the manufacture and installation of sanitary and heating appliances. The proper regulation of these is of vital importance to the public. The sanitary and heating trades have organized under a provincial charter as the Ontario Society of Domestic and Heating Engineers. The charter provides for an examining board for the admission of members. This will elevate the standard of heating and plumbing work if carried out judicially. Such a society can regulate the work of its members and can see that none but men of education and ability instal the sanitary and heating systems in buildings. It can only have a moral influence upon the regulation of sanitary protection. But this moral influence will be great if used unselfishly. It is said that the sanitary arrangements in many of our schools, for instance, are bad and dangerous. Without an ability and conscience in civic officers equal to that of the association the organization can do nothing. Its one effort now should be to teach the public that this Society of Sanitary and Heating Engineers is not a close corporation for the purpose of limiting the number of those engaged in the trade or to shut out foreign competition, but that it has for its main object the perfecting of those systems that it stands for and the equalizing of conditions under which they are installed. We think that this is the thought of those who have labored to secure this charter and is the paramount object of the organization. As such the plumbers and heating trades have not only gained much, but have done a signal service to the province in thus perfecting their organization.

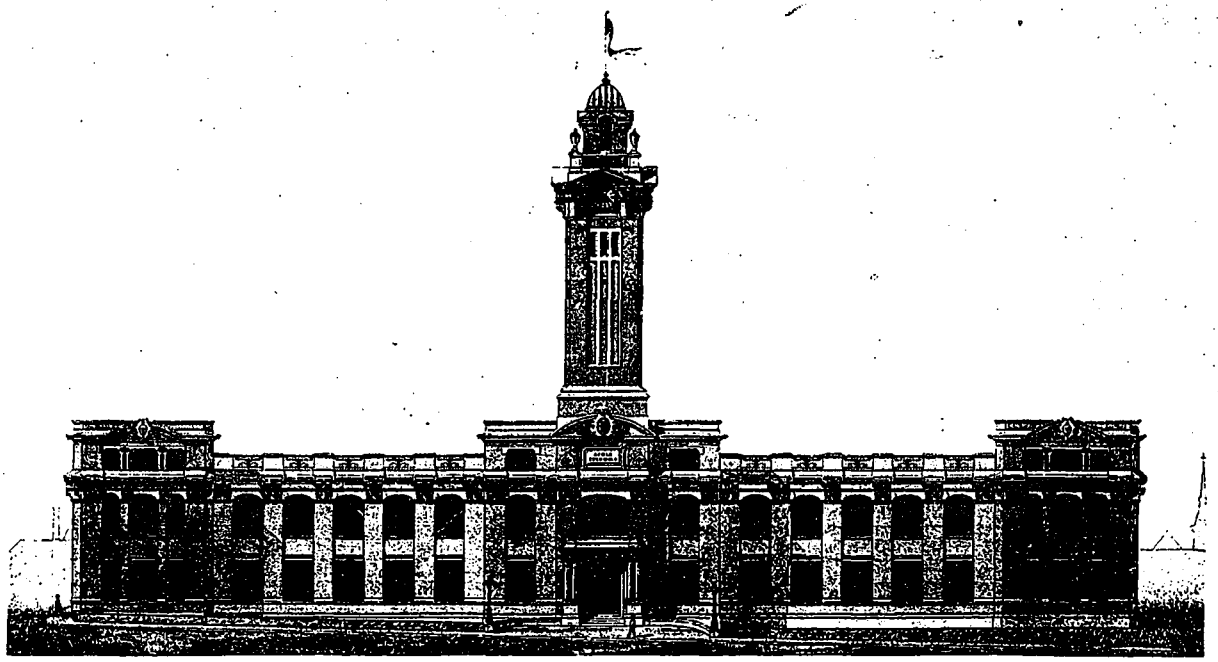
¶ *The surprising lack of general plan in Toronto's municipal improvements a sign of incompetency in civic construction.*

TO THE RESIDENT Torontonian who is full of civic pride and enthusiasm, as well as to the stranger within her gates, the enterprise of that city and belief in her future growth is founded upon a substantial basis of facts. No one who for a moment studies the causes which are now so active in promoting that growth, the rapid development of the Western provinces, and the influx of men and capital from the States and England, together with a general belief in Canada's high destiny among the nations, can believe otherwise than

that Toronto will double its population in the next decade. If this is true, if the estimates and the belief of even her most conservative citizens point to this growth, how is it that there is so little foresight in providing for it? In the entire city we can find no civic improvement that reaches farther than a blind groping after relief from some present and pressing discomfort. The Water Commission lays its intakes upon the bottom of the lake, instead of building water turnnels. The council projects a bridge where it is needed and orders plans drawn by the city engineer. A railroad endeavors to meet present traffic needs, and though it may wish to also provide for the future, it has difficulty in obtaining room for present constructions. A subway is projected to relieve the congestion on Yonge street, and even this is held up to consider the cost. But none of these improvements, each a sheer necessity, and as such good in themselves, takes into account the future, and there is no corelation or plan that unites one with the other. It is almost beyond belief that the same men who will finance a railroad or a building and provide for its bonding for a long term of years, all according to financial plans, and by which future action will be governed, when it comes to the question of municipal growth and providing for future commerce and population, will go into these constructions blindly, with no general plan by which the whole civic expenditure is governed. No man can see clearly into the future, but every man knows that it is wasteful to construct any one of these needed improvements without some reference to future growth. No house is built without some sort of a plan. No factory is organized without provision for extension in harmony with the older building, and no city should add to its municipal improvements without considering future needs and making each expenditure a part of a well devised and permanently established general plan. When that plan has been evolved and established, it is time enough to consider those parts that require the more immediate attention.

¶ *The Bloor street and Danforth avenue bridge project of Toronto a test of the civic intelligence of her citizens.*

THE PROBLEM of the permanent connection between Bloor street and Danforth avenue, in the Rosedale district, Toronto, is in its essential features that of every other civic improvement. As it is acknowledged by all concerned that the improvement must be made, it is only a question of form. If it were not that the commercial value of symmetry and appropriateness was slowly dawning upon the minds of even the most "commercial" in their instincts, that it pays in dollars to invest a margin in mere sentiment, it would be useless to suggest that some scheme other than a straight line bridge might be a paying investment to the city. The city engineer advocates a straight bridge. All engineers advocate the straight and narrow in bridges as the Puritan does in human conduct. But men have found that gentleness, hope and the "milk of human kindness" is a stronger lever toward good deportment, and the investor has found that architectural and artistic conformity with surroundings, and that which aids and not detracts from their embellishment is of more permanent value to the private owner or the city. And that seems to be all there is of it. The city engineer proposes a viaduct that will be strong, imposing and direct. It will serve to connect the two streets for the man who carries freight, because it is the shortest route. There its usefulness ends. The long viaduct must necessarily be made of steel, and the life of steel is, at most, twenty years when exposed to the weather. When subjected to the corroding fumes from railway locomotives it is much less. So much for the advantage of the city engineer's straight line bridge. On the other hand are several schemes that take into account the topography of the country and the sightliness of the structure, features that no civilized community would overlook or seek to ruin. Toronto has not yet reached that stage of civilization when these things are taken into account, but an ever-increasing proportion of her citizens have, and they wish for appropriateness in her utilities both for their own enjoyment and for the future residents who will be obliged to destroy these straight line good enough expedients for that which could be as well constructed now if we but knew enough. It seems of little use to tell people who have never traveled, or those who kept their eyes on the tips they gave servants, when they did, that such a project as that proposed by the city engineer, a straight viaduct that destroys one of the most beautiful views in perhaps the most beautiful city in Canada, would be an impossibility in any European city when there was any possibility of avoiding it. The solution proposed by those organizations in Toronto who have her future reputation as a livable city at heart is so much better, so feasible from an engineering standpoint and so conservative of every natural utility and beauty, that it is beyond comprehension that any other is considered. There is a time coming when Toronto will have a civic plan that will combine all her utilities and development. We do not know whether it will be in this generation or the next, whether like London after the great fire, we will allow the shortsighted policy of those now in control to block the sane development of which such street connections are parts, and the next generation spend twenty times the cost in patching up the deficiencies, or whether we will show that Toronto is at least the intellectual equal of a hundred cities in the United States that are giving a civic plan their first consideration. This Bloor-Danforth bridge is a test of Toronto's civic intelligence. The result will show whether her boast of civic progressiveness is worth listening to. The position of CONSTRUCTION in regard to this, as well as all other similar civic betterments, is that none should be definitely planned until a general civic plan has been evolved and adopted of which these improvements are to be integral units.



Front Elevation, Quebec Technical School, Quebec, P.Q. Rene P. Lemay, Architect.

THE QUEBEC TECHNICAL SCHOOL

A Provincial School Where the Trades are Taught in a Practical Manner and Under Such Arrangement That Workingmen and Apprentices Can Avail Themselves of its Benefits.

THE QUEBEC Technical School, founded by the Provincial Government in 1907, was formally opened on November 1. It is situated on the Boulevard Langelier. It was designed by Rene P. Lemay, F.R.A.I.C., architect.

The construction was started on November 1, 1909. The buildings, which have a frontage of 260 feet and a depth of 180 feet, consist of administration, workshop and powerhouse.

In the administration building are the President's room, and principal offices, a grand vestibule leading to the museum, library, drawing room, public lecture room, class rooms and physic and chemistry amphitheatres. The power house contains engine rooms, boiler room, accumulator room, repair shop, coal room, etc.

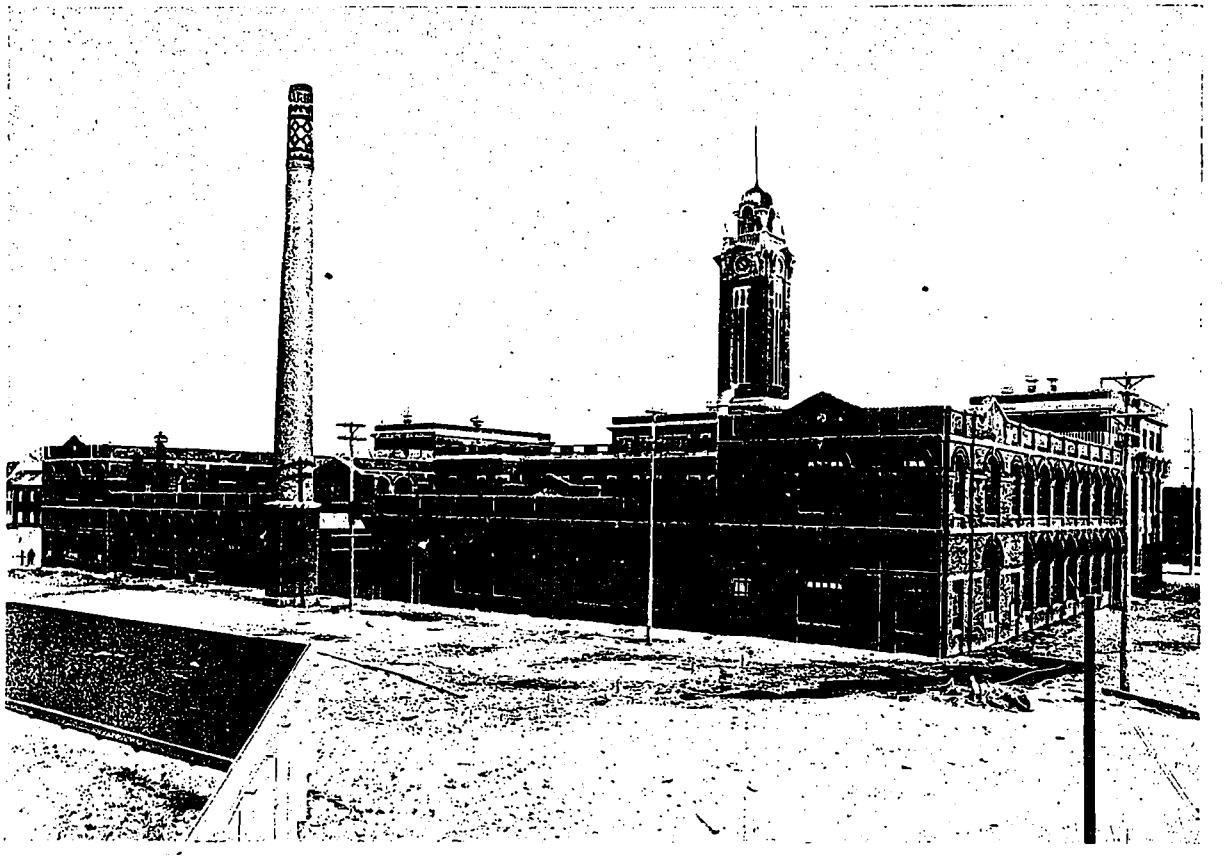
The workshop consists of workroom, foundry, forge, machine room, booth, and show room.

The construction is strictly fireproof, concrete foundations on reinforced concrete footings. The walls are brick, with outside lining of Laprairie pressed brick, with an inside lining of two inch terra cotta. The trimmings and corners are cut stone, a light gray limestone from the Deschambault quarries. The base course is of Riviere a Pierre granite. The interior construction is steel columns and beams fireproofed with concrete. Floors, corridors, halls, vestibule, toilet rooms are of reinforced tile, and roofs of the Faber system. The floors of all the rooms are oak.

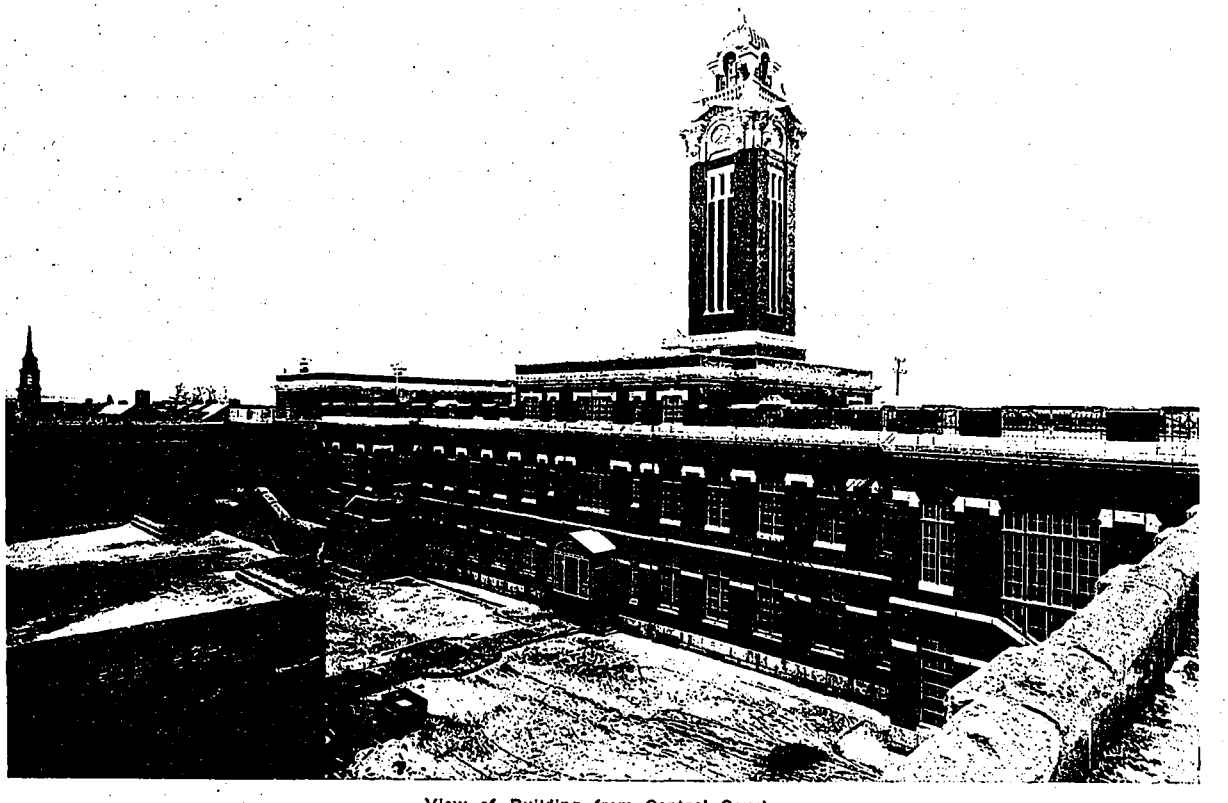
The building is supplied with the most modern electrical equipment, and a forced hot water system of heating and mechanical ventilation complete one of the most creditable structures in Quebec.

As a practical enterprise the erection of this school cannot be too highly commended. It will give to the province workmen from its own environs where heretofore Europe and the United States has been drawn upon for skilled mechanics. It will aid in the expansion and development of domestic industries, and new enterprises will be started when it is found that skilled labor can be procured within the province. The lecture halls are spacious, and the library contains a large collection of the most modern technical and scientific works in French and English. The curriculum of the school is most practical and comprehensive.

As the instruction in this school is designed to cul-



View of Building from Rear.



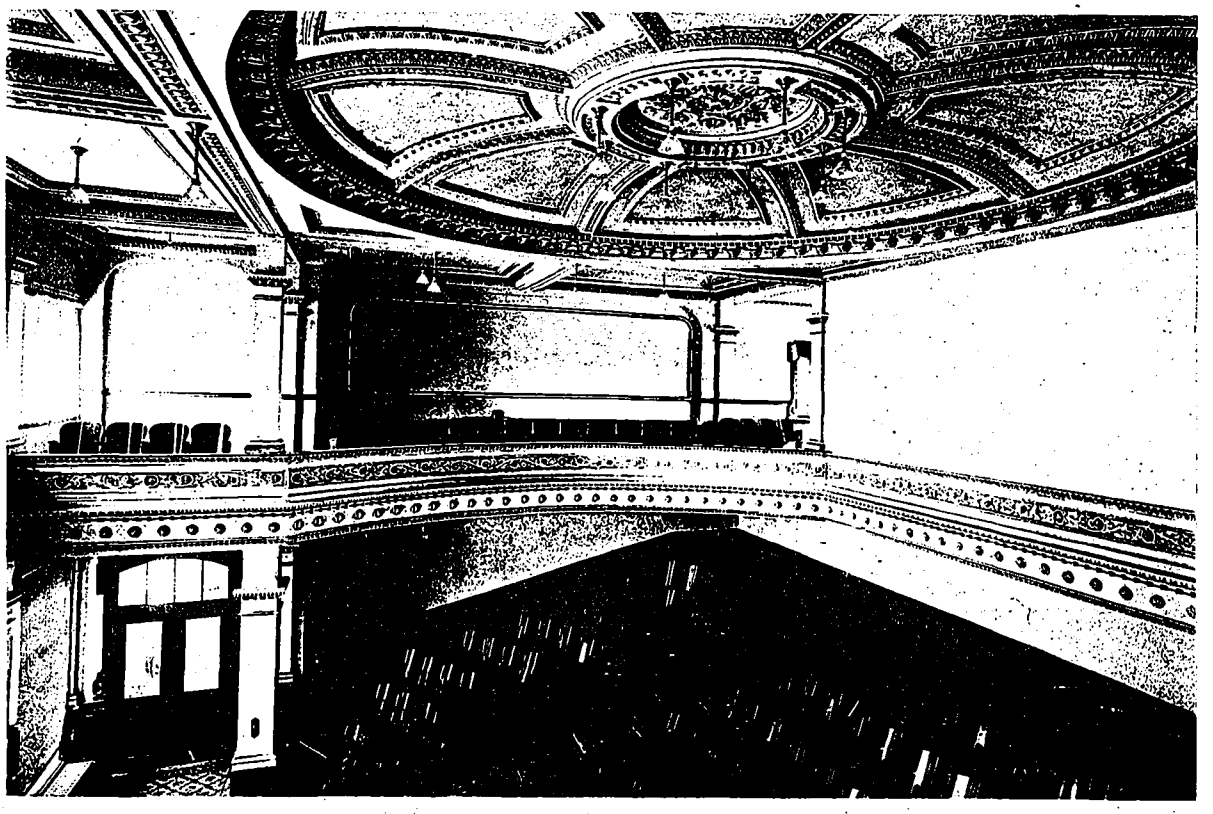
View of Building from Central Court.

Quebec Technical School, Quebec, P.Q. Rene P. Lemay, Architect.

View of Main Corridor Looking North.

View of Entrance Hall.

tivate intelligence, while at the same time it gives the students skill and dexterity in the handling of tools, the training, whether in long courses of two years or the shorter ones of a year, is aimed directly at the development of the reasoning faculties. Men will be taught to think and find relations of the objects of thought with an immediate awareness of those relations. In every case methods which give a superficial knowledge or a trifling familiarity with details of the building trade arts will be avoided,

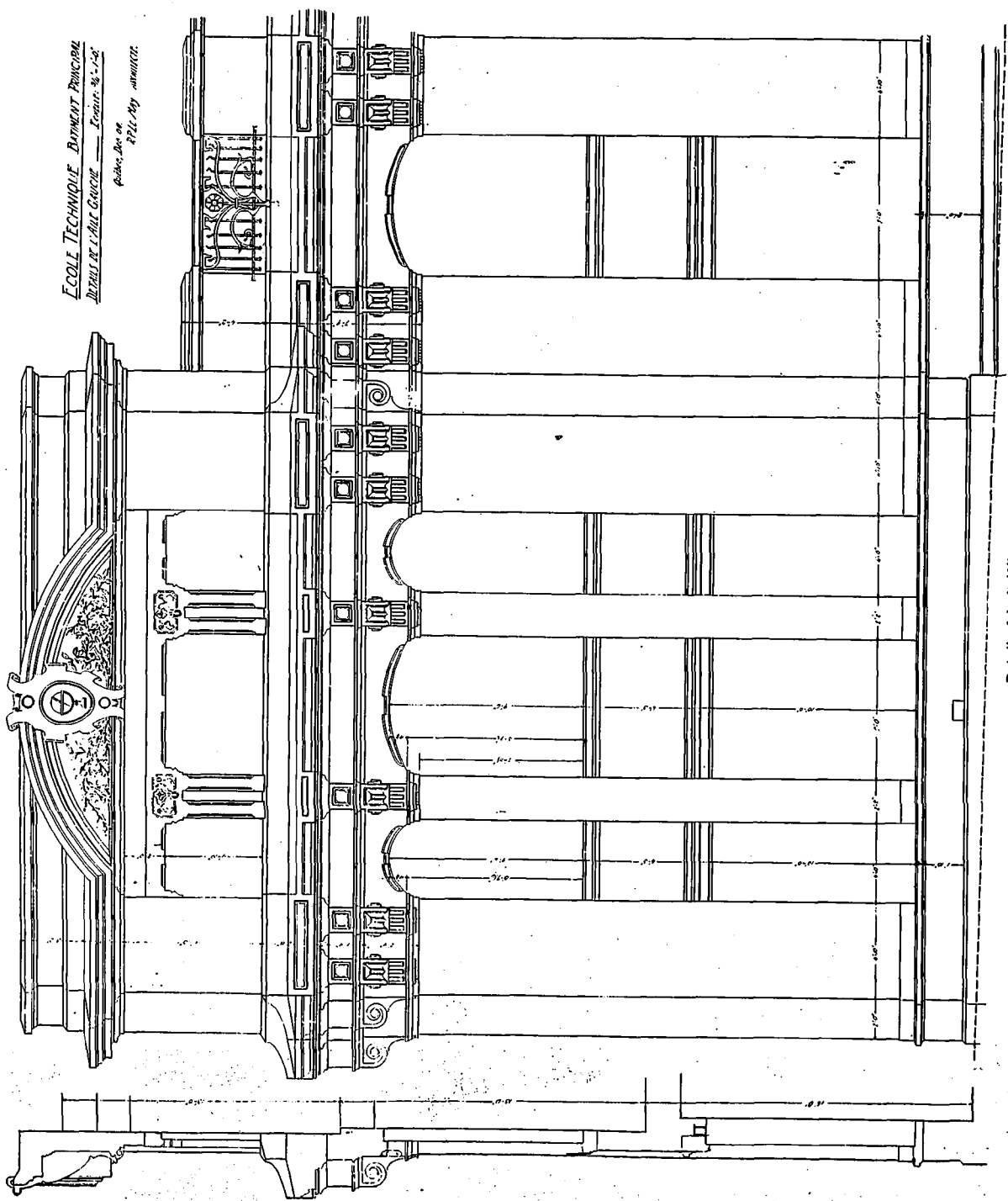


View in Academical Hall.

Quebec Technical School, Quebec, P.Q. Rene P. Lemay, Architect.

and a student's success must depend upon his personal initiative. Both day and evening courses are available; the evening courses following practically the same order as the day.

While a good many young workmen consider themselves "handy with tools," few can take an architect's blue-print, lay out work from it, and successfully run up even the framework for a building. This is one of the first things taught in the school in an effort to familiarize the prospective carpenter with the designs of the architect. The making of doors, window frames, sashes and blinds; the laying of floors, the mitering and coping and bending at unusual angles alike are taught as tests of the builder's skill. Instruction in shop practice and building has coupled with it a lecture on the methods to be followed. An illustration of the method might be as follows:—Supposing Mr. A. is about to build a barn on his premises. To begin with the student will have to learn Mr. A's idea. He consults him; jots down notes as to the length, breadth, height, etc., discusses various kinds of wood and the interior arrangements, number of stalls, feed bins, harness closets, drainage features, etc. In fact, he learns

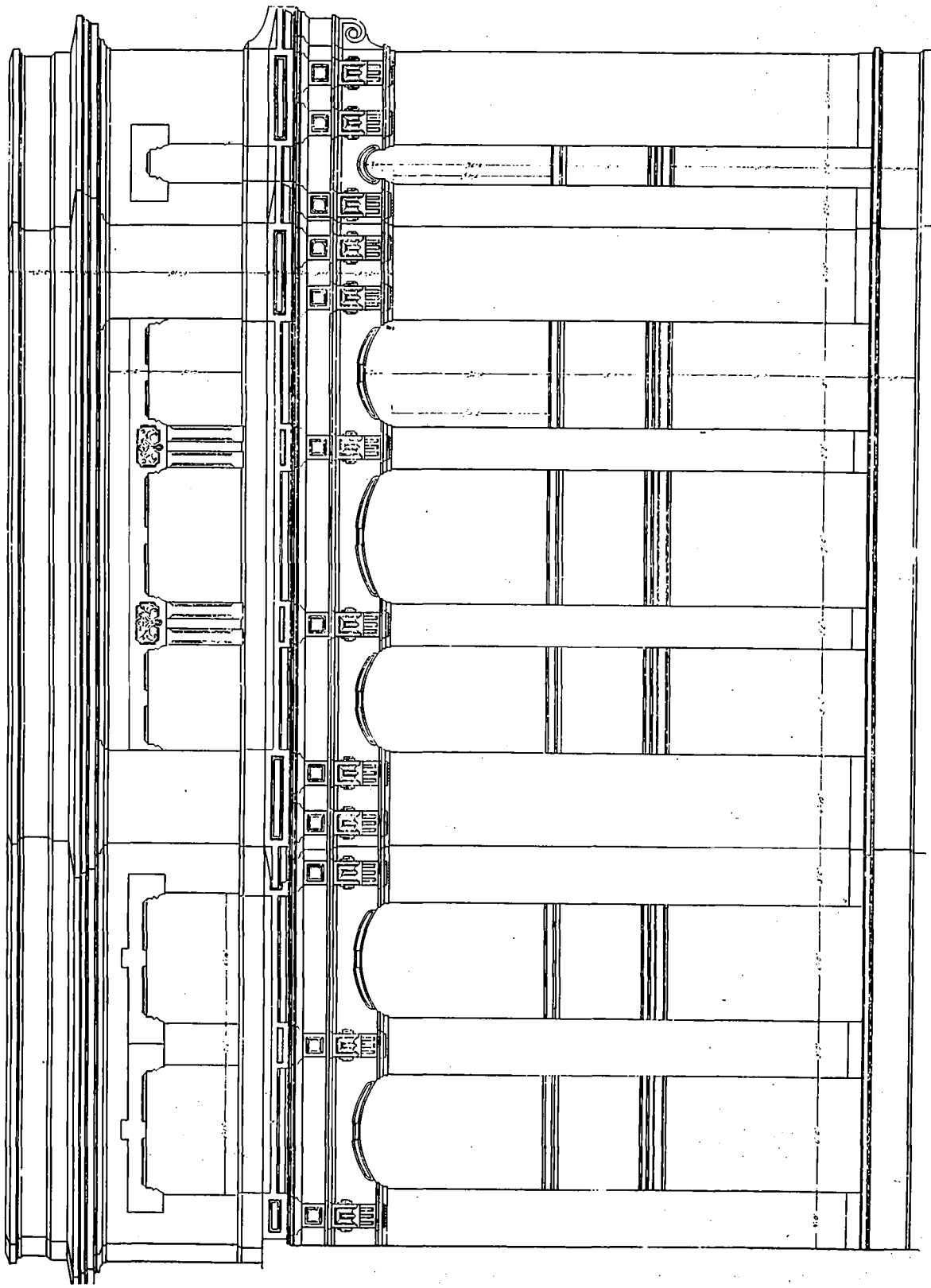


Detail of Left Wing.
Quebec Technical School, Quebec, P.Q. Rene P. Lemay, Architect.

all that he can as to just exactly what sort of a barn Mr. A. wishes. The same with the other courses of study.

The courses are divided into two classes. The day courses or normal courses, and the night courses or special courses. The normal courses are taught in French and in English, and the special courses in both languages, according to requirement.

The day classes comprise the teaching of the following technical trades: Pattern making, carpentry,



Detail of Side of Left Wing.

Quebec Technical School, Quebec, P.Q. Rene P. Lemay, Architect.

moulding, adjusting, forging, wood turning, and drawing.

The fee for the first year is fixed at $3 a month; the fee for the second year, $4; and for the third year, $5 a month.

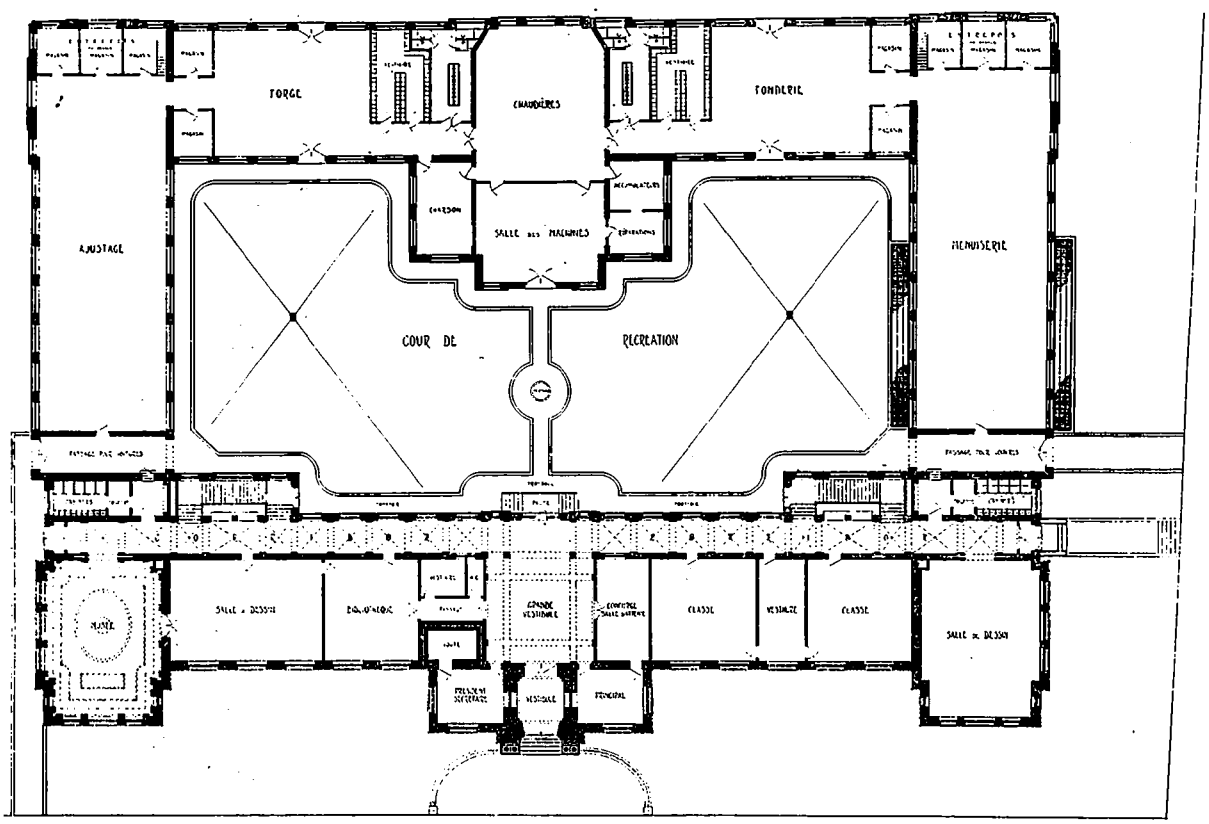
The night classes are for the benefit of laborers and apprentices already employed in industries, in order to give them a technical knowledge of their trade.

The night courses are free, apart from a deposit of $1 which is demanded from each student, and returned to him at the close of each term, providing he has not missed more than three times during the course.

The school was built under the chairmanship of Mr. Arthur Picard and a board of able directors, by Messrs. Simoneau and Dion, who have carried out the architect's plans in a very creditable manner.

The question at hand is what would be the results if their boys were trained in technical schools such as this, provided free by other provinces? What would they earn as they go along through life and how would they stand in competition with thousands of skilled workmen? Would not a system of education which would insure a young man certainty of reaching a position where he might have regular employment at the maximum wages be of incalculable value inasmuch as it saves time and brings that young man to an ample wage-earning capacity at an end of a comparatively short period of study?

These are the important questions which the Provincial authorities of Quebec have been considering and are now putting into practice in this new institution. They do not, perhaps, expect to replace practical experience at a trade, which measure is necessary before one can become a thoroughly competent mechanic, but what they do aim to accomplish is to materially shorten the time required for the young man of average intelligence to lay a secure foundation so that when he comes into actual contact with work his advancement will be more rapid than he possibly could have secured under apprenticeship methods. On the other hand, those who already occupy positions of importance in factories, woodworking mills, iron foundries and machine shops, who feel that their progress is slow, may, by applying themselves according to the systematized methods of this unusual school, prepare to fill positions as foremen and superintendents.

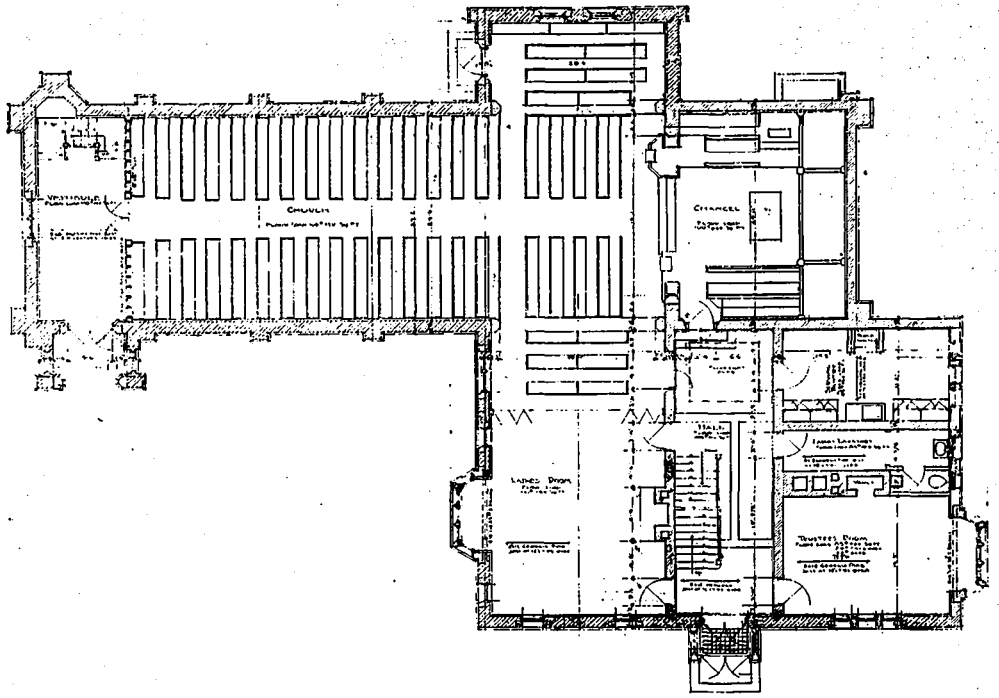


General Ground Floor Plan of Main Building.

Quebec Technical School, Quebec, P.Q. Rene P. Lemay, Architect.

The contractors that assisted the architect in making the Quebec Technical School a notable architectural creation under the general contractors, Simoneau and Dion, are:—L. H. Gaudry and Cie, who placed the structural steel, and also made and installed the ornamental iron work; Laforce and Frere, cut stone and carving; Eugene Falordeau, roofing and copper work; Nap. Gignac, the mill work; Marier and Tremblay, painting and glazing; Hamon and Hess, tile and marble work; Canadian Fireproofing Co., floors, roof and general fireproofing; James Ballantyne, the heating, plumbing, ven-

tilating, and vacuum cleaning system; W. J. O'Leary, electric wiring; Montreal Electric, clocks and telephones; Canadian Fairbanks Co., motor generator set; Laurie and Lamb, Bellis and Morcon engine; Robb Engineering Co., forty horse-power engine; Canadian General Electric, storage battery and booster; Crocker, Wheeler and Co., electric motor; Allis-Chalmers-Bullock, switchboard. The interior furnishing and fixtures were furnished by J. H. Gignac, J. A. Langlais, Edouard and George Valliere. The workshops were fitted up by several houses, each supplying the very best of their specialties, and all contributing to make this practical working school a model of its kind and a lasting credit to the Province of Quebec



Main Floor Plan.
Rosedale Presbyterian Church. Chapman & McGiffin, Architects.

ROSEDALE PRESBYTERIAN CHURCH

The problem of building a chapel and Sunday school section for present needs in advance of the church edifice.

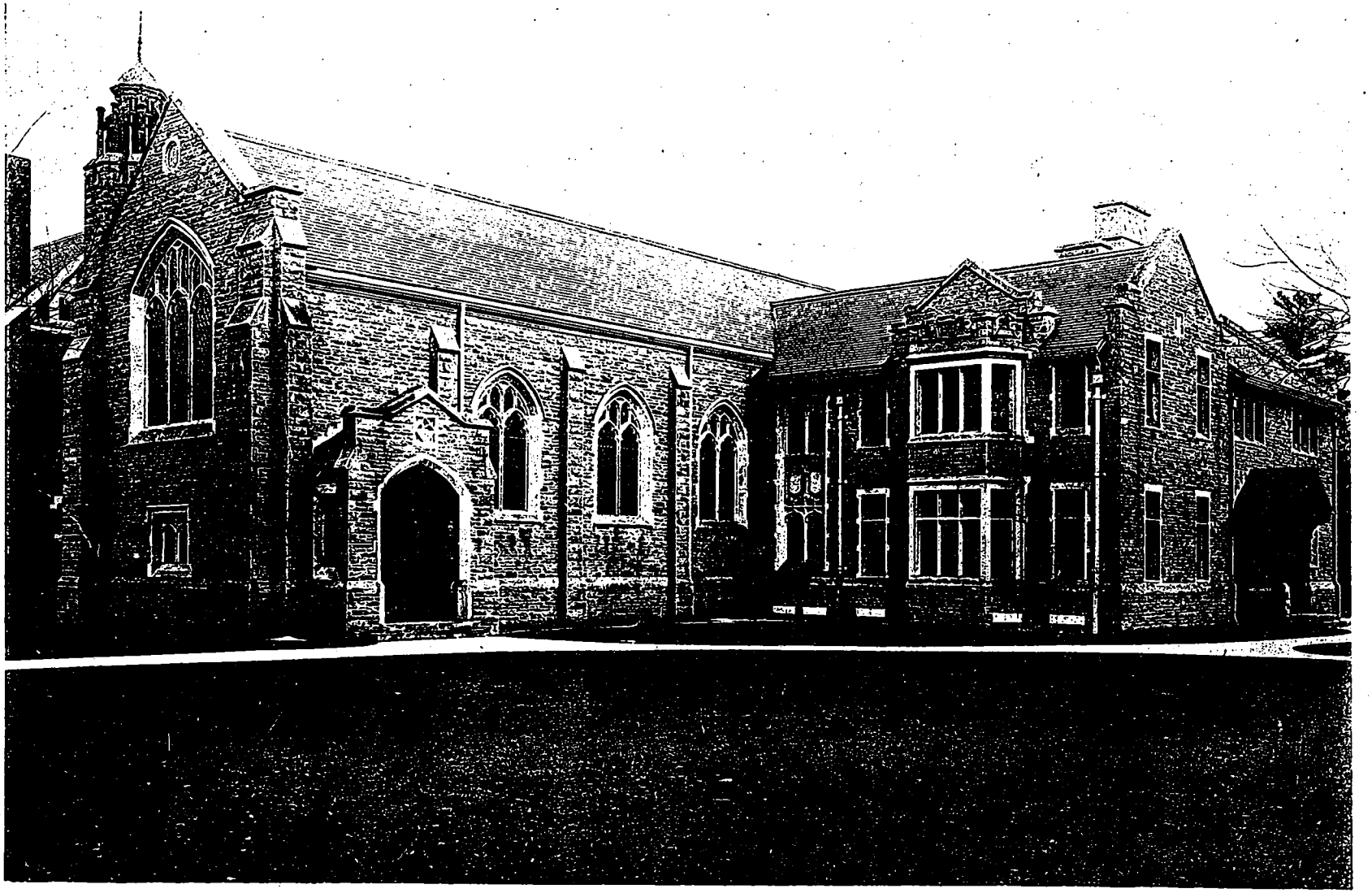
IN PRESENTING the study for the Presbyterian Church at Rosedale, Toronto, Chapman and McGiffin, architects, attention should be called to the perspective sketch, which shows the complete scheme. The photographs show the present structure as finished, which includes the Sunday School and Parish House.

While it was the general desire on the part of the Board of Managers to give an exceptional ecclesiastic character to the edifice, both in plan and in the general design, the completed part shows this to an exceptional degree in the Sunday school section, because it was desired to use this as a chapel or small church until the church edifice was completed. It is arranged with pews and will seat three hundred and fifty people.

The present structure, as will be noted, has been arranged on the lot so that the completed church structure can be placed so as to form a small quadrangle bounded on the west by the church, on the south by the parish house and administration rooms, and on the east by the Sunday school. When completed, the church proper will seat about one thousand.

As shown by the plan, the parish house comprises vestry, trustees' room, ladies' room, boys' locker room and showers, kitchen, and serving pantry. The exterior of the completed section is constructed of Credit Valley sandstone with Indiana limestone trim and tracery. The interior is finished in stucco and stone with an open timber roof of Georgia pine. The church is designed to be constructed in stone, the motif being perpendicular Gothic, and as shown in the preliminary sketch, there will be an imposing tower at the intersection of the nave and transept. The cost of the part already completed was about thirty-five thousand dollars. The appropriation for the complete structure has not yet been determined. As a piece of masonry the walls of the completed chapel show a particularly fine example, the work of Witchall and Son; the carpentry was by Walter Davidson and Son; roofing, Robert Rennie; plastering, Doidge and Son; plumbing and heating, J. R. Seagor and Co.; painting, Joseph McCausland and Son; pulpit and seating, Globe Furniture Co.; metal casements, Hope Manufacturing Co., Alex. Young representative, all of Toronto.

Architects' Perspective View of Complete Scheme for Rosedale Presbyterian Church, Toronto. Chapman & McGiffin, Architects.



Chapel and Sunday School Section, Rosedale Presbyterian Church, Toronto, Ontario. Chapman & McGiffin, Architects.

Interior of Chapel, Looking Toward Entrance.

Interior of Chapel, Looking Toward Altar.

Rosedale Presbyterian Church, Toronto, Ontario. Chapman and McGiffin, Architects.

CONSTRUCTION

A · JOURNAL · FOR · THE · ARCHITECTURAL ENGINEERING · AND · CONTRACTING INTERESTS · OF · CANADA

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CURRENT TOPICS

THE WORKINGMEN'S HOUSE movement promoted by the municipality is taking active form at Winnipeg. There is a movement on foot in that city to place the abandoned site of a former exhibition in the hands of the City Planning Association, (it should be here noted that Winnipeg has advanced to a point beyond most Canadian cities in that it has such an organization) to build thereon model workingmen's homes, thus keeping the property out of the hands of real estate speculators. This is Winnipeg's first step toward the municipal ownership of houses for the benefit of the trades classes.

* * *

THE ARCHITECTS OF CALGARY are of the opinion that the city building by-laws are altogether too drastic with regard to the absolutely fireproof construction of tenement houses. George M. Lang, president, and D. S. McIlroy, secretary of the Alberta Architects' Association, waited on the Legislative Committee recently and protested against this provision of the building ordinance. They maintained that it did not apply to business blocks and should not therefore apply to tenement buildings. Slow-burning floors would cover the matter, they suggested. They stated that the expensive cost of construction made necessary by the fireproofing of tenement houses throughout would mean that the buildings would be so costly that people would not be able to pay the rents which would have to be charged for such apartments.

* * *

PROFESSOR NUSSBAUM, a German experimenter, has made minute investigations into the causes of transmitted noises in structures like apartment buildings, when too often the floors and walls transmit sounds from every direction. In his deductions in regard to partition walls he has found that those of tiles and cement transmit sound most and those of solid clay least. Between the two comes the wall of ordinary brick, and the more the brick is burned the more noise it transmits. A quickly hardening lime mortar is to be preferred to a clay mortar. One experiment showed that when a floor was covered with sand and cork mats spread over it hardly any noise penetrated to the room below, but that when the cork mats were joined together by any material underneath noises were at once perceptible.

* * *

A PERTINENT SUGGESTION that is apt to become a demand is made in the report to the District Trades and Labor Council at Toronto by its Legislative Committee. This is in regard to homes for the workingmen of the city. The scarcity of workingmen's homes led the Municipal Committee to present a report on the solution of the housing question. "Cheap dwellings," says the report, "are badly needed for four reasons: 1. The very rapid increase in the population of the city. 2. The condemning of a large number of dwellings as dangerous and unsanitary. 3. The tendency of speculators to erect large houses. 4. The pulling down of houses in the down town district to make room for large warehouses and institutions. It is therefore recommended that the city be asked to look into the plan suggested and to secure, if necessary, special legislation, in order to put the scheme to practical use. The suggestion is that three tracts of land, large enough for a park in the centre of each, and to provide room for 800 houses each, be purchased, the blocks to be situated in the west, north and east portions of the city. This would make a total of 2,400 houses which, in the estimation of the committee, would soon be disposed of. These dwellings, if erected on the day labor plan, could be run up at one-third less cost than the average home, as the material could be purchased in very large quantities, while the adoption of a system in the building of the houses would also reduce the expense. The city could sell, rent or lease these dwellings to workingmen at a figure that would just cover the cost of material and labor, plus the interest on their money. In the opinion of the committee, houses could be provided for the poor man at prices at least 40 per cent. cheaper than the usual valuations."

ARCHITECTS, especially those in the Western provinces, should refuse to furnish descriptive matter, drawings or photographs of structures which they have designed, to any newspaper without a distinct understanding that the architect's name be included in the publication. This, not only because every educated person wishes to know the author of the design if it is worthy of notice, and it is therefore a matter of news, but the ignorant newspapers and public who believe that the dollars involved and the contractor who gathered and placed material that produced the building, will gradually become impressed with the fact that without a design the money and material would be useless. As with a book the author is of more importance than the man in the print shop who made up the forms. Of course, these same newspapers will continue to say that the architect "bid" for the work, and that he got the "contract" for the building. It would be too much to expect that the distinction between submitting a design and a "bid," or that of commission instead of a "contract" could be made, but by refusing information and illustrations to newspapers unless credit for design is given, will aid the profession in obtaining the recognition that belongs to it.

* * *

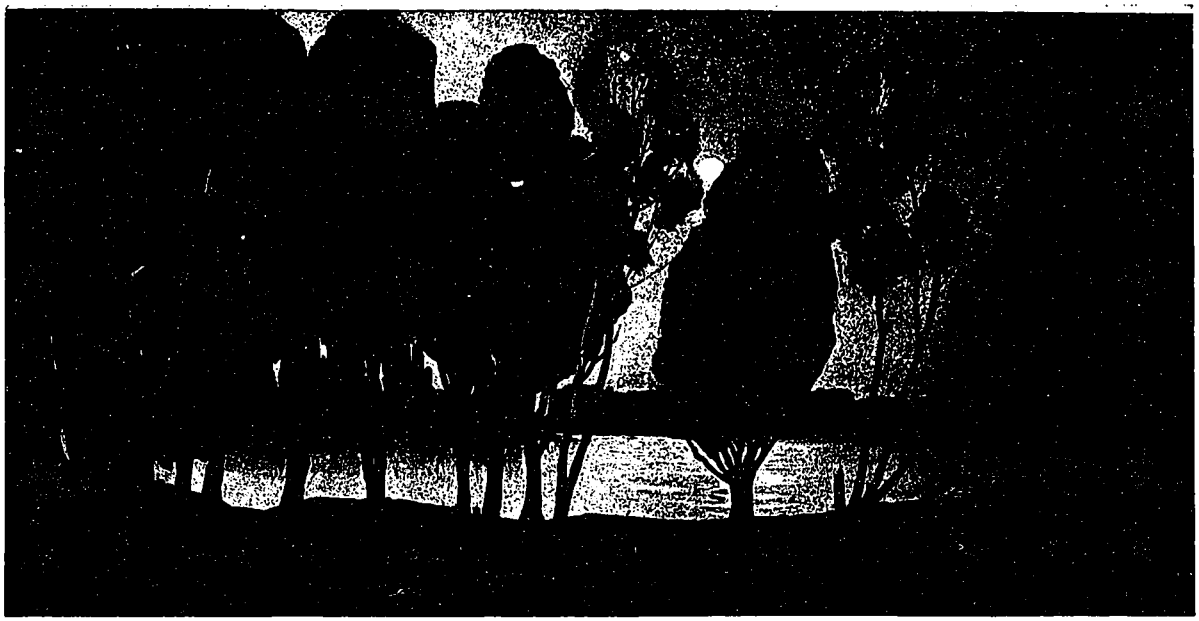
AS THE STEEL MARKET is the barometer of business, so is the Builders' Exchange, its personnel and its operation the indicator of the building progress of the city of its activities. As the owner and the architect represent investment and design, so the members of the exchange in a large degree stand for the quality of the structures. But if the Exchange is rightly organized and conducted, the majority of its members business men as well as contractors and material dealers, it will be much more. It will be the board of trade and the clearing house of the city's structural growth. Such an exchange exists at Vancouver. There the architects and the members of the Exchange get together and discuss present conditions and those to come, so that their city may attain the reputation of being well planned and well built. They know the value of making the most of the city's natural advantages and have a civic pride as well as a due commercial spirit in connection with their work. They vie with the local Board of Trade in seeking for advantageous freight rates, not only on their own material but the city's imports in general, and take an active part in railway matters generally. They meet the architects half way, both in respect for the profession, and in cooperation to obtain the best results. With such a spirit behind its organization of builders, Vancouver cannot fail to be not only a well built city, but one in which the civic conveniences and local pride will not be found wanting.

* * *

ON THE RIVER bank some miles west of Chicago is the town of Terra Cotta. It is given to industry as to inhabitants, and mostly dreams by the man who as lord of the manor rules the fair domain. He is W. D. Gates, and while his extensive factory turns out architectural terra cotta, favored by architects for its artistic quality, some of his dreams came true in the shape of vases and things which have become famous under the name of Teccoware. Sometimes he goes away from home and becomes an ordinary tourist, and no one knows that he is the proprietor of the American Terra Cotta Works which makes money, and the artist chemist who originated the beautiful green Tecco and spent a fortune in the production of these works of art before it became popular, and stood for the one example of original ceramic art in the western continent. It must have been when on one of these tours that he met with the incident that he, in a moment of abstraction, confided to our friend Randall of the "Clay-worker." His description of the old cracker and his horse, harness and wagon is equal to Hopkinson Smith at his best; his thrilling account of the imaginative charge of the Confederates has Winston Churchill (He of the Crossing) beat a mile, and his pathetic description of his tears over the imagined slaughter could only be equalled, but not excelled, by Laura Jean Libbey. It seems a pity that the tears could not have been caught and preserved in one of his tall tecco vases instead of causing a freshet down the mountain side where the earthworks marked the place of the battle field that never heard the "sharp crack of musketry" so vividly described. It is hoped that this successful adventure into the realm of descriptive writing will not be so attractive as to result in a novel and the abandonment of the terra cotta and tecco vase works on the bank of the creek at Terra Cotta, Illinois.

* * *

FROM THE ANNUAL reports of the Director of Education and of the Jamaica Schools Commission and the special report of an inspector from England who recently visited and inspected the secondary and training schools and the colleges of Jamaica, it appears that education is making steady progress in the colony. During the last fiscal year the enrollment in elementary schools increased from 89,902 to 94,923, and the total expenditures of the Department of Education from $302,589 to $324,-844, an increase of $22,255. An effort is being made to meet in part the urgent need of better school building furniture. Since the need of better buildings, furniture, and appliance has been seriously recognized, larger appropriations for these objects may be expected from year to year. Th prosperity of the colony justifies the demand for improving the equipment of the schools. The time seems opportune for Canadian manufacturers of school furniture to establish general agencies in Jamaica, where a line of samples could be exhibited. No expensive furniture is needed. Strong desks at a moderate or low price would be popular. A good business might be done in furnishing iron frames for desks, the woodwork to be done in Jamaica, where mahogany, West Indian cedar, and other suitable woods are abundant. Correspondence and catalogues should be in English, and not in Spanish, as some manufacturers see mto think. It is important in all cases to quote the prices.



"Lakeview," Mural Painting by Archibald Brown, Toronto, Ontario.

STUCCO DESIGN AND BRICKWORK IN TORONTO

The work of John M. Lyle, Sproatt & Rolph, Wickson & Gregg, present different phases of architectural design in Toronto.

WHILE THE AVERAGE in residence design in Canadian cities generally is higher than in the United States, it is through the intelligent use of brick that the Canadian architect gives that noticeable, substantial and home-like feeling to his executed work, particularly in houses of moderate cost. His interior designs worked out in stucco are also interesting, because he can usually secure sympathetic co-operation by the workman in stucco in its combination with interior woodwork. Some excellent brickwork is noted in the recent additions made to the residence of W. R. Johnson, of Toronto, by John M. Lyle, architect.

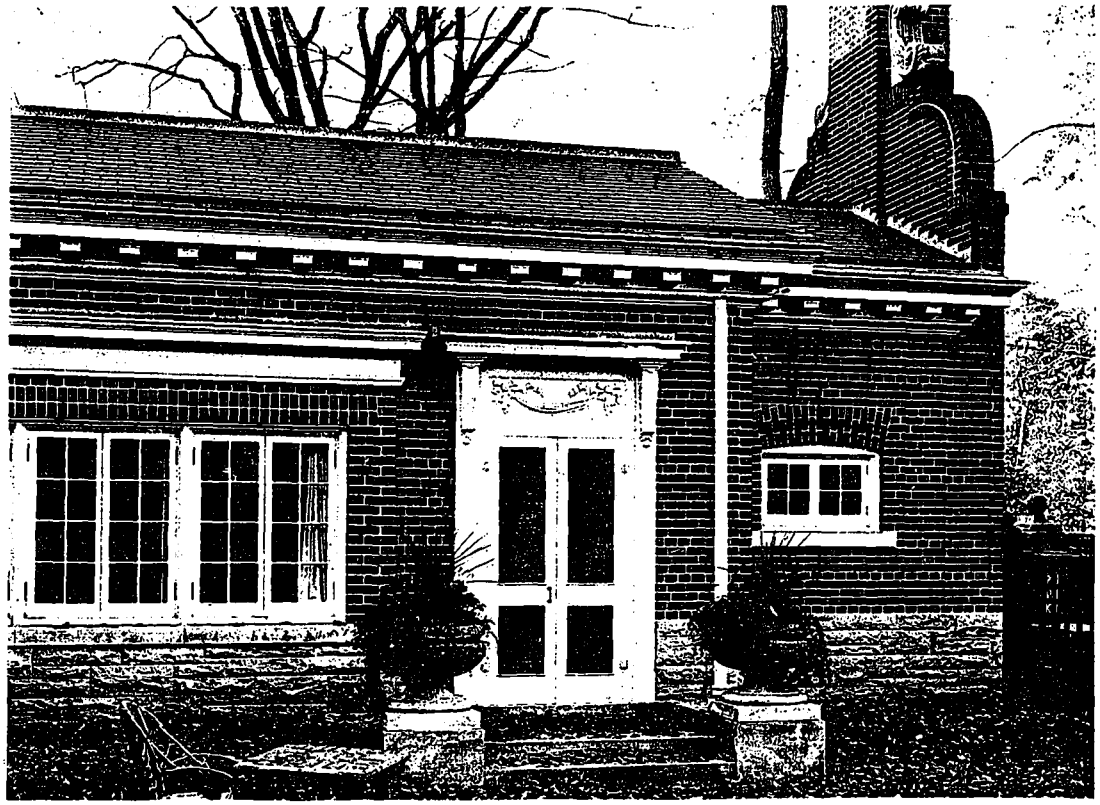
In designing the gate and fence shown in illustration, it was quite necessary to keep in mind the fact that the gate and fence were quite close to the front portion of the house, and in order to get the sequestered effect given by a brick wall, it was necessary to keep same rather low down in front. It was also thought that the iron gate should not be too high to give a shut-in appearance to the main entrance.

The living room is an addition to his original house. It is panelled up to height of ceiling in red oak. The ceiling is of plaster, except in the inglenook, which is of oak. The plaster relief was designed to be in scale with the room, in which it was desired to have a rather low effect. The relief, therefore, has keen kept very flat. Canadian emblems of corn, grapes, wheat and pine cones have been used to suggest a local character.

In reference to the inglenook and treatment of the wood carving, etc., it was the desire of the client that all the carving should bear tool marks, and suggest earlier type of wood carving. It was also his desire to avoid the ordinary mantel type of fireplace, and to adopt a medieval idea of a wood fireplace and low ceiling inglenook. The color of the woodwork in this room is a very dark Cathedral.

In the Sir William Mulock sun room illustrated, it was the desire of the client to have a bright, sunny room completely surrounded by a conservatory, so that on looking out through the openings of the sun room one would be able to see the green and bloom in the conservatory. Unfortunately it is impossible to get in a photograph the charm of this room. The entire walls are executed in Keene's cement; the ceiling above pilasters in plaster. The floor is marble mozaic. The furniture was also designed by the architect, John M. Lyle. Unfortunately, the photographs do not show the detail sufficiently clear enough. In designing this room the architect attempted to echo in the furniture, marble mozaic floor, and in the plaster work, both in the caps and bases of pilasters, etc., a reeded motive combined with the fan pattern. The same detail is carried out in the chairs and tables.

Showing superb brickwork and somewhat similar in their early Georgian feeling are the designs for the residences of T. Gibson and Edwin Bell, by Sproatt and Rolph, architects. That of Mr. Gibson is of cherry red brick laid in a gray mortar that does not show white against the warmth of the brick, yet is light enough to avoid muddiness in shade. The trimmings are of white limestone, and the roof slate. That of Mr. Bell is built of John Price's red brick laid in gray mortar. The trimmings and porch, and the blocks in the frieze are of Indiana limestone. The roof is slate. The interior trim is similar in each. In the Gibson house the floors of the living

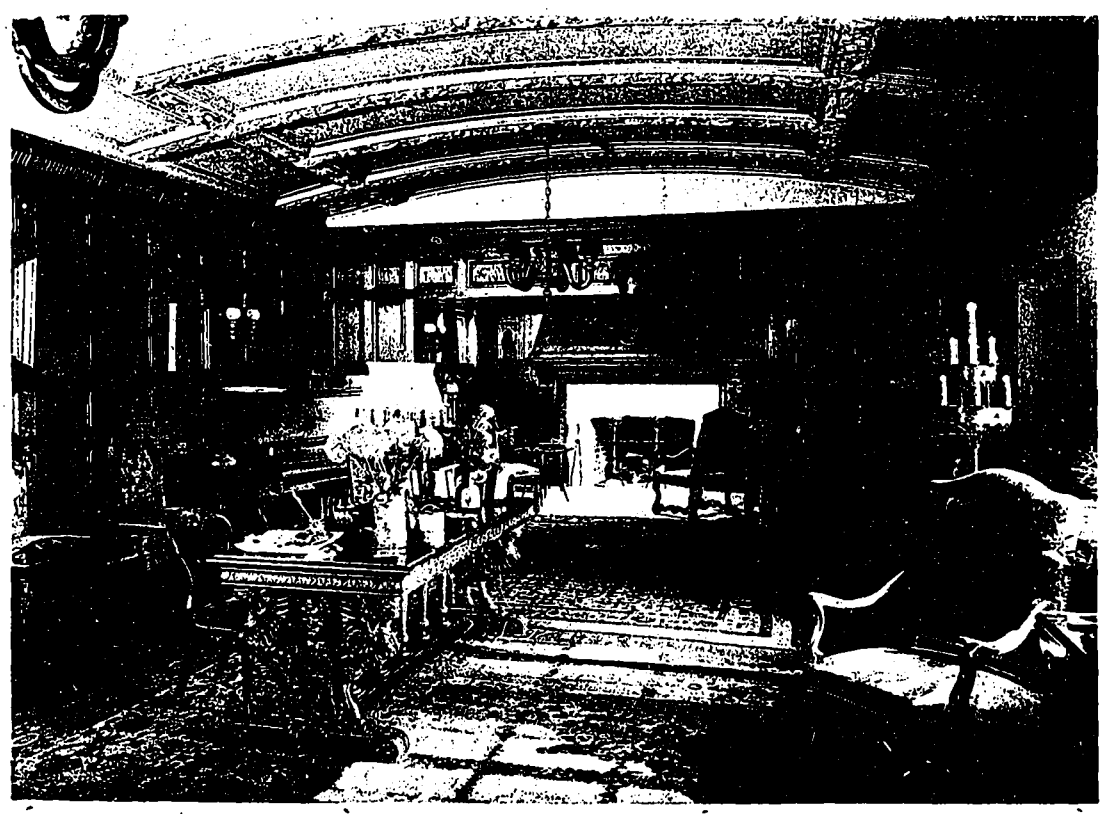


Detail of Brickwork.

Detail of Garden Wall.

Addition to Residence of W. R. Johnson, Jr., Toronto, Ontario. John M. Lyle, Architect.

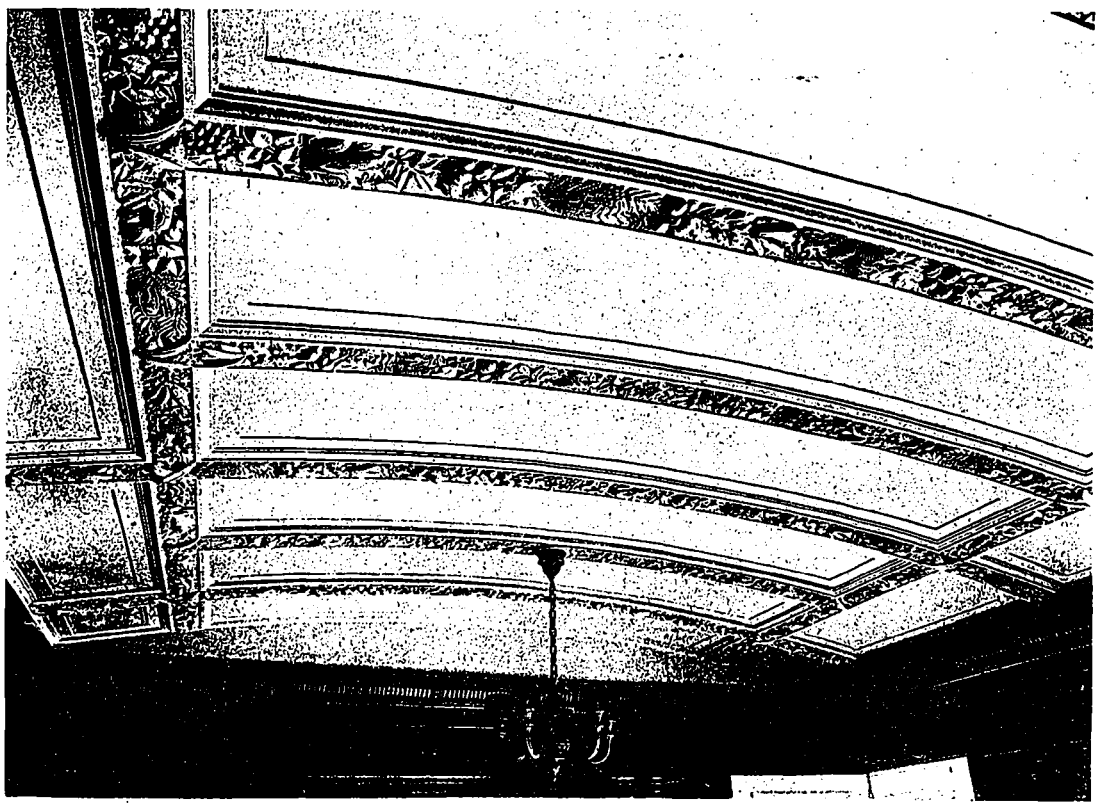
Detail of Gate and Entrance.



Living Room.

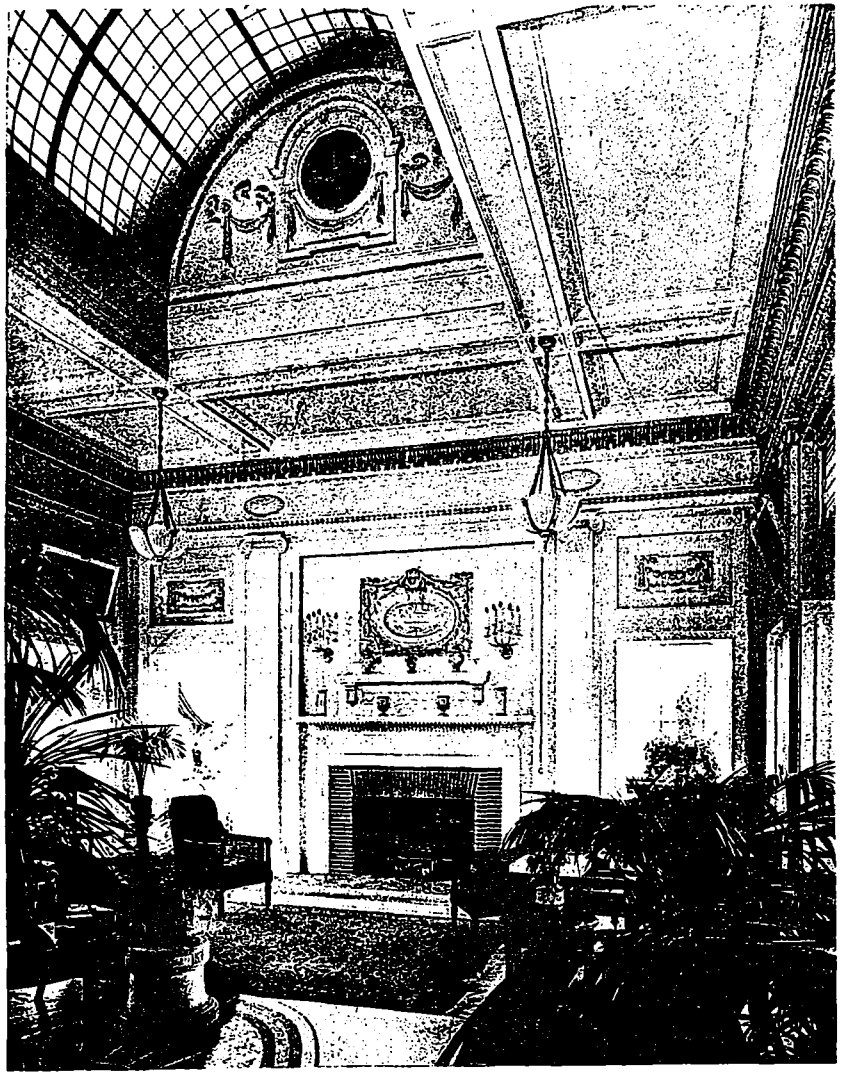
Addition to residence of W. R. Johnson, Jr., Toronto, Ontario. John M. Lyle, Architect.

Detail of Mantel in Living Room.

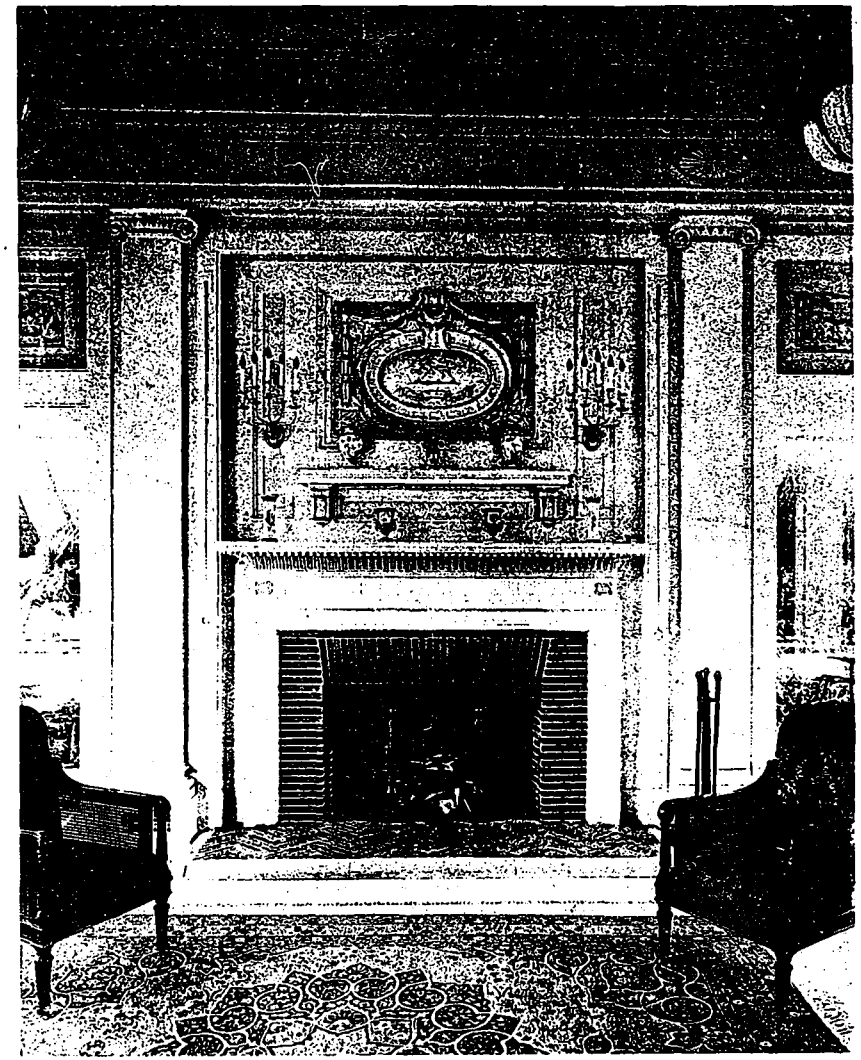


Detail of Ceiling in Living Room.

Addition to Residence of W. R. Johnson, Jr., Toronto, Ontario. John M. Lyle, Architect.



Sun Room.



Detail of Mantel.

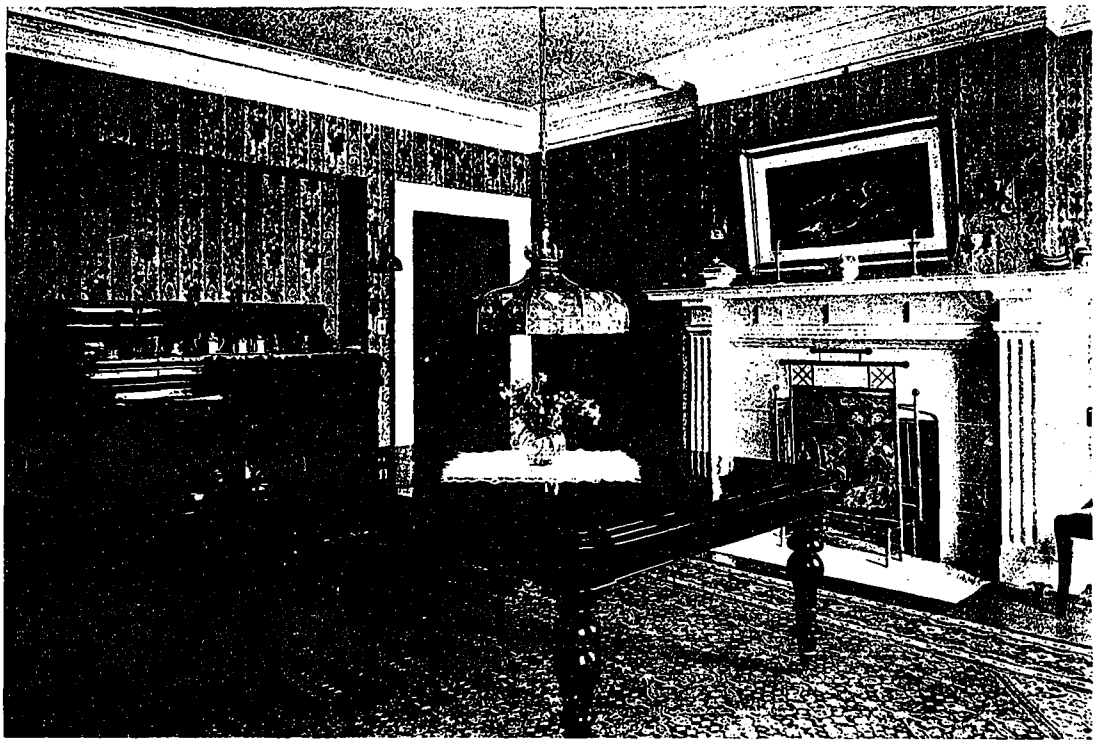
Residence of Sir William Mulock, Toronto, Ontario. John M. Lyle, Architect.

Front Elevation.

Residence of Edwin Bell, Toronto, Ontario. Sproatt & Rolph, Architects.

Front Elevation.

Residence of T. Gibson, Toronto, Ontario. Sproatt & Rolph, Architects.



Dining Room.

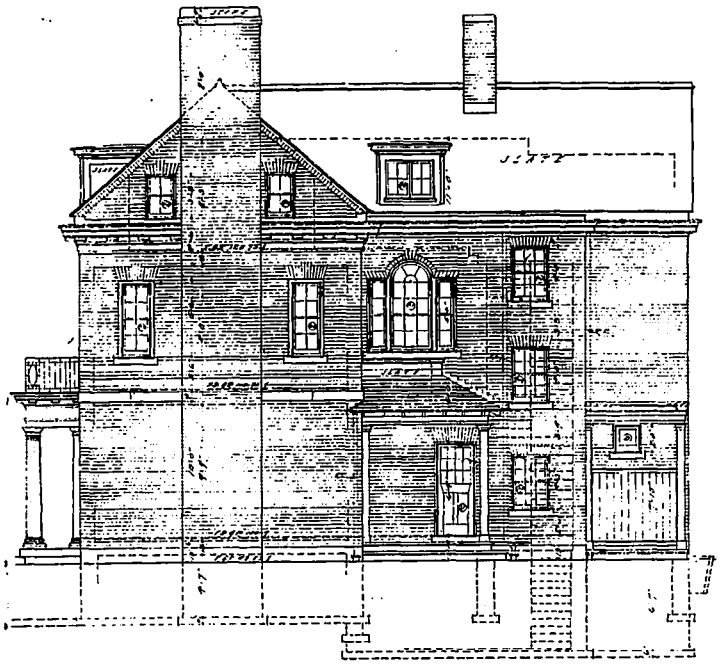
Living Room.

Residence of Edwin Bell, Toronto, Ontario. Sproatt & Rolph, Architects.

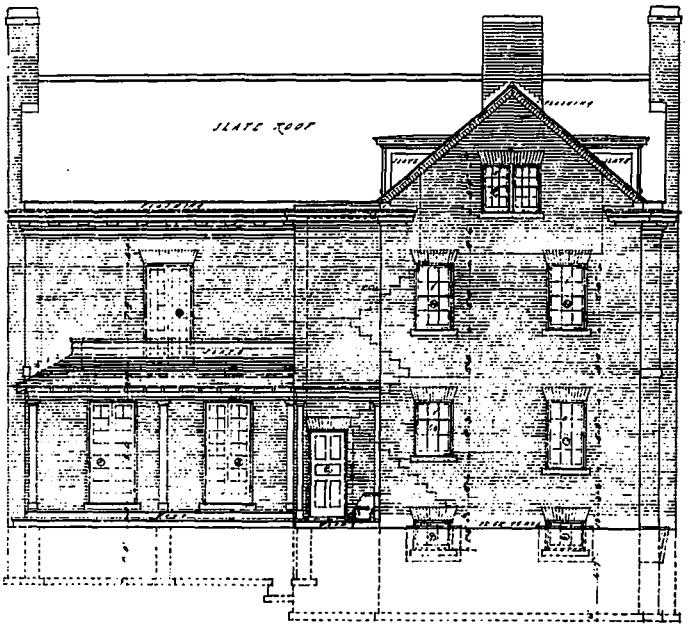
Living Room.

Library.

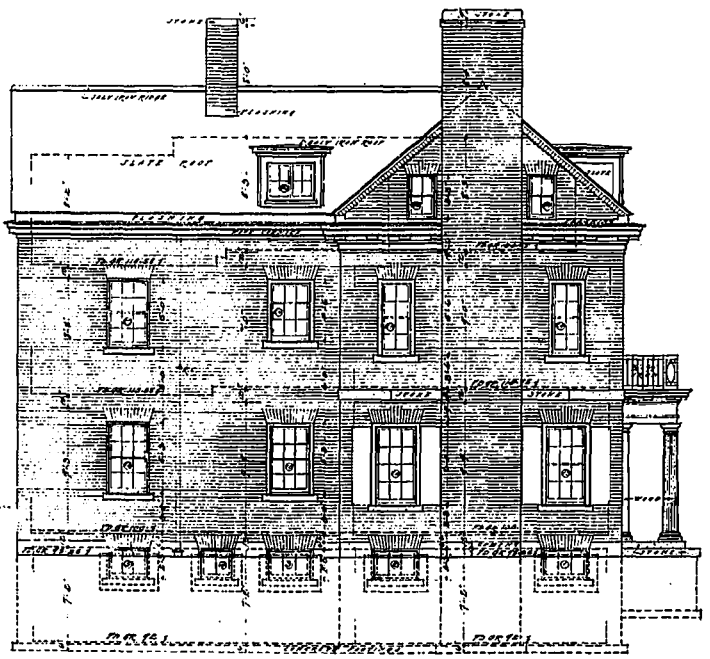
Residence of T. Gibson, Toronto, Ontario. Sproatt & Rolph, Architects.



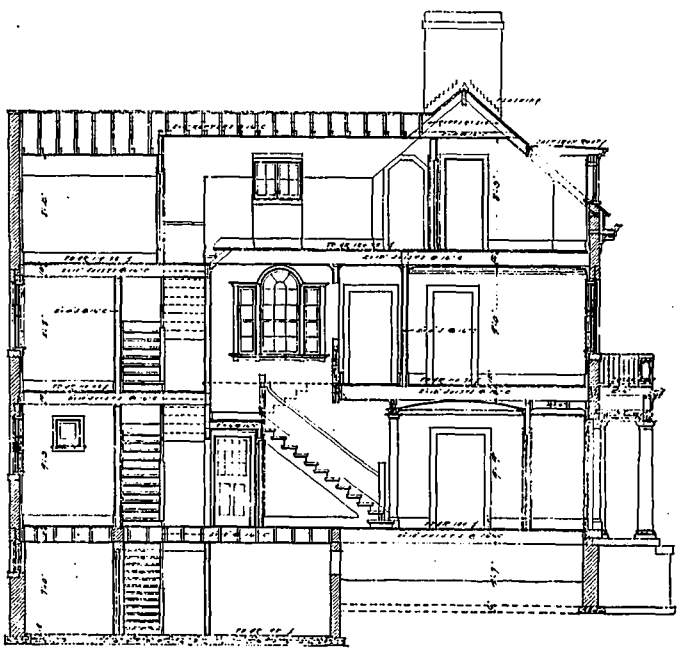
East Elevation.



North Elevation.

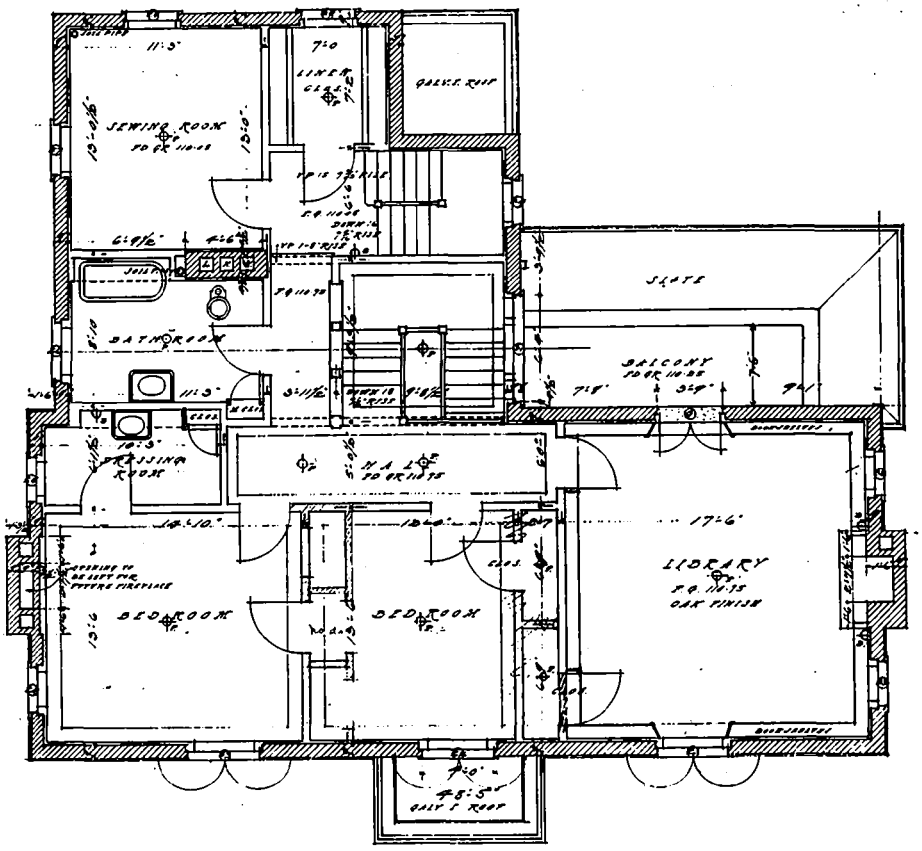


West Elevation.

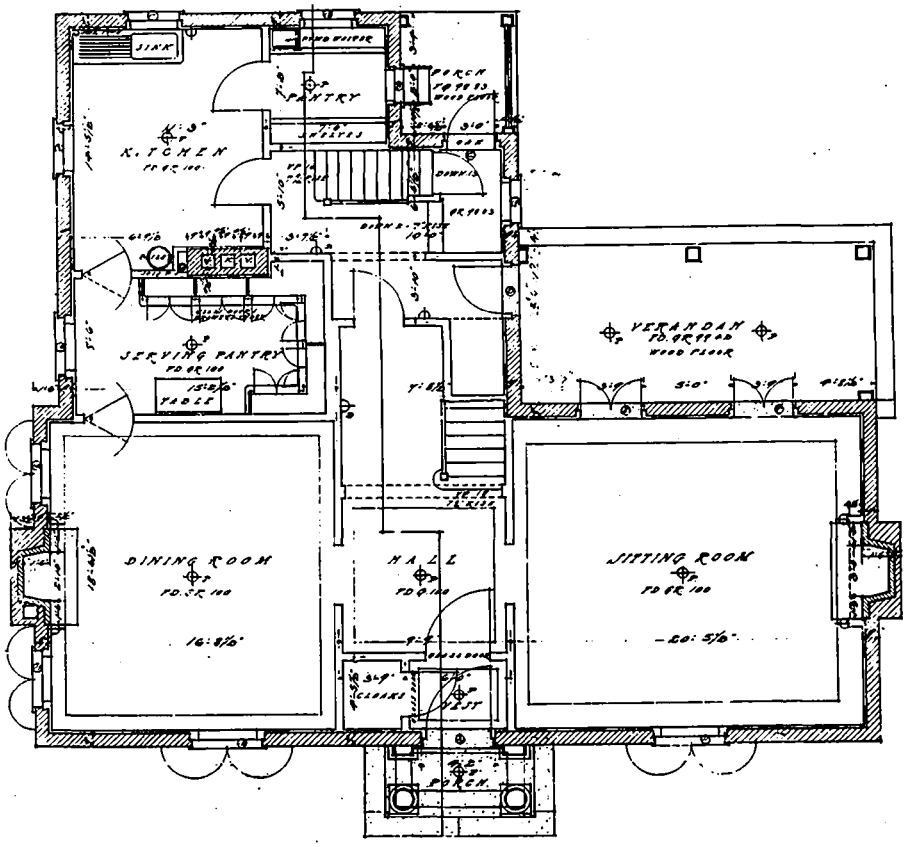


Section S.S.

Residence of T. Gibson, Toronto, Ontario. Sproatt & Rolph, Architects.

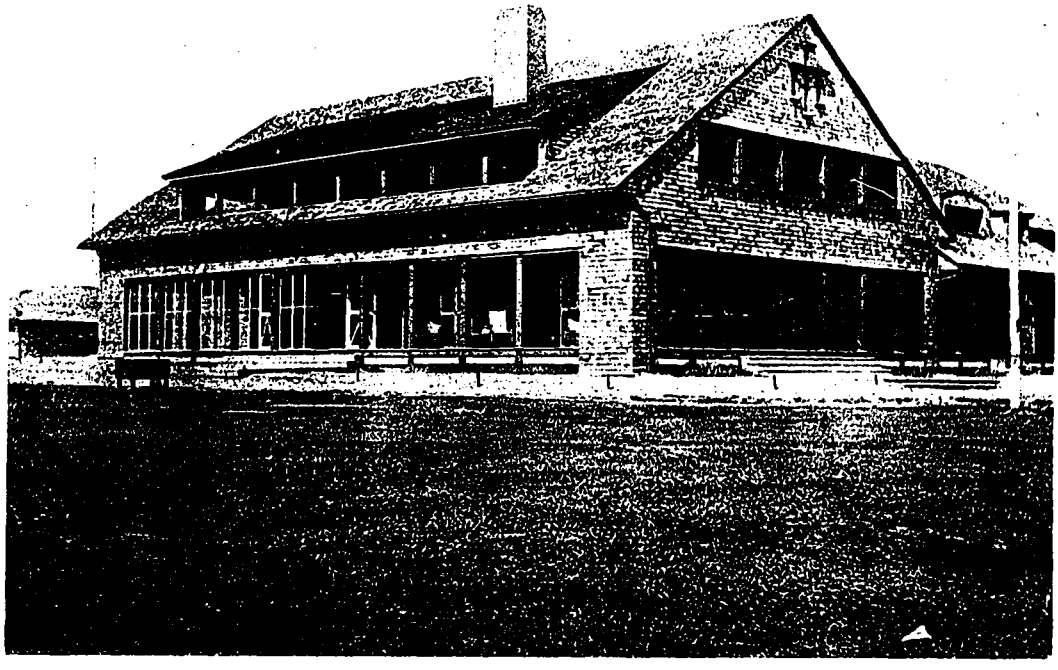


First Floor Fla



Ground Floor Plan.

Residence of T. Gibson, Toronto, Ontario. Sproatt & Rolph, Architects.



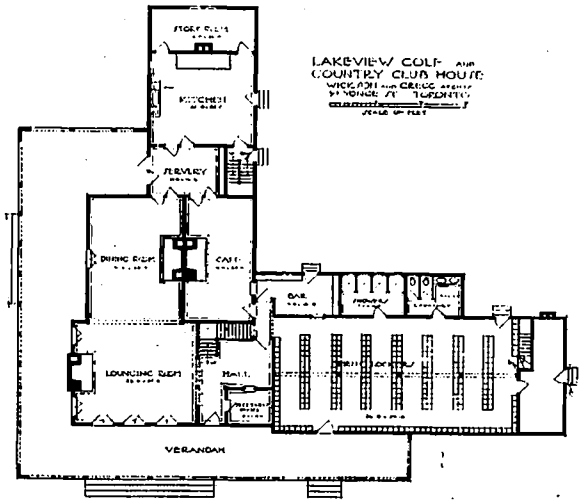
Lakeview Golf Club, Toronto. Wickson & Gregg, Architects.

room and dining rooms are oak, stained nut brown, and the ceilings are ornamental stucco. The fireplace in the living room is stucco, and that of the dining room Caen stone. In the Bell house the floors of the living and dining rooms are oak. In the former the ceiling is stucco; the woodwork is white. The mantel is white, and the fireplace of Caen stone. In the latter the trim is white, the doors mahogany, and the mantel white, with the face and hearth of limestone.

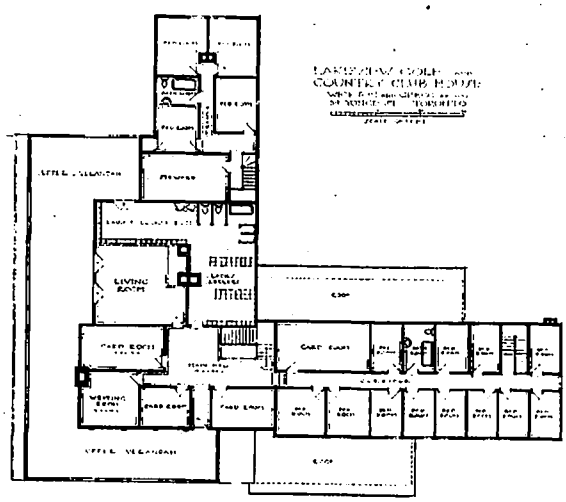
The Lakeview Golf Club of Toronto, Wickson and Gregg, architects, is a pleasing example of country club architecture. It has several verandahs and continuous second story windows that give ample air and unobstructed view. The interior is laid out to accommodate a large membership, and is supplied with every accessory needful to the comfort of the members. The plan gives ample space on the second floor for sleeping accommodations. There is a men's locker room and shower baths in one section, and separate room with lockers and sitting room for ladies in another section of the house. The general sitting room is commodious and appropriately furnished and decorated. A large dining room adjoins the sitting room, which can be thrown in combination to form a dance hall. In addition to several fireplaces, the heat is supplied by two furnaces. The lighting is supplied by acetylene gas, and the house is wired for electricity. The wall over the large open grate in the sitting room is decorated with a mural painting of exceptional value and of appropriate design, the work of Mr. Archibald Brown, of Toronto. In design the panel illustrates the name of the club, "Lakeview." It not only gives a certain distinction to the club interior, but illustrates in a most pronounced manner the value of mural paintings as decorative features, especially in places where their beauties can be leisurely studied. The complete color harmony of this panel with its surroundings and its suggestive repose is characteristic of Mr. Brown's mural, as well as his landscape painting, which is of an exceptionally high order.

THE WORKERS' DWELLINGS Act, of New Zealand, approved December 3, 1910, provides that the governor may from time to time, by order in council gazetted, set apart for the purposes of this act any Crown land; also the Minister of Labor, on the recommendation of the board of the land district (consisting of a superintendent and two others appointed by the governor), may from time to time purchase such lands as he thinks fit for the purpose, which shall be set aside for the purposes of this act. On any land so set apart the Minister may erect buildings or may convert any buildings already erected into structures suitable for workers' dwellings.

The law provides that any person, male or female, who is employed in work of any kind whose earnings at the time of his application do not exceed $851.63 per annum, and who is landless, may make application to the official board of his land district to purchase one of these dwellings, accompanying the application with a deposit of $48.66. He must agree to pay the capital value of the property (after deducting the amount of the deposit paid), together with interest thereon at the rate of 5 per cent. per annum by weekly, fortnightly, or monthly installments (as may be arranged) for a period of 25½ years. When the agreement is complied with, the



First Floor Plan.



Second Floor Plan.

Detail of Sitting Room.

Lakeview Golf Club, Toronto. Wickson & Gregg, Architects.

dwelling becomes the property of the worker in fee simple.

The law also provides for a weekly or monthly tenancy at a rental of 6 per cent.. of the capital value, or by a renewable lease of 21 years at the same rental.

The tenant, lessee, or purchaser of a workers' dwelling shall reside therein, and if he fails so to do the board may cancel his agreement or lease, and thereupon all moneys paid under the agreement or lease shall be forfeited; provided that the board may at any time permit a purchaser or lessee to absent himself from his worker's dwelling for any period not exceeding 12 months at any one time.

REINFORCED CONCRETE BUILDING

An exhaustive review of reinforced concrete construction from a permanency, cost and fireproof standpoint, with comparative tables.

THE USE of reinforced concrete as a material for building construction is of comparatively recent origin. It has only been made possible by the great strides in the methods of manufacture of cement and steel and the development of structural engineering as a science. The greatest progress has been made during the last two centuries. Up to 1860 cast iron and timber were principally used. From 1860-1890 wrought iron took precedence only to be replaced by steel, which in turn is being superseded in many instances by the most recent material, namely, "Reinforced Concrete."

The compressive strength of concrete is about 10 times its strength in tension; while steel is just as strong in tension as in compression. For equal volumes, however, steel costs about 50 times as much as concrete; its compressive strength is 30 times as great as concrete and in tension it will carry 300 times as much load. For equal loads, then, concrete would cost 6-10 as much as steel for compression and six times as much for tension. Thus it is seen that the combination of the two materials forms a new one more economical than either taken separately, i.e., the compression is taken by the concrete and the tension by the steel.

All materials to be cleaned.

The radio of moduli of elasticity (n) is assumed as 15. The straight line theory is used for flexure neglecting tensile strength of concrete.

Where T beams are used there shall be sufficient bond between slab and web, the overhang shall not exceed four times the thickness, twice the width of stem, or one-fourth the span of beam.

The bending moments used are for continuous beams and for end beams.

For slabs reinforced in two directions the ratio of load carried by the transverse reinforcement is

where L = length and B = breadth. L is not to be greater than 1½ times B.

In this case the load is transferred to beams varying as ordinats of an isosceles triangle.

Columns shall not be longer than 15 times the least side.

The working or safe stresses are as follows:

Bond between concrete and steel, for plain bars is 60/, for deformed bars 120/.

Shear = 120/. Combined with diagonal tension = 40/. Tension in steel in beams = 16000/ and not more than ½ E.L.

Columns reinforced vertically only shall take No. 500 in concrete and No. 7500 in steel; with at least 1 per cent. and not more than 4 per cent. vertical reinforcement, and at least 1 per cent. as hoops concrete takes No. 650 and steel No. 9750/.

The hoops shall not be farther apart than ⅛ the diameter. In beams the bars shall not be closer than three times the diameter c. to c. and two times diameter from inside of beam. If placed in layers they shall be 1 in. apart.

The materials of which concrete is made are always easily obtainable. Sand and stone are found in all localities and large supplies of cement and steel bars are always kept in stock, so that there are no delays depending on the rolling and fabrication of special structural shapes and details, manufacture of special shapes of ornamental terra cotta, or cutting of stone or timber to required sizes, all of which results in the more rapid construction of concrete buildings. Two prominent examples of rapid construction are the factory of the Pierce Arrow Motor Car Company in Buffalo, and the Ingall's Office Building in Cincinnati.

The Pierce Arrow factory, four stories high and having a floor space of 107,500 square feet, was started in October, 1909, and was ready for occupancy in 10 weeks. The ground plan was 308 ft. x 62 ft., with a wing 105 ft. x 51 ft. It was built according to the mushroom system with columns spaced 20 ft. 6 in., carrying a load of 150 and having brick curtain walls.

The Ingall's Building represents the modern type of office buildings and is the highest concrete building that has yet been erected for this purpose, there being 16 floors. It was completed in August, 1903, 198 days after work was started. The building covers a ground area of 100 x 50½ feet and is 210 feet high. The loads are as follows: Ground floor 200 lbs., second floor 80 lbs., and upper floors 60 lbs. per square foot. The wind load was taken as 30 lbs. per square foot, starting 50 in. above ground. Half of this was assumed to go to the interior vents and the other half to the end walls.

The following method of construction was adopted. After the forms for each story were built, the columns were poured one day, and the floors were placed on the day following, the time of erecting forms and pouring concrete being 10 days per story. As three tiers of forms were used, each tier was left on 20 days.

Another feature of concrete that is of importance is the fact that it gains strength with age. This property has been taken advantage of in the construction of buildings; and then after a year or two adding another story. Taking an example, suppose a four story building is erected and is designed as such, then at the end of say, two years, the concrete will have gained sufficient strength to permit of the addition of a fifth story without increasing the size of the columns. The economy of this feature is easily apparent.

Concrete has also successfully withstood fires as shown in the Baltimore and San Francisco fires. In the Baltimore fire two buildings that stand as pro-

minent examples are the U.S. Fidelity and Guaranty Company, and the Commercial and Farmers' National Bank Building. In the former, the columns and floors were of reinforced concrete and walls of brick. After the fire the concrete frame stood out as a skeleton, the brick walls for a large part having given way.

The Bank Building is especially interesting, due to the fact that only the first story, including the floor of ceiling was of reinforced concrete. Above this were four floors of timber, with plaster partitions. During the fire the upper part of the building collapsed and the debris fell onto this reinforced concrete floor. Attached to the underside was ornamental plastering studded with glass globes containing lights. After the crash it was found that this plastering was not only not cracked, but none of the glass globes were broken, and after the investigation the report on this building stated that no other repairs were needed outside of cleaning.

In San Francisco at the time of the fire there was only one reinforced concrete building and that was in the course of construction. There were, however, some others in the earthquake region and several steel frame buildings fire-proofed with concrete. These buildings withstood the test so well that four years after the fire there were in San Francisco alone 128 completed reinforced concrete buildings, among them being the Southern Pacific Railroad Hospital costing $550,000. To show the strong hold which concrete obtained as a result of the earthquake, where there was one concrete bridge before, there were fifty, four years after.

The report of the committee of the American Society of Civil Engineers which investigated the results of the earthquake and fire contains the following:

"For columns the fireproofinng that will stand up best is red brick set in Portland cement mortar. Equal to this is a casing of solid concrete at least 4 in. thick with a mesh of reinforcing metal. The remaining examples of column failures must be laid to the failure of terra cotta tile. The writers believe, however, that it (terra cotta) is the least valuable of all materials commonly used for fireproofing. For floor construction some form of reinforced concrete is preferable to tile."

It is sometimes stated that failure is due principally to the action of a stream of cold water applied to the heated surfaces. However, two very interesting fires occurred in which water was not used, the fires being left to burn themselves out. These were the factory of the National Fireproofing Company near Washington, D.C., October 20. 1908, and the fire at Winthrop Beach, Mass., Oct. 2, 1908, in which a number of frame buildings surrounding a partly finished concrete cottage were burned.

In the case of the Washington fire, the nearest fire hydrant was half a mile away so that no water could be used. The whole factory was destroyed. The walls were built of terra cotta, and in practically every case, even where walls were left standing, the faces of a large percentage of the tiles were split off. An interesting feature was the fact that, in one place, a terra-cotta wall had a concrete foundation. In this place the terra cotta was entirely demolished, but the concrete wall came through the fire practically unharmed.

At Winthrop Beach, Mass., two large frame hotels and several frame houses were destroyed. Eight feet away from one of these hotels there was a concrete cottage in the course of construction. The walls were 1:316 monolithic concrete and the interior of timber, of which the joints and floor boarding were in place. The doors and windows had not been closed in and the frames for them were stored in the cellar, making excellent fuel.

It is interesting to note that the fire department left these frame buildings and the concrete cottage to take care of themselves while they devoted their attention to saving adjacent frame houses. After the fire the only repairs necessary outside of replacing the timber work is the replastering of the outside of the wall next to the hotel. Otherwise the concrete was not injured. As evidence of the heat the granite curbstones on the opposite side of the street spalled off and crumbled so that they had to be replaced.

The above tests of the behaviour of concrete in actual fires should be sufficient evidence of its value as a fireproofing material.

It has been the impression among a large number of persons that reinforced concrete was much higher in cost than other materials. This, however, is not always the case, for there have been instances where concrete buildings have been built at the same or less cost than the same building would have cost if built of brick and timber. One instance of this is in the case of the two schools at Chatham and Madison, N.J. Both are built on the same floor plan and in the Chatham School, built of brick and wood, the cornices were of wood, flashings of tin and ceilings of stamped metal to keep the cost down, but in spite of this the reinforced concrete school at Lincoln cost no more than that paid for the inferior structure.

Mr. E. G. Perot gives the following costs per cu. ft. for reinforced concrete buildings, omitting power, heat, light, elevators and decorations:

Warehouses and Factories ..	8c. to 11c.
Stores and Loft Buildings ..	11c. to 17c.
Schools, Hospitals, Etc.	15c. to 20c.

However, the first cost is not the only thing to be considered. The real cost consists of the first cost plus the cost of maintenance. The following analysis is based largely upon that given by Mr. J. P. H. Perry, manager, Contract Department, Turner Construction Company, New York:

COMPARATIVE APPROXIMATE YEARLY COST OF INSURANCE IN CENTS PER $100 of FACTORY BUILDINGS.

Exposures none; area not large; good city department; no private fire apparatus except such as pails and standpipes.

	B	C	B	C	B	C	Add for Brick or wood buildings in Samll Towns without best of Water and Fire Departments.
General storehouse....	20	45	60	100	100	125	25
Wool storehouse.....	20	35	40	60	75	100	25
Office building.....	15	30	35	50	100	125	25
Cotton Factory.....	40	100	100	200	200	300	50
Tannery.....	20	40	75	100	100	100	25
Shoe factory.....	25	80	75	100	150	200	50
Woolen Mill.....	30	80	75	100	150	200	50
Machine Shop.....	15	25	50	50	150	100	25
General mercantile....	35	75	50	100	100	150	25

Note:- "B" stands for Buildings, and "C" stands for Contents.

PLATE I.

COMPARATIVE COSTS OF BUILDINGS OF CONCRETE AND MILL CONSTRUCTION.

Initial Cost of Building	Mill Construction. $100,000.		Reinforced Concrete. $110,000.	
Yearly charges:				
Interest at 6 per cent.....		$6,000		$6,600
Taxes at 1 per cent.....		1,000		1,100
Fire insurance:				
Building.....	at 75¢	750	at 25¢	275
Contents.....	at 100¢	1,000	at 80¢	800
Deprecation.....	at 1.25%	1,250	at .25%	
Items charged against mill construction only:				
a. Loss due to vibration, assume		450		
b. Increased light, 1per cent. increase in efficiency of labor. Assume labor equal to⅔ value of contents on $50,000.....		500		
c. Vermin losses.....		100		
d. Protection against fire at.5 per cent.on value of 50 per cent. of building and contents.....		500		
TOTAL.....		$11,550		$9,000
Annual saving of concrete over mill construction.....				$2,250

PLATE III.

The relative costs of the three types of building are:

Mill Construction ..... 100 - 130
Reinforced Concrete ..... 128 - 143
Structural Steel ..... 140 - 154

These values were obtained from 44 architects, engineers and contractors for the best of each class and show that in some cases reinforced concrete will be lower than mill construction and in practically all cases is less than steel.

Taking up the various items under maintenance separately we can get a general idea of the yearly expenses:

(1) Interest: This item varies directly with the initial cost.

(2) Taxes: Varies directly with initial cost.

(3) Insurance on Building: Reinforced concrete and fireproof steel receive about the same rates. Mill buildings run from equal rates to two or three

times the rate on reinforced concrete. The equal rates apply only where the rate on mill buildings is so low that no lower rates can be given. Tables I. and III. show comparative average rates. A canvass of 255 owners showed that 26.6 per cent. carried no insurance, while a great many more only carried it on account of mortgages requiring it.

(4) Insurance on Contents: Generally varies with the character of the building, except in some particular lines of industry that are especially hazardous.

(5) Depreciation: On account of the recent development of structural steel and reinforced concrete, values of depreciation are difficult to obtain. There is no doubt, however, that there is some depreciation in steel buildings. Most of the cost of depreciation of reinforced concrete buildings is in the roofing, doors, and other parts not of concrete; and, while there is no knowledge other than the increase in the strength of concrete, it may be said that the depreciation would amount to ¼ per cent.

Kidder's Handbook gives the depreciation for Mill Construction at 1 to 1.5 per cent. Matheson's "Depreciation of Factories" puts it at 1.2 per cent.

(6) Results of Vibration: This applies only to factories and buildings where machinery is used, but it is apparent from the very nature of the material that there should be less vibration in a reinforced concrete building. Vibration causes "walking" of the machinery resulting in a loss of alignment of shafting and increased wear on the journal blocks and moving parts. This increases the power necessary to operate the machines.

The saving by eliminating vibration would amount to at least $1.50 a day or an annual saving of $450. In the case of the average manufacture. It must be remembered that this does not take into account the increased efficiency of the machines which would probably equal or exceed this amount.

The experience of a button manufacturing company illustrates the effectiveness of concrete construction in reducing vibration. This company gives their experience as follows:

"We are running our machinery here at as high speed as we were ever able to in other buildings, and in general at higher speeds and with less waste time for adjustments and consequent repairs. I have no scientific data to furnish on this speed. It is perfectly obvious that if one can get 5 or 10 per cent. more efficiency out of machinery, concrete buildings have a big advantage over others."

The chief engineer of the same company writes:

"In the matter of our experience with vibration in our reinforced concrete building as compared with the vibration of the same equipment in a building of the ordinary mill construction would say:

First, the type of vibration that concerns us the most is that due to very slight lack of balance in parts rotating at high speed, in distinction from the vibration that might be evident from machinery of a heavier type, due possibly to reciprocation as in heavy printing presses, or from shock as in punch press work and the like, or vibration of a machine tool due to chatter or like cause.

In our experience previous to this building we had difficulty in anchoring our machinery so that this high frequency vibration would not in a short time loosen the fastening as well as cause loss of adjustment in the machines themselves. We find this difficulty almost wholly overcome in our present concrete buildings, and further, machines standing rather high from the floor which are subjected to more or less horizontal shock, we were never able in a mill construction building, even by bolting through the floor, to prevent those machines from loosening. On our present concrete floors we have no record of any one of these machines requiring even to be tightened to the floor after being installed.

As to building vibration, we never had experience with any building as free from jar, trembling, etc., as our present one, the results in all cases being a surprise to us in the elimination of these undesirable features."

(7) Light and Sanitary Qualities: An increase in the amount of light, increases the efficiency of employees. The window area in a reinforced concrete building can be made from 40 per cent. to 150 per cent. greater than for mill buildings. The percentage of window area for mill buildings averages from 30 to 40 per cent. of the wall area; for reinforced concrete 70 to 80 per cent.

The waterproofing qualities of concrete permit frequent washing of floors and makes dampness and rotting impossible where wet processes are used. Its low conductivity results in only small variation in temperature and its homogeneousness prevents drafts.

This should result in a saving of at least 1 per cent.

(8) Vermin Losses: In the case of losses from vermin, a paper goods manufacturer states that reinforced concrete saves him $4,000 per year. In a concrete building there is no place in which rodents can live. A saving of $100 per year is exceedingly low for any business large enough to require a concrete building.

(9) Fire Protection Value: Although a building and its contents may be fully insured, the owner or occupant suffers by loss of reputation from his failure to fill orders, loss in efficiency of his organization due to his skilled operatives accepting other positions during shut down and loss of new business due to inability to fill contracts.

On the other hand a fireproof building increases the confidence of employees and incidentally adds to the peace of mind of the owner. Use and occupancy insurance can be obtained at a cost of about 5 per cent. on building and contents. It covers estimated profits, and other sources of income based on the legitimate use and occupancy of the building. Reinforced concrete should therefore result in a saving of at least ½ per cent. per year.

In table 3 is given a comparison between mill construction and reinforced concrete. Assume a mill building costing $100,000 and concrete 10 per cent. more or $110,000. The yearly charges are based on the above estimates.

This shows an annual saving of $2,550 in favor of reinforced concrete which if capitalized at 6 per cent. would represent a capital of $42,500. In

COMPARISON OF COSTS OF MILL AND REINFORCED CONCRETE BUILDINGS.

Location	Size in Plan	No. of Stories	Character of Comparison: Use and Loads	Bid or Estimate	Reinforced Concrete	Mill Construction	Per Cent R.C. More than Mill	Per Cent R.C. Less than Mill.
Boston, Mass.....	120 X155	9	Warehouse	Bid	$196,000	$212,500		6 3-10
Cincinnati, OHIO..				Estimate	19,100	16,000	162-10	
Cincinnati, Ohio.			Press Bldg.	Bid	4% More than Mill	4% Less than R.C.	4	
Cincinati, Ohio...	60000 sq.ft.		Bakery 300 lbs.	Bid	62,500	64,000		2 3-10
Detroit, Mich.....		3	Factory 300lbs.	Bid	28,500	28,200	1 1-2	
Fall River, MASS..	112 X112	4	Factory	Bid	88,500	74,000	10 3-10	
Grand Rapids, Mich.			Factory	Bid	86,000	85,300	1 3-10	
Jersey City, N.J...	60 X140	5	Factory 200lbs.	Bid	56,000	62,000	7 1-10	
Jersey City, N.J...	94 X 38	6 and Bsmt.	Warehouse 200 lbs.	Bid	45,000	390.0	9 3-10	
Manchester, N.H....	100 X 45	5	Factory	Est.	72000	52000	27 7-10	
Nashua, O.....	200 X100	8	Storehouse	Bid	131000	117000	10 7-10	
New England.....			Shop	Est.	69539	65868	5 2-10	
Pittsburg, PA.....	100 X120	4	Warehouse	Bid	63636	61489	3 3-10	
St. Paul, MINN...	165 X235	7	Mfg. 200 lbs.	Bid	10000 less than Mill	10000more than Mill		

Mean - R.C. 6 7-10% more than mill cost.

PLATE IV.

COMPARISON OF COSTS OF STEEL AND REINFORCED CONCRETE BUILDINGS.

Location	Size on Plan Plan	No. of Stories.	Size of Panels.	Character of Comparison: Use and Loads.	Bid or Estimate	Reinforced Concrete	Fireproof Structural Steel	Comparative Cost of Steel and R.C. Building. Walls assumed the same. Per Cent R.C: More than Steel	Per Cent R.C: Less than Steel
Brooklyn...	140 X 190	8 and 2 Bsmts.		Warehouse 200 lbs.	Bid	$250,000	$280,000		107-10
Boston.....	550 X 129 341 X 231	2 & Bsmts. 1 & Bsmts Sawtooth Roof		Textile Mfgr. S. & C.		278,289	Combination Steel with Heavy Mill Floor. 286,445		2 8-10
Cambridge..	60 X 320	5			Bid and Cost	90,000	Wood Floors 87,330	3 3-10	
Cincinnati.		16 & Bsmts.		70 lbs. Office	Bid	Structural Frame only 20% Lower	Entire Bldg. 4% Higher than R.C.		4
Des Moines..	152 X 66	6	22 X16	Factory 200 lbs.	Estimate	60,650	69,750		13
Fairmont..	50 X 100	2 & Bsmt.		Mch. Factory 200 lbs.	Bid	25,000	26,000		107-10
Indianapolis		5 & Bsmt.		Hospital	Bid	793,000	823,000		3 6010
Indianapolis	71 X 120	5 & Bsmt.	16-0 X20	Department Store, 125 lbs.	Bid	89,500	96,000		6 8-10
Ohio.....		12		Mfg. 200 lbs.	Bid	Less than Steel 40,000	40,000 More than R.C.		
Springfield	283 X 105	8 & Bsmt.	20 X 20	Loft 150 lbs.	Bid and Estimate	280,000	320,000		12 1-2
St.Louis...		10 & Bsmt.		Apartment 70 lbs.	Bid	290,000	304,000		4-10
St.Louis 120 X 140		7 & Bsmt.		Hotel 70 lbs.	Bid	171,000	184,000		7
St.Louis...	86 X 120	6 & Bsmt.	16 X 18	Office 70 lbs.	Bid	170,000	184,000		76-10
Wichita...	75 X 140	10 & Bsmt.	16 X 18	Office 70 lbs.	Bid	282,000	303,000		69-10

Mean - R.C. costs 6 4-10% less than Fireproof St.Steel.

Plate V.

other words, a concrete building oven though it cost 10 per cent. more to build would save over 2 per cent. per year on all fixed charges.

Putting it differently, a concrete building can cost 50 per cent. more than a mill construction building and still save money.

Tables IV. and V. give comparisons in cost of actual buildings and while not authoritative are fairly accurate.

Before deciding on any particular type of building, the above facts should be carefully considered and comparative estimates made in order to ascertain which form of construction will best fulfil the purpose for which the building is intended.

Average Cost of Insurance on Reinforced Concrete Buildings and Contents, with Sprinkler Equipment.

Agricultural Implement Factories	$0.06
Automobile Factories	.045
Bakeries	.07
Clothing Factories	.06
Lithographing and Printing Establishments.	.055
Machine Shops	.04
Metal-Working Plants, without Sprinklers..	.06

Risks not ordinarily open to competitive rates unless of superior construction:

Rubber Factories	.055
Shoe Factories	.05
Textile Mills	.05
Tobacco Factories	.06
Wood-Working Plants	.07

Under this type of construction the insurance may be accepted, not only at a lower rate, but under a considerably lower valuation, probably resulting as a whole in reducing the cost of the insurance from 40 to 50 per cent. over the ordinary type of factory and warehouse buildings.

A FEW IMPRESSIONS ON CITY PLANNING

By COLBORNE P. MEREDITH

Paper read at the fourth annual convention of the Royal Architectural Association of Canada as a report upon the proceedings of the Third National City Planning Conference recently held at Philadelphia.

IN THE COURSE OF a short paper, and with the time at my disposal, it will, of course, be impossible for me to more than touch upon the many and varied aspects of the town planning problem, which were dealt with at the Philadelphia Conference.

The gathering was a remarkable and representative one. Delegates were present from 110 cities of the States, from Canada, and from Europe. The Mayor of Philadelphia, at the banquet which was the concluding feature, said: "The conference has been the most absorbing thing in my experience in this city, because of the earnestness, the seriousness of purpose, and the vigor with which the leaders in it have discussed the various questions that have come before it." One could not fail to be impressed. This was a gathering of men striving towards an idea.

After long years of blind groping and futile circulation around a common centre, the forces of the architect, the engineer, and the social reformer, have converged towards town planning as a basis for action, and from the travail of their union has been born a new art, expressing a new ideal.

Such was the origin of our civic regeneration. Contrary to the impressions of some, this movement does not include various advanced views on diet and ethics. Rooted in common sense, and watered by our increasing fount of knowledge, this, the fairest product in our age of progress, is also essentially the most democratic. It will benefit all—from the pauper in the slum to the prince in the palace.

A striking feature of the Convention was the wonderful exhibition of drawings, paintings, sketches and models, illustrating various schemes proposed, or actually carried out, for the beautification of the cities of the States and Europe. A score of cities demonstrated what has been done in the reclamation of waste lands, the building of boulevards and the construction of civic centres.

May I here make a suggestion that such an exhibit would prove of incalculable value to Canada. Would it not be possible to arrange for such an exhibit to be gathered, and to be shown in the larger cities of Canada in turn? The Royal Institute would have a special status in the organization of such an exhibition, and it would be easy to form a committee among the members in each city to handle the purely local part of the business.

It was most inspiring to note the interest taken by the general public at the Philadelphia exhibit. The galleries of the city hall were crowded—twenty thousand persons visiting the exhibit in one day alone—and I am sure a similar result could be obtained here, followed by a similar measure of civic awakening.

I will now endeavor to summarize the papers presented at the Conference, and also to draw attention to some points, which, during the subsequent discussions, seem to prove more or less controversial.

On the subject of "Standardized Street Widths," Mr. John Nolen, of Cambridge, Mass,. said in part:

"It would not be difficult to convince anyone not already convinced—if such there be—of the importance of fixing street widths more intelligently and discriminately. At the present time an average of 20 to 40 per cent. of the total area of cities is devoted to streets, rising in the case of Washington, D.C., to 54 per cent. Therefore, even a slight variation in the widths of the streets of a city becomes a matter of importance.

"What are the causes of the existing difficulties in this matter of street widths, and what are the remedies? Some students of this subject are of the opinion that the evils are due, in part at least, to a standardization of street widths. But is the standardization itself the evil. Is it not the arbitrary and unintelligent character of that standard; and is not the remedy another standard, or other standards, rather than the abandonment of the principle of standardization?

"What are the facts which should determine street widths? They are (1) the width required for 'a line of vehicles,' thus fixing roadway units; (2) the width required for 'a line of pedestrians,' thus fixing sidewalk units; (3) the classification of the streets of a city according to the traffic requirements put upon them, or the other functions that they are to serve; and (4) an estimate of the present and future traffic of the streets of any given class, the width required to meet that traffic, and then the standardization of that width."

Mr. Nolen then adduced various statistics showing classifications which have been adopted as standards in England and Germany and at Washington.

Mr. B. Antrim Haldeman, of Philadelphia, in discussing Mr. Nolen's paper, said:

"The standardization of the units upon which the widths of streets may be based appears to be an entirely logical proposition. If definitely established, it should not fail to result in large economy. Restrictive legislation might be necessary to prevent a future increase in the width of vehicles. The two-foot unit for determining the width of sidewalks might not be sufficient for fat men of

baby coaches, but they may safely be classed as allowable exceptions."

Of immediate interest by reason of its relation to Mr. Nolen's paper, was the paper by Mr. Chas. Mulford Robinson, entitled "A Narrowing of Minor Streets as Affecting Tenant and Property Owner."

"Raymond Unwin," said Mr. Robinson, "puts the unreasonableness of the requirements of unnecessarily wide streets in this striking way:

"'A mansion such as Chatsworth or Blenheim will be adequately served by a simple carriage drive from 13 to 20 feet wide. The population of such a building will be larger than that of a row or group of cottages, and the amount of wheel traffic to and from it many times as great; yet for the cottage road asphalt or concrete paved footpaths, granite curbs and channel, and granite macadamized surface, the whole from 40 to 50 feet wide, and costing, with the sewers, etc., from £5 to £8 a lineal yard, are required by the local authority, under our existing by-laws.'

"The burden of all this cost," continued Mr. Robinson, "to which is to be further added the value of the land thus withdrawn from productive use, is borne by the occupants of the district, whether they be tenants or owners. If our present method of standardization is unduly extravagant, it should not be permitted to persist simply through inertia, and because it saves trouble in surveying and thinking."

Mr. Thomas Adams, of the town planning department of the Local Government Board of England, said that, after investigating conditions in Germany and Sweden, he had come to the conclusion that the system of high tenement block dwellings was as much the result of wide roads, as wide roads had become the result of the tenement system. "The one," he said, "was complementary to the other."

"But it is our duty to consider the owner as well as the tenant. Fortunately it does not always happen that the tenant's gain is the owner's loss. If the narrowing of minor residence streets tends to reduce rents, it does not follow that it tends to reduce property values. The latter are for the most part—as regards property of this character—the capitalization of net income, expected if not realized. A reduction in rents, which results from reduction in carrying charges, may leave net income unaffected. Real estate would feel its influence in various ways.

"In the first place, it would tend to create stability in values. The concentration of through travel upon certain streets would raise the value of the frontage on those streets for commercial purposes; while the assurance that intermediate streets would not be encroached upon for business purposes, would have a beneficial effect upon property on such streets. They would be free from the danger of invasion by elements inconsistent, and out of harmony, with their present use.

"Though a good deal has been said about the cost of making needlessly wide streets, a factor of scarcely less weight is the cost of maintaining such thoroughfares once they are built. The man who held property on a small street would make a great saving in this respect.

"When a city restricts the number of dwellings per acre in any given area, it places an approximate limit on the amount of traffic for which provision need be made by the local streets of that area. The necessity no longer exists to require that there be adherence to rigid specifications designed to take care of a traffic which may increase with unchecked rapidity. It becomes possible at last to adjust the street development to the property's development. But when no limit is set to the latter, as in unrestricted areas, the standard for the street widths must be set by the promoter's dreams. It will be correspondingly high, and correspondingly forgetful of the common good."

A paper was read by Hon. Lawson Purdy on Condemnation, Assessments and Taxation in relation to city planning, but the limits of my time will not permit me to quote this at all fully. I should like, however, to mention the interesting explanation of Excess Condemnation given by Mr. Purdy, in which it was clearly brought out that if we had improved methods of making awards for damages, and the power to take a reasonable amount of land, in addition to that required for the new street, it would be possible to open these streets with small expense to the city and with advantage to every one.

A paper was read on "The Location of Public Buildings in Parks and other Open Spaces," by Mr. Frank Miles Day. This paper consisted of a plea for the retention of open spaces as such purely and simply, and it was held that the usage of a park as a site for a public building was only allowable when the ground encroached upon was remote from the park proper.

"City parks," said Mr. Day, "acquired in many instances at vast expenditures, are seemingly so vital that it is obvious that the potential value of such open spaces must never be lost sight of when it is proposed to erect in them structures of sufficient size to appreciably affect their character as open spaces.

"Eternal vigilance is the price of the preservation of open spaces. Upon those who would diminish their area should be thrown the burden of proving the wisdom of such a course."

In the discussion which followed, Mr. Thomas Mawson, of Liverpool, maintained that rural landscape and architecture are not opposed one to the other.

Professor Olmsted, of Harvard, supported Mr. Mawson in his contention, namely, that many a beautiful landscape exists of which a building forms an essential part, and which would be injured by the removal of the building.

I will now quote as briefly as possible from a most interesting, and in a sense revolutionary, paper by Mr. Ernest Flagg, entitled Public Buildings:

"In dealing with the plans of cities, the placing of public buildings and the re-arrangement of streets, one seldom finds ideal conditions. Cities are seldom made out of whole cloth; a case like that of Washington does not occur once in a century.

"If the city is old the streets are apt to be narrow and crooked. If it is new the plan expresses no higher aim than the desire to obtain the greatest possible number of city lots to a given area.

"American cities of to-day are unlike any others of the past, and public buildings intended for them should be considered in view of this fact. Background and scale must be studied from a new point of view.

"In order to understand these conditions, one should know something of the causes which have led to them

"Within the last twenty years the steel frame and elevator have wrought a most extraordinary change in our way of building for commercial purposes. If such a revolution in the method of building had occurred in a country where architectural training was general, and public taste cultivated, it is probable that the problem it presented would have been dealt with very much in the same way that the builders of Western Europe dealt with their great problem, near the commencement of the thir-

teenth century. That is to say, they would have allowed themselves to be led by the methods they used. In other words, they would have been truthful, and all good art is truthful.

"It is needless to say *we* set about the task in an entirely different way. We tried to make our buildings look like anything but what they really were; and a great deal of ingenuity was expected to accomplish a result which reason must pronounce as opposed both to good taste and to common sense. No one man can invent an architectural style, and no body of men working upon lines contrary to reason can invent one.

"Although we have such a multiplicity of laws that it is a question whether the individual has not less freedom here than anywhere else on earth, yet every man's right to disfigure the city by the erection of eyesores and monstrosities along the streets has never been questioned. We have high buildings and low buildings indiscriminately, buildings of every kind of material and of every color jostle each other in the wildest confusion. This is the American background for public buildings.

"Whenever I have seen the design for a great municipal improvement, intended for an American city, I have found indicated for the surrounding buildings, the long sober lines of the European city; but they are unattainable here. These plans are misleading; no background or setting of that kind can be had for public buildings, and the makers of such pictures deceive themselves, and are doomed to disappointment.

"Should these buildings, then, be low and massive, of a different type and of a different kind of architecture from the surrounding structures? Or should they out-Herod Herod and dominate them in height and extravagance of design?

"A true architectural style is capable of every shade of expression, from the most light and fantastic to the most majestic and dignified.

"But height in itself is certainly no detriment; height is not inconsistent with dignity; the very contrary ought to be true; the trouble is that we have not yet applied to the high buildings the same truthful, simple, and artistic treatment which ages of experience have taught us to use in monumental buildings of moderate height.

"But the time will soon come when all this will be changed, and when that time does come, I predict that public buildings in the United States will be carried to such amazing heights, that the tallest commercial building will be dwarfed by them. I have no doubt that heights approximating 2,000 feet will be reached within the next twenty-five years, for I see no reason why such heights should not be practical.

"Quite as important as form is the question of site. One hears the expression "civic centre" with increasing frequency, and the opinion is rapidly gaining ground that no public building of great importance should be undertaken singly, but rather as a part of a general plan for city improvement.

"Instead of selecting a new location upon comparatively inexpensive land, with the idea of improving the surroundings by the building up of a new centre, we adhere to the old location, where a general plan of improvement can only be carried out with great difficulty by destroying valuable existing buildings, and by condemning land which is extremely costly. The European method is to reclaim slum districts, to use the sites of abandoned fortifications, or to go away from the existing centre and establish a new town or locality alongside the old one.

"We do not have such opportunities here, but we do have our slum districts and undesirable quarters, which can be transformed at comparatively little cost for the land, and where the improvement would so benefit the surrounding region that the increased revenue from taxation would almost offset, if it did not entirely offset, the cost of the improvement. A law to permit the city to condemn land in excess of its actual needs would certainly make it possible to carry out such plans at little cost to it.

"When great sums of public money are to be spent, why not spend them in a way to accomplish the greatest good? ?

"The advantages of this method are so many and so obvious that it would seem that it need only be suggested to insure its merits over the American way; but it does not find favor here at present, and until we are educated up to it, no very extensive city improvements, through the grouping of public buildings, such as one sees so often in European cities, are likely to take place, for the cost will be prohibitive."

The final paper, from which I will quote at length, is that entitled, "Building in Relation to Street and Site," by Mr. Lawrence Veiller. This paper provoked a great amount of discussion, so I trust you will pardon me if I quote somewhat fully. Mr. Veiller said:

"We have laid so much emphasis in recent years upon the importance of right city planning that there is some danger of our loading it too heavily, of placing upon its shoulders burdens which the movement was never intended to carry.

"Contrary to the popular impression, city planning is not a panacea for all the ills of the body politic. There is a popular belief that city planning will solve the housing problem. Nothing could be further from the facts. The housing problem, as we know it in America, is largely a sanitary problem. It is chiefly the problem of good municipal house-keeping.

"That city planning will not solve the housing problem, is readily to be seen when one considers the experience of those cities in America which have developed excellent city plans. Notwithstanding its almost ideal plan, Washington has the unenviable notoriety of possessing some of the worst slums in the entire country.

"When, however, we come to consider one phase of the housing problem, a phase which fortunately has as yet developed in but few American cities, namely, the problem of land overcrowding or congestion, we find there is a deep and vital connection between city planning and housing reform.

"What are the points, it may be asked, at which city planning touches the housing problem? There are but three—the regulation of the height of buildings, the depths of lots, and alleys. To the deep lot we can trace most of our housing evils, so far as they relate to land overcrowding. The depth of lot, if one can judge from the information received from many American cities, seems to vary from 50 feet to 200 feet. In the great majority of cities the lots exceed 100 feet in depth.

"We must recognize that in every city the time some day comes, when what has once been the best and most fashionable residential district of the town, ceases longer to be so, and gradually goes through that deteriorating process which keen observers cannot fail to have noticed. When a part of a city has been put to uses thus foreign to the original intent, the deep lot which had been an advantage in the original plan, becomes a serious evil.

"With the changed values which ensue under such a development, it is impossible for the owner to keep vacant as large an amount of open space as was possible for the well-to-do citizen who utilized it for his own home. How are we to determine what is the most desirable lot unit for our growing cities? We cannot expect to confine the owners of high-class residences to the narrow limits of the shallow lot that is best suited for the ultimate needs of the neighborhood when, in future years, it becomes a tenement district.

"Realizing, however, the tendencies that will be at work in future years, even in the best residential sections of cities, it is the part of wisdom to establish as the standard a lot of the shallowest depth practicable. What, it may be asked, is the desirable lot unit for a tenement section?

"My answer is a lot unit which will result in houses

not more than two rooms deep. From an architectural point of view there is no housing problem, so long as houses can be built not exceeding two rooms in depth. This involves, of course, shallow lots, and therefore shallow blocks, which means a great increase in the number of our streets, and therefore a material increase in the direct cost of government.

"For our large cities and for our industrial towns I believe the lots should not exceed in depth 25 or 30 feet. This means that there would be no front yard, and no back yard; that the houses built in continuous rows would have one frontage on one street and another frontage on another street. This must seem at first consideration a startling and radical departure from what we have been accustomed to consider as desirable in the housing of the poor.

"In the first place, we should frankly recognize that the common unskilled laborer cannot afford to pay for the vacant land at the front and rear of his dwelling. Such land, if left at the front or back of the ordinary workingman's house, becomes an unsightly bare patch of ground, without grass, and a gathering place for all the waste material of the family existence.

"It would be far better in most cities if the houses were built solidly against each other.

"So far as the alleys are concerned, there is much replanning to be done in our American cities. The alley problem is one distinct in itself, and yet one that must be grappled with if our cities are to progress. Fortunately, it is a problem that can be solved without very great difficulty.

"The remaining point at which city planning touches housing reform, is in the regulations of the height of buildings, and their relation to the streets on which the buildings abut.

"The tall building means concentration of population. It may mean also congestion of population. It means, when it becomes general, lack of sufficient light and ventilation. It means subjecting thousands of people to working under artificial conditions.

"As tall buildings bring so many evils in their train, I think we all agree that they should be discouraged as a general city development. We should, therefore, fix our street widths more with reference to the uses to which they are to be put than with regard to the height of the buildings, and leave the building by-laws to settle various heights for various widths.

"There must be a definitely conscious purpose of bringing about a system of classification of buildings within the city. We may establish civic centres, we may have streets so laid out as to facilitate most readily the movement of the city's population, we may have appropriate landscape architecture, we may have the city's waterways developed, yet, unless with all of these elements of city planning there goes at the same time the determination of the rational depth of lot and the adaption of street widths to height of buildings, the establishment of a rational zone system, the division of the town into quarters for various definite uses, we shall have done little toward remedying the worst conditions which confront us to-day as a result of the lack of a definite city plan."

Mr. Raymond Unwin, of England, in opening the discussion, said that city planning can do more for the housing question than Mr. Veiller seems to believe:

"There are," he said, "two satisfactory forms of city dwelling: (1) The self-contained or cottage dwelling; (2) A group of homes combined within one building. A block tenement of the type which we find prevailing in some great American cities, fulfils none of the requirements of individual freedom and well-being. It is the most unhealthy, the most inconvenient dwelling that we know of, and absolutely the most miserable type of place in which children can be reared.

"The first and most urgent problem is to relieve the pressure of population to some extent, and this can only be done by carrying some of the population into the suburbs and there housing them in better conditions."

Mr. Unwin then proceeded to describe some of the garden city movements in England, instancing Hampstead, where there is a restriction of twelve houses to the acre.

"Mr. Veiller," he continued, "has taken for granted that it is quite the right thing to limit the depth of a building plot, to say to a man that he shall not have a piece of ground for a garden, yard or open space. Why? Because it is difficult to prevent some evil-minded persons from erecting stables or shacks at the back of the house.

"It seems to me, however, that this and other difficulties arise partly from want of proper control of the plot owner and from a wrong system of city planning. Your streets run in the same direction all over the town, and at the same distances apart. Now a town does not consist of a series of buildings of one class; it consists of a series of different quarters required for different purposes, which in turn require different sized and shaped building sites, different widths of roads, and altogether different treatment. If the plan is laid out on the principle of main and subsidiary centres, and a frame-work of main roads to suit the special requirements of each district, this will tend greatly to give stability to the character of each area. When change must occur, it will be comparatively simple to re-arrange the spaces between these main roads as the character of the area changes, and the occasional re-arrangement of a few minor streets would surely be much better than to saddle dwellings with the great expense of constructing a street in front and a street behind merely to secure open space."

Mr. Irving K. Pond, of Chicago, in continuing the discussion, said in part:

"The site of many an important city has been determined quite by accident, and its plan has been rather a matter of happening than of design; so our problem in most cases is more along the lines of reconstruction than of redesign."

"The dedication of certain districts or areas to certain uses is cardinal in what I conceive to be a proper theory of city plan and reconstruction."

Mr. Thomas Adams, town planning expert, Local Government Board, England, disagreed with the somewhat fatalistic remarks that were made regarding the necessity of the tenement system.

"Cities," he said, "are the most artificial part of our civilization. We fix the lines of our streets, we put up ugly lamp-posts, and everything that is necessary to make the cities objectionable. The remedy," Mr. Adams stated, lay in the development of cheap land outside the city, and transportation facilities thereto.

The principal points brought out in the general discussion on Mr. Veiller's paper were as follows:

City planning and housing are connected at three points—depth of block, height of buildings, and alleys—city planning should so arrange streets and divide lots, as to eliminate deep backyards in the poorer quarters, which are the source of most housing evils, so far as they relate to land overcrowding. This necessitates dividing the residential districts into zones, each of which shall have its particular depth of lot. In the poorest quarters the lots should be shallowest, perhaps only 25 feet deep, with streets or other municipally controlled space, which may be used as a parkway or garden, or playground at either end.

If in addition the houses, or tenements, which would be located on these shallow lots should run in a general northerly and southerly direction, every room would have sunlight for several hours.

To meet the difficulty presented by the necessity of varying block depths, the suggestion was made that a block of two hundred and fifty feet in depth should have a fifty foot street running through the middle, thus forming on either side one hundred feet blocks. The fifty feet street should not be immediately constructed, nor should it necessarily be converted into a playground or park, but should be left in public ownership. In this way the conditions which called for a two hundred and fifty foot block would be provided for, and at any time a subdivision into one hundred foot blocks could be made.. The fifty foot strip in the middle of the block, or a strip of varying width, might be used privately for gardens, until such times as it should be needed for public use.

There were many other interesting and valuable papers, but some would hardly be of immediate interest to us as architects, so I will not enter into a discussion of them.

It is noteworthy that a sub-committee of the Conference has been at work to endeavor to frame a statute which should be created to carry out and remove obstacles to the dreams of city planners. The report of this committee was presented at the Conference. Objection was made by Professor Freund to compulsory zoning or districting in cities, owing to the lack of fixity in business life of the city.

The discussion which followed the reading of the report, developed a strong general sentiment for excess condemnation, and a thorough going governmental control of the city's growth.

I feel that it would not be right to complete my report on the Philadelphia Conference without some reference to the warm-hearted manner in which the delegates were entertained by the people of Philadelphia. Besides the various social diversions so generously provided, one also had the opportunity of studying some practical aspects of the town planning proposition, as Philadelphia has under consideration a great re-modelling scheme, several models of which were on view.

At the banquet which concluded the Conference, Secretary of the Interior, Fisher, in assuming his duties as toastmaster, declared that the hope of democracy lies in the city.

"All of us, I presume," he said, "have been impressed with the importance of the city. The cities seem to typify the civilization of the time. We've been told that the problem of the city is the problem of the country. We all know what a preponderating influence Paris has had on France. The great problem to solve is how to work out the difficulties of the cities. I want to record myself with one of those city planners who said: 'The City and Hope of Democracy.' The city is no longer the be the menace, but the citadel of the nation. The things we are concerned about are no longer governmental problems, but we are considering the city as the place where men live and work, and we are trying to make it more beautiful and pleasant. In studying the problems we are glad to know that right here, in this city, so much is under accomplishment along these lines."

Mayor Reyburn spoke briefly to the toast, "Philadelphia's Comprehensive Plans." In introducing his subject, he referred to the great benefits Philadelphia had derived from the members of the Conference, whose valuable suggestions, he said, would help in the working out of his plans.

Count J. H. von Bernstorff, German Ambassador to the U.S., responded to the toast "City Planning in Germany." His address consisted of a detailed description of the manner in which Frankfurt has been planned and developed. He said the City Council had full power to fix the widths of all streets and to prescribe the kind of paving to be used.

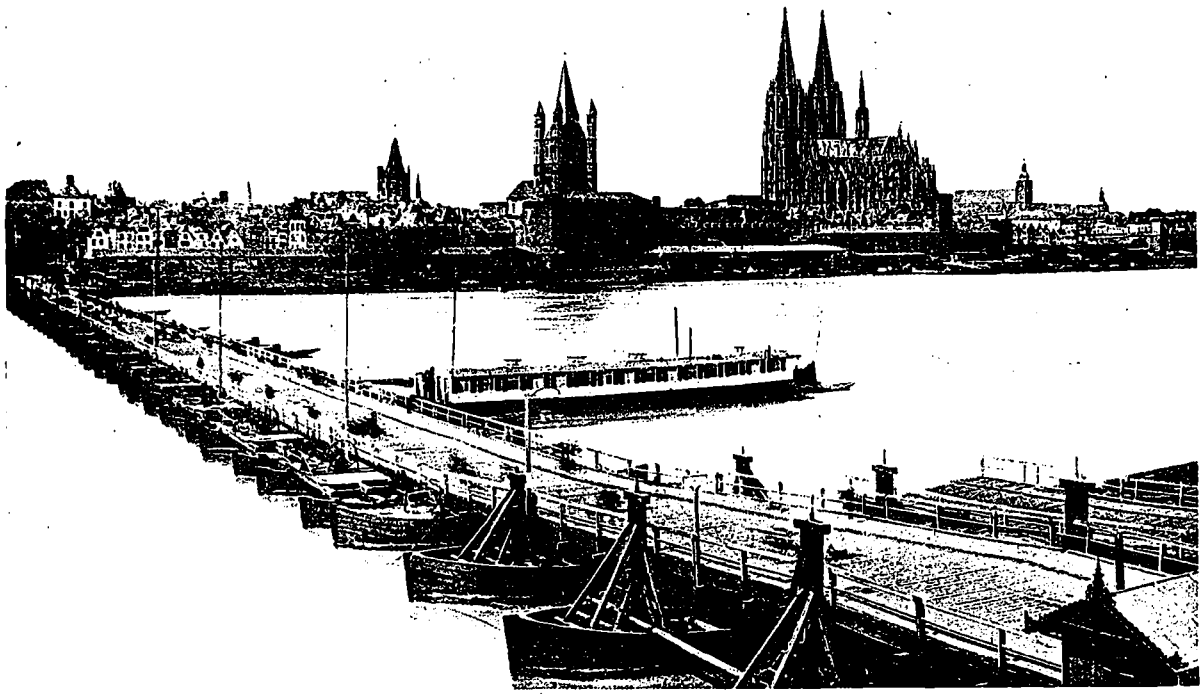
Department of Art and City Planning will be established by the Federal Government, which will work a greater revolution in the development of the United States than that being accomplished now in the comparatively new Department of Agriculture.

"We cannot imagine what a revolution will be wrought in an amazingly short time by the creation of such a department as a part of the National Government," said Senator Newlands. "We can accomplish this only by creating a public opinion in favor of such really constructive work."

In this connection it is interesting to note that at one of the business sessions, it was decided to petition the National and State Governments to take an active part in city planning, and to initiate negotiations with foreign governments for exchanging city planning exhibits.

Gentlemen, in concluding my paper, may I make an appeal for an awakened interest on our part, as architects, in regard to this vital question? We have here a body of men of artistic perceptions and technical skill, gathered from many parts of our country. Since we have exceptional qualifications, have we not also exceptional obligations? What a flood of civic reform would be let loose if the architects of this Dominion plunged into this question with whole-souled enthusiasm. We have opportunity enough. Our towns springing up mushroom like, are they to go through the same process of degeneration and decay that is menacing the older cities, or are they to be built for the future, a tribute to the generation that reared them. We talk of the Broad Dominion, but with our present nonsensical system of city planning, apparently our Dominion is not broad enough to hold even its seven or eight million population. If it were, we surely should not be confronted with the incipient slum evil, which dooms men and women to herd like cattle amidst squalor indescribable.

Those conditions exist to-day, principally as the result of a lack of foresight a few generations back. What is going to be our heritage to posterity? Are we going to shrug our shoulders and say that this is the business of somebody else. I have confidence in the profession that it will rise to the call of opportunity and make the civic life of this Dominion an example to the world in its striving towards the ideal.



Bridge of Boats at Cologne.

THE STORY OF THE BRIDGE

By WALTER SHAW SPARROW

Abstract of a carefully prepared paper printed in the "Builder" in seven parts. Part I., Primitive Bridges. Part II., The Roman Genius. Part III., Mediæval. Part IV., In the Middle Ages. Part V., Evolution of Timber Bridges. Part VI., Stone Bridges and Some Problems. Part VII., Hints on the Study of Bridge Decoration.

V. *Evolution of Timber Bridges.*

THIS SUBJECT IS VERY important, and we took a rapid glance at it in my first article, but no time will be lost if we try to get into closer touch with its broad aspects.

There are three lines of descent in the lineage of timber bridges, and each of the three comes down to our times from a very remote period in the life of prehistoric man. Sometimes they unite and sometimes they intersect, and the results produced by their separate action and by their intersection evolve traditions and types in the art of building. It is convenient to put a name on these lines of descent:—

1. Primitive endeavor, which often hardens into stereotyped forms of unskilled carpentry.
2. Primitive carpentry of a progressive order.
3. Skilled and constructive carpentry in which mechanics and fine art go hand in hand together.

The first line of descent had its rise in two ways—in overthrown trees, which may be called windfall bridges, and in branches of trees that happened to span rivers from opposite banks. These were the earliest suspension bridges, and natives use them now in Central Africa.

The nature-made bridge is older than the remains of the Galley Hill man, the earliest known Briton, whose age has been estimated by Professor Arthur Keith as about 170,000 years, perhaps more, and whose skeleton, dug up from palæolithic gravel in Kent, together with teeth and bones of the mammoth, a tooth of the hippopotamus, and a lion's foot, is well within the range of variation in recent man. This wonderful fact is admitted by anthropologists. So we may rest assured that the cradle centuries in the nursery of the human race preceded the Galley Hill man by a long, indefinite time—long enough to

get rid of simian characteristics. Indeed, the Galley Hill man was contemporary with remarkable attainments in the line of art, sculpture, engraving, and painted decorations on the walls of caves. Hunting, too, required infinite resource and pluck and skill, because the fauna comprised lions, bears, hyenas, sabre-toothed tigers, bisons, the mammoth, and the wooly rhinoceros. It is clear, then, that 170,000 years ago, or thereabouts, the intelligence of man was alert and wide-awake; and this is a thing to be kept in mind when we think of the romantic descent of bridges from a tree which a storm of wind had hurled astride some deep hollow in the ice or in the land, making a safe footway for an early ancestor of the Galley Hill Briton.

From this accident we pass on to a tree which man himself cut-down deliberately in order that it might span a dangerous gap in a field of ice or an abyss formed by a mountain torrent. Human intelligence, the inventor of sculpture and painting, would wish to do what a gale of wind had done by accident; and from that moment the first principles of secure bridge-making were discovered. Not only was the footway strong and firm, but branches growing from the tree-trunk gave support to the hands. Any bough that blocked up the way could be topped off with a flint axe, till at last no handholds would be left save those which were convenient and necessary. Even to this day in country woods we find rustic bridges having not much more art, bridges so narrow and so simple that the footway, roughly hewn from a tree-trunk, is rudely guarded at the sides with handrails of dressed branches.

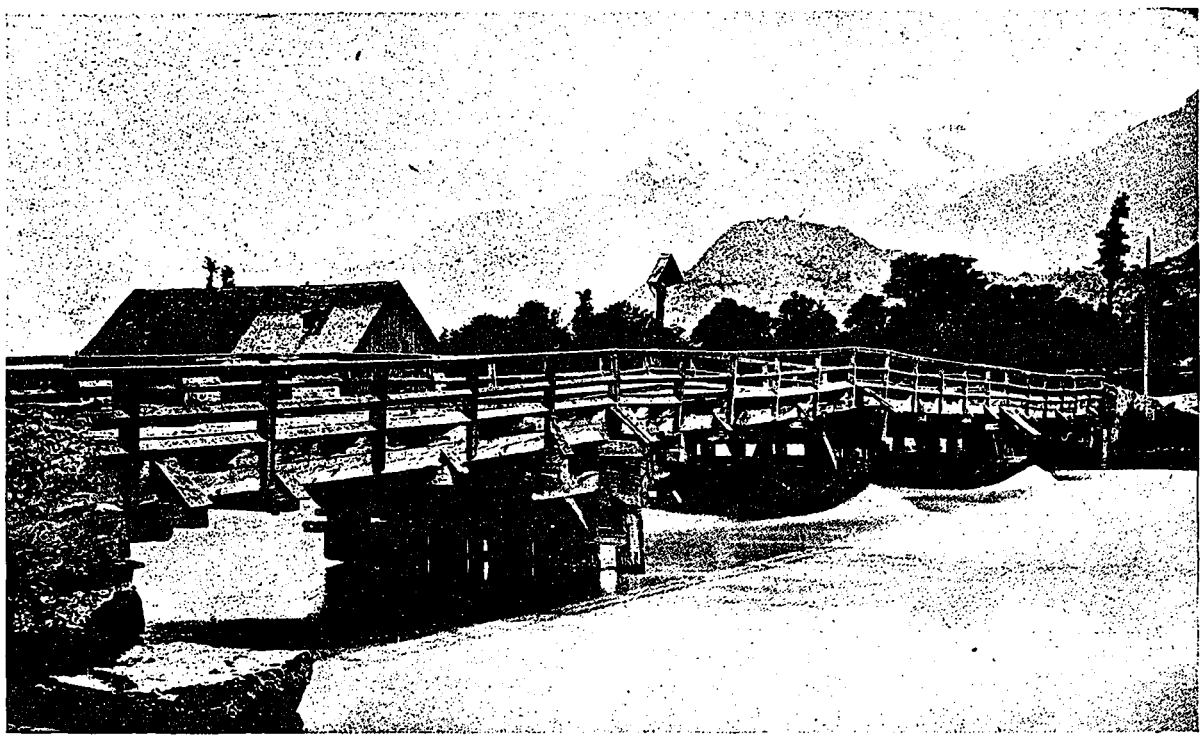
This first type of bridge is a narrow pathway for men walking single file. But its descendants are many and various. I will mention a few. The earliest would be suggested by circumstances of war. A single tree-trunk stretching from bank to bank would not be of much help in a rapid attack, since the act of crossing it single file would be a slow movement and quite easy to repel. On the other hand, if several tree-trunks were laid side by side several warriors could advance abreast; and if the tree-trunks were placed at some little distance from each other, then covered transversely with branches and with turf and soil, a still wider bridge could be made with the exercise of less invention than that which Quaternary man loved to exhibit both in his rock-painting of animals and in his sculpture. If you consult Don Antonio de Ulloa (1716-1795), you will find that bridges of this type have long been made in the mountainous parts of South America. He says that the wooden bridges "consist of only four long beams laid close together over the precipice, and form a path about a yard and a half in breadth, being just sufficient for a man to pass over on horseback."

Other types of the primitive bridge were suggested by man's earlier efforts to make a home for his family. Thus, for example, the construction of the first lake-dwelling was a great event in the primeval craft of bridge-making; and we infer, from evidence that still exists in different parts of the world, that the foundation of timber logs under lake-dwellings became useful also in spanning rivers, as among the ancient Gauls, whose methods of bridge-making united the footway of felled trees to a criss-cross of tree-trunks to form piers and abutments. This Gaulish handicraft has survived in Savoy, and we find an Eastern parallel in the log piers of Kashmir bridges, where a descent from lake dwellings is often strikingly suggested by quaint little rude booths and shops along the footways.

Again, another development from the tree-bridge is what I may call the step-ladder bridge such as you will find at Bettwys-y-Coed, where the Miners' Bridge takes you at a sharp angle from a low level to the summit of a bank. That is a ladder rather than a bridge; and a similar thing, but more adventurous and intricate, was seen in Tibet by Capt. Turner in 1783. This was a bridge of turpentine-wood forming two ladders; these were inclined towards each other, but separated at their tops by a considerable space, across which was a level platform. The ladders tapered upwards, their lower ends were fixed in masonry, and handrails aided the ascent. This bridge, in 1783, was said to be 140 years old. Its purpose was to escape from floods, and so we may connect it with that old type of European bridge which ascended at a sharp angle to the centre and then shelved downwards. Many railway lines of today are crossed by stepped bridges having a horizontal platform at top to connect their sides.

But these bridges are all firm and heavy, and you will think of other primitive examples which are frail, like Congo bridges of boughs and stakes and bindweed. Whence came these fragile structures? From the primeval art of the round hut, from the architecture of rods interlaced with osiers and plastered with mud and clay? Stick bridges and bamboo bridges belong to a phase of human handicraft having a certain frail elegance, a certain revolt against rude and clumsy heaviness. Such work is often ineffectual, yet it lives on in a good many parts of the world, and here and there it has some architectural charm, notably in the roofed bridges of bamboo at Sumatra, a protection against heat. In another old type of covered bridge, namely, the Swiss, the aim is to keep the footway free from snow. But the odd thing is that the timber bridges of Switzerland are still primitively rude in construction; they seem to show no advance on the Pons Sublicius of the Romans.

Several authorities have attempted to restore the Pons Sublicius from descriptions given in the historians, and I note two of the restorations, one by Canina and the other by Colonel Emy. They differ much. Canina strengthens the footway between each span, fixing a beam slantwise from each road bearer to one of the pier timbers. Colonel Emy, on the other hand, chooses a slighter design, in which I do not feel the genius of the Roman people. That the Sublician bridge was a solid structure, very difficult to destroy, is vividly shown in the legend of Horatius Cocles and the great fight which he and his two companions fought against the whole Etruscan army under Porsena. It was necessary for them



Sion Bridge and Mount Ardon.

to keep the enemy at bay while the Romans broke down the bridge behind them, and the story does not lead us to suppose that many axes made a gap without much difficulty.

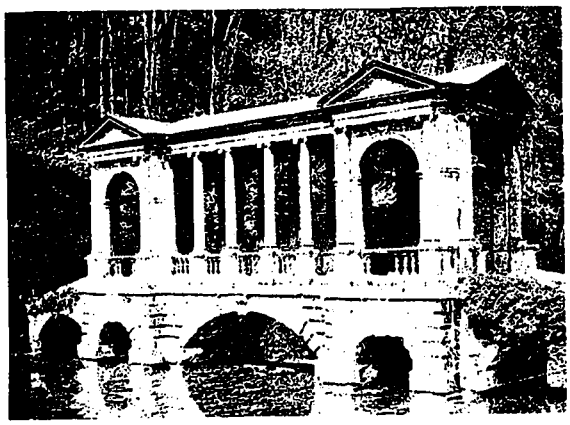
The Roman timber bridges, as described by the historians, have had many modern descendants. Palladio built one at Bassano, the Bridge of Brenta, but he added a roof carried by slender wooden pillars. There were five arches of 12½ metres each, and a roadway 9 metres wide. The beams bearing from pile to pile were strengthened with straining beams and with braces; this formed a rude approach to an arch of timber, and like an arch it exerted a lateral thrust and required abutments. Perhaps you have seen illustrations of a wooden bridge designed by Robert Stevenson and built over the Clyde at Glasgow in the years 1831 and 1832. The main principles were precisely similar to those both in Palladio's work and in the drawing by Canina of the Pons Sublicius.

Stevenson's bridge had fourteen spans, each of 34 ft., measured from centre to centre of the piles forming the piers, and giving in all a waterway of 476 ft., uninterrupted except by the narrow width of the piles. A span of framework consisted of seven ribs, each composed of three beams—that is to say, of two diagonal braces and a horizontal straining beam. The braces were 13 in. in depth and 12 in. broad, and each straining beam was 12 in. square. The whole structure was carried by thirteen rows of bearing piles. Seven piles made a row, pitched at a distance of 5 ft. 2 in. apart, and secured to each other by four pairs of collar braces.

To find European timber bridges of rare excellence we must study the three great masterpieces designed and brought to completion by the brothers Grubenmann, and destroyed during the war of 1799. Ulric and Jean Grubenmann were village carpenters, born at Teufen, in the canton of Appenzell. Ulric seems to have been the abler of the two; certainly he was a man of true genius, who gained unrivalled knowledge of what could be done in the spanning of great distances by a skilled use of corbelled and trussed bearings. He began the bridge of Schaffhausen in 1755-56, and in 1758 his work was complete. The total distance covered in two spans was 364 ft.; the stone pier was 8 ft. out of a straight line, and the angle pointed upstream. The abutment near Schaffhausen was 171 ft. from the angle, and from the angle to the opposite shore was 193 ft. Ulric would gladly have spanned the whole distance in a straight line and in one magnificent bay, but the authorities interposed, ordering him to find use for a masonry pier remaining from a stone bridge which a flood had ruined in 1754. Telford believed that Ulric Grubenmann could have built the whole structure over the Rhine in a single suspension from abutment to abutment. So perfect was the work, so admirably scarfed, trussed, strutted, braced, bolted up, and suspended, that only two faults could be found with it—namely, the roof was too heavy and ugly, and the parts were too dependent on each other, so that an injury to one portion of the structure from a cannon-ball, for instance, might have proved disastrous to the bridge as a structure.

Grubenmann's methods were simple. "The braces proceeding from each abutment," said Telford, "are continued to the beam which passes along the top of the uprights, and the lowest of these general braces are actually united under that beam, thereby forming a continued arch between the abutments, the chord line of which is 364 ft. and the versed line

about 30 ft. These braces are kept in a straight direction by the uprights, which are placed 17 ft. 5 in. apart. If this bridge had been formed in a straight line between the abutments I can see no reason why this form of construction should not have supported a roadway of about 18 ft. in breadth, as well as a slight roof; because, in that case, all the weight arising from the braces which proceed from the middle pier would have been saved, and the



"Palladian" Bridge, Pryor Park. Built by Ralph Allen, 1750.

roof might have been made much simpler and lighter."

While Ulric Grubenmann was working at Schaffhausen his brother John built a bridge quite similar in kind at Reichenau, 240 ft. in a single span; and then, some years later, the two brothers constructed their Wittingen Bridge over the Limmat, near Baden. It had a span of 390 ft. The form of construction was different. Seven beams were built close upon each other, forming a catenarian arch between the abutments, with a rise of 25 ft. The beams were of oak, in lengths of 12 ft. or 14 ft., breaking joint in the manner of masonry. They were not fastened by pins, bolts, or scarfings, but were kept together by iron straps placed 5 ft. from each other and fastened by bolts and keys. The roadway intersected them at about the middle of their rise.

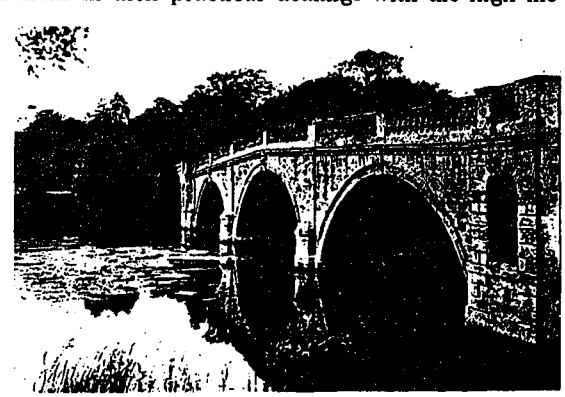
The influence of the Grubenmann brothers travelled to America, where it found in Bludget an able interpreter, for Bludget's bridge over the Portsmouth River was similar in principles to the bridge at Schachausen over the Rhine, and its span was 250 ft. Since that time the evolution of timber bridges has remained in the U.S.A., where it may be studied in work having great variety, for it ranges from the criss-cross of logs for bearing piles to the most intricate combinations of lattices and trusses. There is at times too much intricacy. "Many wooden American bridges are trusses which almost defy analysis, the designs being, however, obviously suggested by an attempt to combine at least two of the three types of bridges. No advantage whatever is gained by a combination of this kind; on the contrary, great disadvantage is almost sure to follow its adoption, namely, that it will be impossible that each part of the structure should, under all circumstances, carry that portion of the load which the designer entrusted to it. For suppose a bridge constructed partly as a girder and partly as a suspension bridge, the girder being very stiff and deep, the chain perfectly flexible with considerable dip. Let the chain and girder each be fit to carry half the passing load. It is perfectly conceivable that the deflections of the two should be so different that the girder would, under the actual load, break before the chain was sensibly strained, or the difference in the relative dip of the chain and depth of the girder might be such as to cause the former to give way first." (Professor Fleeming Jenkin.)

And many American bridges provoke another criticism—they belong to a nation that believes itself to be free from the dangers of war in its own home territories. Think of the giant Portage Bridge, and imagine a modern shell falling upon its woodwork, which rises on a huge scaffold of timber frames over the Genesee River, 234 ft. above water level. The scaffold piers rest on masonry piles above the level of floods, and they taper upwards to a double gallery forming a support for the railroad. The general effect has the trellised fascination of a scaffolding, and we see in the design that same passion for a sort of airmanship in light craftsmanship to which street architecture in the U.S.A. owes the sky-scraper.

In a later paper an attempt will be made to consider modern bridges in their relation to those preparations for war that turn so many countries into armed camps.

VI. *Stone Bridges and Some Problems.*

In reading the history of this subject one is troubled by half-a-dozen questions that flash into the mind repeatedly, and find there no answers based on authorities. To what extent were the ancients guided by mathematical theories and calculations in their practical dealings with the high me-

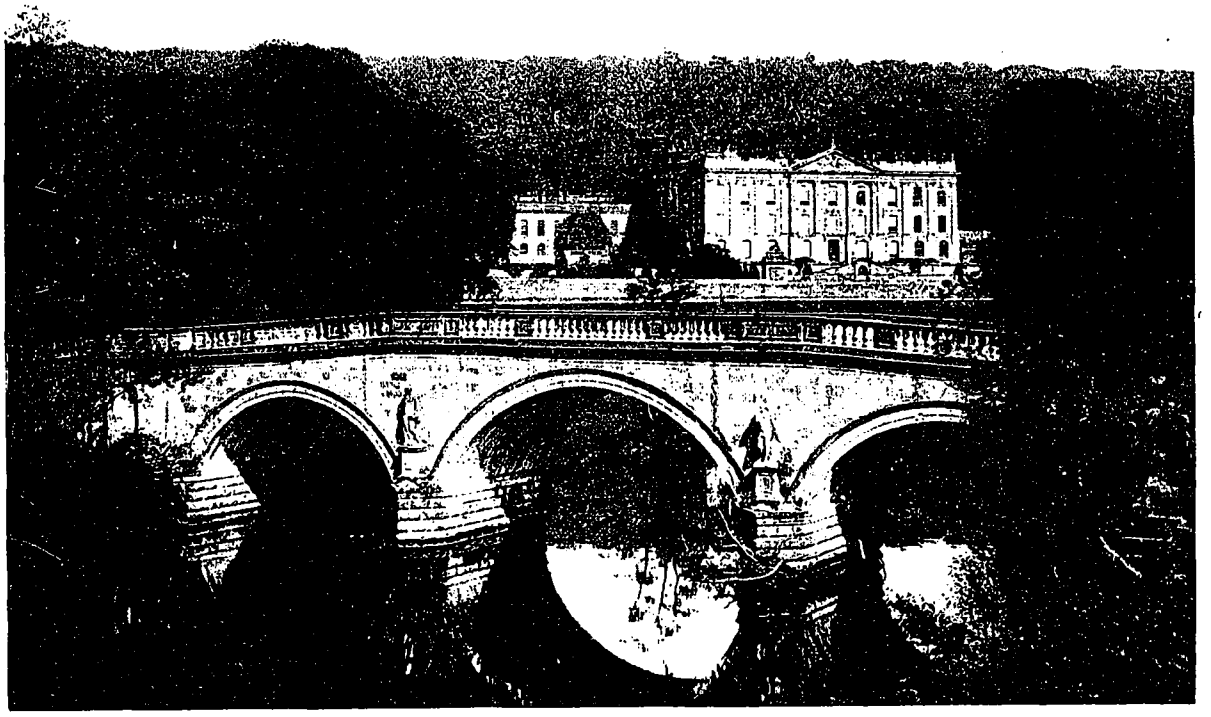


Bridge, Renaissance Type, in Cumberland Park, the Dukeries.

chanics of arched bridges? Did they start out from the point of view, afterwards held and explained by Bacon, that experience was the only safe guide to success in practical work? Were some of them at all like the great mathematicians of the 17th and 18th centuries, who often passed by experience and observation, founding their analytical research on hypotheses which were contradicted by events and by experiments in craftsmanship. Was there among

the Romans such a man as Leibnitz, who, in 1691, solved the problem of the catenary curve, showing that this was precisely the curve which an arch ought to have if its materials, infinitely small and of equal weight, were to rest securely together and in equilibrium? And was there a Roman Bernouilli, or a Roman La Hire?

Unfortunately we cannot get at all near to the scientific art of bridge building, as this thing appealed to the Romans in hours of speculative talk. Vitruvius does not help us here. But if we can take for our criterion of what was probable and likely from the general character of the Roman genius in action, then practice in bridge building was the only recog-



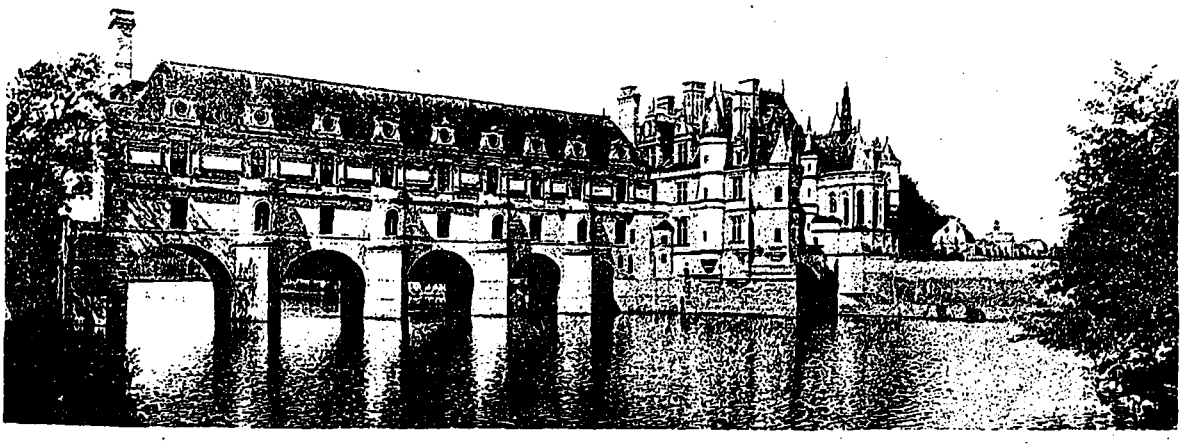
Chatsworth Bridge and House, Derbyshire. Renaissance.

nized guide, just as success or failure in war was the only recognized test of a general and his troops. Practice bred traditions, traditions formed a discipline of craft laws, and these things, passed on from generation to generation, were familiar to all good masons, so that architects and engineers had at their beck and call a body of workmen thoroughly conversant with those stern facts of practical mechanics that the winnowing experience of centuries had kept and treasured for the common use. Roman bridges and aqueducts, still extant, though sometimes in ruins only, belong to periods often wide apart in date, and from their family likeness we can infer with safety that in this perilous work, subject always to the waywardness of storms or the devastating power of floods, and the vibration of heavy traffic, sound conservative methods were the rule, little store being set on experiments in cheaper ways of attaining the same measure of convenience. It is remarkable, for example, that, although the Romans took infinite care in the making of their cements, they mistrusted mortars of any kind in bridge arches, preferring to give a huge aqueduct such dimensions and such proportions of its parts as would enable it to stand firmly without any cement at all between the joints of its masonry. Experience had taught them, we may believe, that slow-drying mortars were very compressible, and that quick-setting cements could not be used without risk in hewn masonry, because of the time which must elapse between their use and the bedding of heavy stones in their places upon it. They must have known, too, that when mortar was used in a bridge there should be no more of it in any joint than just enough to hinder the contact of stones, and to exclude the air without harm to an even bearing. To do the work without mortar was a compulsive discipline that made thorough craftsmanship a habit, and how perfect this construction with dry stones could be in Roman hands is very well shown in a story that concerns the giant aqueduct of Segovia. Several arches of this great monument were broken down during the wars of the 15th century, and Isabella the Catholic had them reconstructed in the best manner of her time. Less than three centuries later the reconstruction gave way, necessitating further restoration, while the untouched Roman work remained a prodigy of youth in heroic old age. Marshal Ney visited the aqueduct in 1808, and when he saw the startling contrast between the old work and the new he pointed to the modern part and said, "The labor of men begins there!"

For the Roman arcades seemed like the work of gods.

The most pitiful things in human "progress" are the dry rot of theories and the cancer of cheapness that eat their way into the vitals of craftsmanship. In the 18th century a disease of theoretical speculation got a firm grip on the technics of bridge building; no work of importance was done without interference from library mathematicians, as well as from infinite talk and hesitation. Greater ado could not have been made if a successful bridge had never been built in the history of the world. And what good came from all the fustian of jostled theories? Perronet was regarded as the most scientific bridge-builder of his time; his knowledge was said to be prodigious and his gift of writing enabled him to be persuasive as well as scientific and learned. Yet his work was accompanied by blunders which in the Middle Ages would have shamed a quiet practitioner like Isembert, whose art was a rational application to special needs of thoroughly tested old methods and traditions. Perronet's self-confidence was so great that his operation of striking the centres of the bridge at Neuilly, by removing the immediate support of the arches, was begun eighteen days after the keystones had been put in their places, when the mortar had not yet become hard enough to bear new pressure without yielding. The crowns of the arches sank 23 in., showing that his mathematical resolutions without excellent mason's work were dangerous and humiliating. Smeaton, in a more tragic way, had to learn the same lesson from his disastrous bridge over the Tyne at Hexham, and learned engineering did not save the Tay bridge from catastrophe. One could name many other examples of bad work, all arising from self-conscious and theoretical habits of mind passed on to the 19th century by the spirit of the late Renaissance art. Is there not more in rule of thumb than in rule of theory?

To study the worth of local traditions we have only to take a tour through Wales, where, as late as the second decade of the last century, the master mason of every district was able to build a good sound bridge, obeying traditions probably as old as the mediæval bridges at Llangollen, Brecon, and Holt. Welsh masons were never ashamed of scabbled faces to their stone bridges, nor of rough natural textures; their economy went hand in hand with good taste; while we for a long time have spent many thousands of pounds on daintily-finished craftsmanship that looks tame in a pile of ordered masonry. I have never seen a genuine Welsh bridge that did not add romance to a fine landscape setting, and I wonder always why Englishmen have failed to keep their old fondness for a bold handling of stone in bridges. Remember the feeble affectations that try to look architectural in the coupled columns to Waterloo Bridge. Rennie, like Telford, wished to be architectural, and he was encouraged by the example set by Perronet. But Rennie and Telford were engineers, and never once did they achieve success in their efforts to be architects also. It was not in their nature to do what Ammanati had done in the finest bridge of the Renaissance, the Ponte della Santissima Trinita over the Arno at Florence, where the graceful and rhythmic arches have curves which are cycloids. Their rise from the springing level to that of the crown is only a trifle more than one-sixth the span, while the roadway above, though starting from approaches which are but moderately raised, has a mild gradient admirably suited to the needs of town traffic. The piers are in excellent proportion, and their stern cut-waters are useful foils in an architectural design unrivalled among bridges for its blending of lightness with alertness and supple vigor. Yet one Victorian expert, William Hosking, in 1842, tried to prove that the piers were too massive, but he was laughed at by architects, who said that Ammanati alone could have improved the noble design. The fact is that from the 18th century onward engineers were for ever busy with projects for reducing the size of bridge piers, and in this they were partly right and partly wrong. They were partly right because the mediæval system of using piers as abutments had many disadvantages, though necessary in those days either for military reasons or because a bridge had to be a sort of perforated dyke to deepen the river up-stream. Old London Bridge was such a dyke, and all mediæval bridges



Chateau of Chamonceaux.

of any note could be cut for defensive purposes in any part of their course without much risk to adjacent arches. On the other hand, monster piers not only interfered with navigation; they formed many a dangerous rapid below bridge, they turned flooding water into inundations, and made the drainage of mediæval towns unhealthy. All these points were noted in the 18th century, and much thinner piers were advocated as if they had no disadvantages of their own. The thrust was to be carried over the arches to the abutments. There were to be no abutment piers at all, though wars and rumors of wars kept Europe in a ferment. Perronet alone protested. He told his employers, the French Government, that it would be prudent, in designing bridges for rivers of great width, to introduce some strong piers, which, in case of need, might serve as abutments; they could be placed at distances of three or four arches apart.

I hold, then, that modern types of bridge building are all imperfect, and that the next European war will prove this to be so. While engineers have been constructing their hideous metal monsters, and scheming to get in masonry the maximum of strength with the smallest amount of materials, a necessity for defensive preparations has pressed with ever greater urgency on all alert nations, and the result is that ways of communication everywhere are out of keeping with the needs and with the destructive power of modern war. In recognition of this plain fact, what importance need we attach to such details of construction as the relative proportion between the breadth of piers and the span of arches? Here is a little table to show how the engineering mind has viewed that one point from Roman times to the reign of Victoria:—

Bridges.	Breadth of piers.	Span of arches.	Period or Engineer.
*Rimini	5	33	Roman.
†Vicenza	11	25	Roman.
†Alcantara	38	110	Roman.
‡St. Esprit	32	115	Mediæval.
‡Old London	15 to 34	10 to 33	Mediæval.
‡Lyons	44	96	Mediæval.
§Port Royal	44	72	Mansard.
§Orleans	19	106	Hupeau.
§Neuilly	14	128	Perronet.
§Llanrwst	10	58	Inigo Jones.
§Westminster, London	17	76	Labelye.
§Blackfriars, London	20	100	Mylne.
§Perth	18	77	Smeaton.
§Dunkeld	14	90	Telford.
§Kelso	12	72	Rennie.
§Conon	8	65	Telford.
§Bewdley	8	60	Telford.

*Unusual proportions in Roman work.
†Each pier an abutment.
‡War bridges, with piers acting as abutments.
§Modern peace bridges, showing their variations from the 17th century to the death of Telford in 1834.

It will be seen that the proportion has been varied from nearly one-half of the span to a ninth part of the chord. What a war bridge should be at the present time is a hard nut for architects and engineers to crack: but an arched bridge, carried by a new and much lighter type of abutment piers, seems to be least at variance with the common sense of military defence.

The subjects chosen for illustration include the beautiful bridge by Ammanati, architect and sculptor, who died in 1592: the Rialto, finished by Antonio da Ponte in 1591; some English Renaissance types, and a striking general view of seven Paris bridges. I do not know whether the piers of a bridge are proper pedestals for figures in sculpture, but the Chatsworth bridge is one example among many of this decorative convention. A flood would wash the statues thoroughly and keep them clean, but this seems hardly enough to account for their position above the cut-waters. The Rialto, founded on 12,000 piles 10 ft. long, is carried above the Grand Canal to a height of 24 ft. 6 in. Its fine arch has a span of 91 ft., and the footway is 72 ft. wide. The design has often been given to Michelangelo, but it belongs unquestionably to Antonio da Ponte, who was chosen by the Senate in a competition against Palladio.

Hints on the Study of Bridge Decoration.

M. Charles Beranger, of the Librairie Polytechnique, Paris, has begun to publish a series of full and thorough books on bridge-building, as useful to us as to French students. Already eight volumes have been issued. They include:

1. "Ponts en Maçonnerie." Par E. Degrand, Inspecteur-Général des Ponts et Chaussées, et Jean Résal, Ingénieur des Ponts et Chaussées. Two volumes, illustrated; 40 francs.
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For this great work, to be completed in five abundant parts, M. De Dartein has made exact measured drawings from sixty-eight bridges, and each example represents a well-chosen type having great historic interest. The author has taken a line of his own, dwelling on the ornament of bridges, their decoration, and from his earnest study of the 18th century we learn what he admires in one varied phase of French design. He is thoughtful and thorough, but I wish some photographs had been added to the illustrations, because measured drawings give only the dry bones of constructed work. How to decorate a bridge is a question beset with so many practical difficulties and so many artistic problems that it ought to be discussed by a congress of architects and engineers. I cannot think that M. De Dartein will say the last word on this important

Ponte Rialto, Venice. Built between 1588 and 1591, by Antonio da Ponte.

theme, but his material and his personal taste will be invaluable, presenting facts and provoking discussion. He lingers often enough over details of ornament, which, so they seem to me, are superfluities in a bridge, because they swell the cost of production without any real benefit to the mingled utility and dignity needful in bridges. These qualities should appeal to us in great stern lines, in rhythmic proportions, and in a scale that befits the surroundings. No bridge can be fine and beautiful when it is dwarfed by its environment or when its own bulk is so massive and uncouth that it degrades a neighborhood. Many engineers do not grasp the truth of this criticism, for their metal monsters are often as wrongly placed in a quiet and gentle landscape as a giant from Brobdingnag would be at Lilliput. The Roman bridge at Alcantara is noble and heroic just because the scale of it is in grand accord with the rocky vale of the Tagus. It completes a grand site, and finds its own completion in that site. This happened also in the Roman bridge at Narni, by which two mountains were linked together across the River Neva.

I have spoken of this bridge in an earlier article, but may add that in the existing remains, consisting of a pier and a fine arch, there is no applied decoration. The main thing to be noted is the powerful ring of voussoirs, because, extradossed in a very remarkable manner, it is independent from the spandrils. A bridge with arches of that type has architectural character, and this quality is obtained by designing arches for a special purpose, i.e., to save them as much as possible from the vibration of heavy traffic sent down from the roadway through the spandrils. Still, it cannot be said that all fine Roman bridges were free from redundant ornament. Pomp and pride exerted a bad influence at times; and from the Roman genius later ages borrowed numerous superfluities that weakened the aspect of bridges in many countries. It is in such Roman work as the Pont du Gard, where no detail is called for, and where the architect's aim was to meet nobly the needs of a well-considered programme, that we realize the futility of adding to a bridge any detail that neither springs from nor calls attention to some organic essential. To construct ornament is easy—is, indeed, a commonplace of bad taste, while to ornament construction is difficult, because judgment tells us that a great design carried out in simple and thorough masonry is in itself ornamental and complete. Applied decoration may harm it, just as a human face is disfigured by sticking-plaster.

Consider, too, the bridge-builder's own attitude towards his art, for upon that more than anything else the character of his work depends. What has he got nowadays as an inspiration? He has all the self-consciousness that modern life produces and increases; he has also as a dictating guide the industrial spirit, with its delight in cheapness and its tolerance for hideous designs; and so, if he in his duties as an engineer is to produce art, he must achieve that good thing by deliberate effort and without help from his employers. Every now and again, by rare good fortune, an engineer builds a bridge having some rude grace of its own, some quality that seems a near neighbor to art itself. Thus the Menai Bridge does not spoil a glorious landscape, unlike the Britannia, a monstrosity that cost £398 per foot run. From one point of view the Menai Bridge is bad, and we return to an important subject when we note that suspension bridges are so vulnerable as to be unfit public servants in a time of war. They represent a sort of aviation in mechanics, which modern artillery would soon destroy. Any such bridge as the Pont de la Caille on the route between Geneva and Annecy, or the steel suspension over Niagara gorge, would have little value as a road if even one shell struck the permanent way, so called.

This consideration is one among many that we have to weigh carefully when we wish to look at bridges in their relation to life and art. M. De Dartein, I believe, lingering over decorative features, loses count

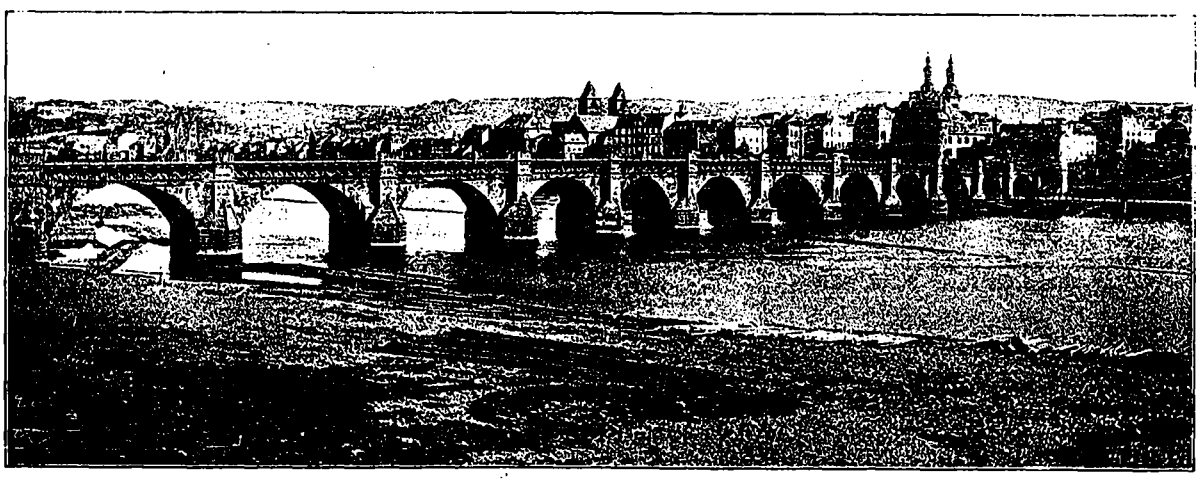
of the plain fact that bridges ought to show in their construction some fitness for their great work as essential agents in military tactics and strategy. At a time when a secret society of bridge-wreckers, guided and disciplined by a military power, could do incalculable damage to railways and other roads at the outbreak of hostilities, having previously sent two thousand men with explosives into the country to be attacked; at such a time, surely, bridges should not be studied because of their ornamentation. All spies and secret agents could be bridge-wreckers also, and a good many of them may be, for we cannot suppose that strategists on the Continent are blind to the demoralization that would seize upon an enemy if at the beginning of a war the business of concentrating troops to resist invasion were seriously impeded by shattered railway bridges. Are you not amazed, therefore, that the utility for war in mediæval bridges became a lapsed principle, when it ought to have been handed on to our time in a series of adaptations responsive to new conditions? So my views on the decorative aspect of bridges, like those on other questions belonging to my subject, have for their aim the realization of what a bridge should be in an age that prepares for war. I am not moved by those types of modern bridge-building that crib from civic architecture, displaying columns, pilasters, niches, battlements, balustrades, turrets, and towers, pinnacles, statues along parapets, and statues above the cut-waters of piers, with other finery that serves no purpose in the essential life of a contemporary bridge. What Hoskings said in 1842 is good as a criticism to-day. He pointed out that the most eminent engineer-architects, in their efforts to take hints from street buildings, had failed to produce anything but meanness and absurdity, or a combination of both.

What this critic would have said had he lived to see the Tower Bridge, with its spurious mediævalism and its biscuit-like aspect, I cannot imagine. Hosking had common sense, and he seems to have been allied with a bad temper. Among the principles that he advocated strenuously I should like to note three:

1. That bridges, in the combination of their leading lines, should be bold and simple;
2. That infinite care and skill should try to make their passage across dangerous places a secure and safe highway; and
3. That far too much money is wasted in stone bridges on the high finish of exterior surfaces. Hosking was disinclined to regard great city bridges as probable exceptions to this rule, for he said: "It may be fairly questioned whether both Waterloo and London bridges would not have been finer objects had the masonry of their external faces been merely rough-axed, or even left scabbled, instead of being fair hammer-dressed; and certainly many thousands of pounds might have been saved in the execution of the former work, and a much better result produced, by the omission of the coupled columns and their immediate accessories, and by the use of a plain parapet of a more reasonable height, instead of the high, the enormously expensive, and absurdly ugly balustraded enclosures which now aid the columns and their projected entablatures to deform that splendid structure."

This Puritan outlook appeals to me, for I believe that good bridges should be as sternly efficient, as indomitably fit for their purpose, as were the Ironsides of Cromwell's army. Beauty in a bridge is a thing apart from any Cavalier-like finery of dressing ornament. It shows that the different members forming a bridge are co-ordinated with fine judgment, and that the build of each member is in nice accord with its own work and with the great office which the bridge as a whole has to fulfil daily under varying conditions of stress and strain, and in relation to its environment.

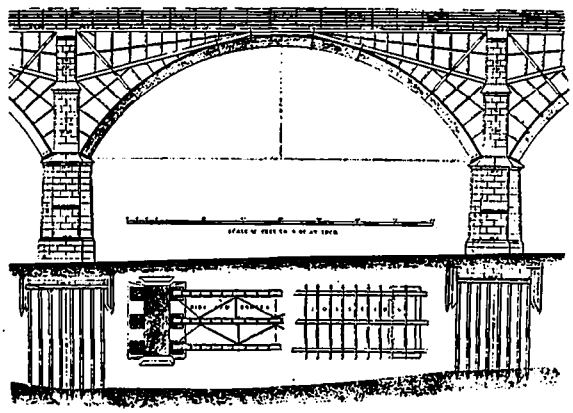
When the railway bridge at Ludgate Hill was finished there was a public outcry against its gaunt and shabby ugliness; but as soon as some ornamental metalwork was fastened upon its sides the outcry ceased, as if such a trumpery makeshift could give merit to an imbecile design that disgraced the main road leading to St. Paul's Cathedral. When things of this kind are allowed to happen in the heart of a great city, who can have confidence in civic authorities? What chance is there that new projects for bridges will be considered publicly and officially



Moselle Bridge, Coblenz.

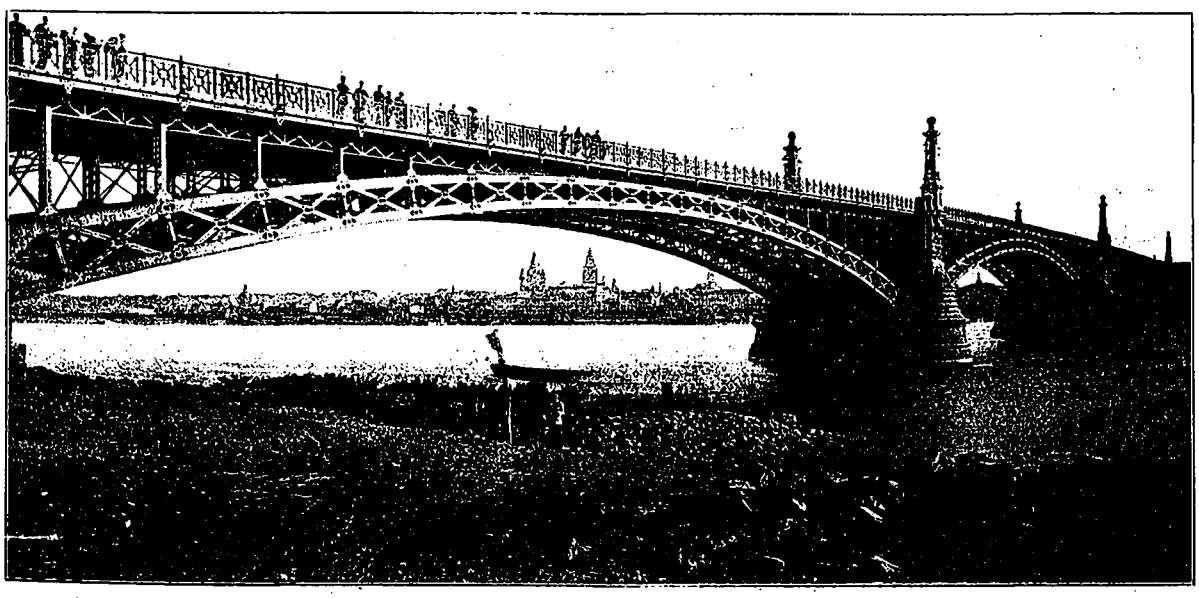
from the various standpoints determining their value in peace and in war?

Some types of bridge-building stand apart from each other in abrupt contrast. The Tower Bridge, London, and the Roman bridge at Narni, Italy, are separated not by centuries only, but by a marked degeneration in the spirit of craftsmanship. What would be the use of those ornate towers if the suspended roadway connecting them with the bank-sides were cut by a shell or by explosives? And what historic relation exists between the principle of



Wellington, Dean, Railway Bridge. Victorian.

metal suspension and the towers, whose corner turrets and tall pyramidal roofs seem like feeble echoes from the French Renaissance and its Gothic inheritance? The Menai Bridge is better by far, and note that the cables rest on the summit of their supports, unlike the tubes of the Britannia Bridge, which pass through the towered piers about two-thirds up, so that we wonder how the masonry of the upper parts is upheld. This mistake had its original source in a misunderstanding of two things—first, that a column or a pier is meant to bear a weight placed on the top of it; second, that bridge towers of old were neither decorations nor make-believes, but necessaries of mediæval town life and warfare. They were to defend the bridge and its service to citizens. Note the difference in spirit between it and the Old Brig of Stirling, that we must place among the best bridges of its period. Its design has a fine rhythm, its round arches are admirably handled, and the simple masonry has vigor and grace. I give, too, by way of contrast, a photograph of the first metal bridge, dating from about the year 1780. At an earlier date, in France, an attempt was made to erect a bridge of cast iron, but the project was given up as too costly. This occurred at Lyons in 1755. Then an English ironmaster, Abraham Darby, became possessed of the same idea, and he made use of it with practical success in the Severn valley, hard by the town of Ironbridge. Cast-iron was chosen, in ribs consisting of two pieces; and a bold design proved that a new principle could be adapted with grace and efficient skill to the historic tradition of semi-circular arches. This bridge still exists. It crosses the Severn in a span of 100 ft. 6 in. (the total weight of ironwork is 378½ tons); its roadway shelves a little; and perhaps we find in this original work a clue towards the solution of that pressing problem as to the type best suited for a war bridge under present-day conditions. For arches of this kind, strong enough to bear traffic and railways across rivers, might be designed with such abutment piers as would not obstruct the waterway too much. The New Bridge at Mayence belongs to this type. For the rest, the width of arches in a war bridge would be determined by the reasonable degree of ease with which a broken span could be repaired after being cut by a shell; or, if not repaired, made temporarily efficient for light traffic. But it seems certain that a war bridge in any strategical position should have an "under-study"—that is to say, a bridge similar to itself, but at some little distance from it, and having a branch road or line to connect it with the main line or highway. Usual hazards of war, we may suppose, would not be likely to breach both bridges at the same time.



New Bridge, Mayence. From Castle.

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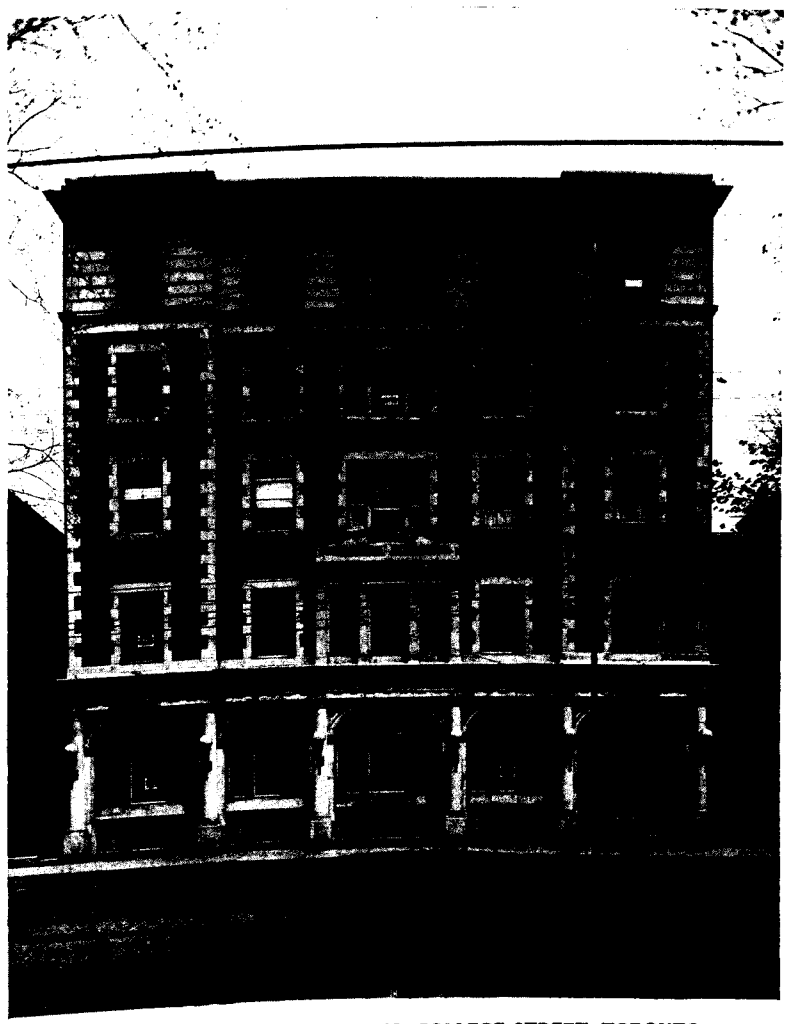

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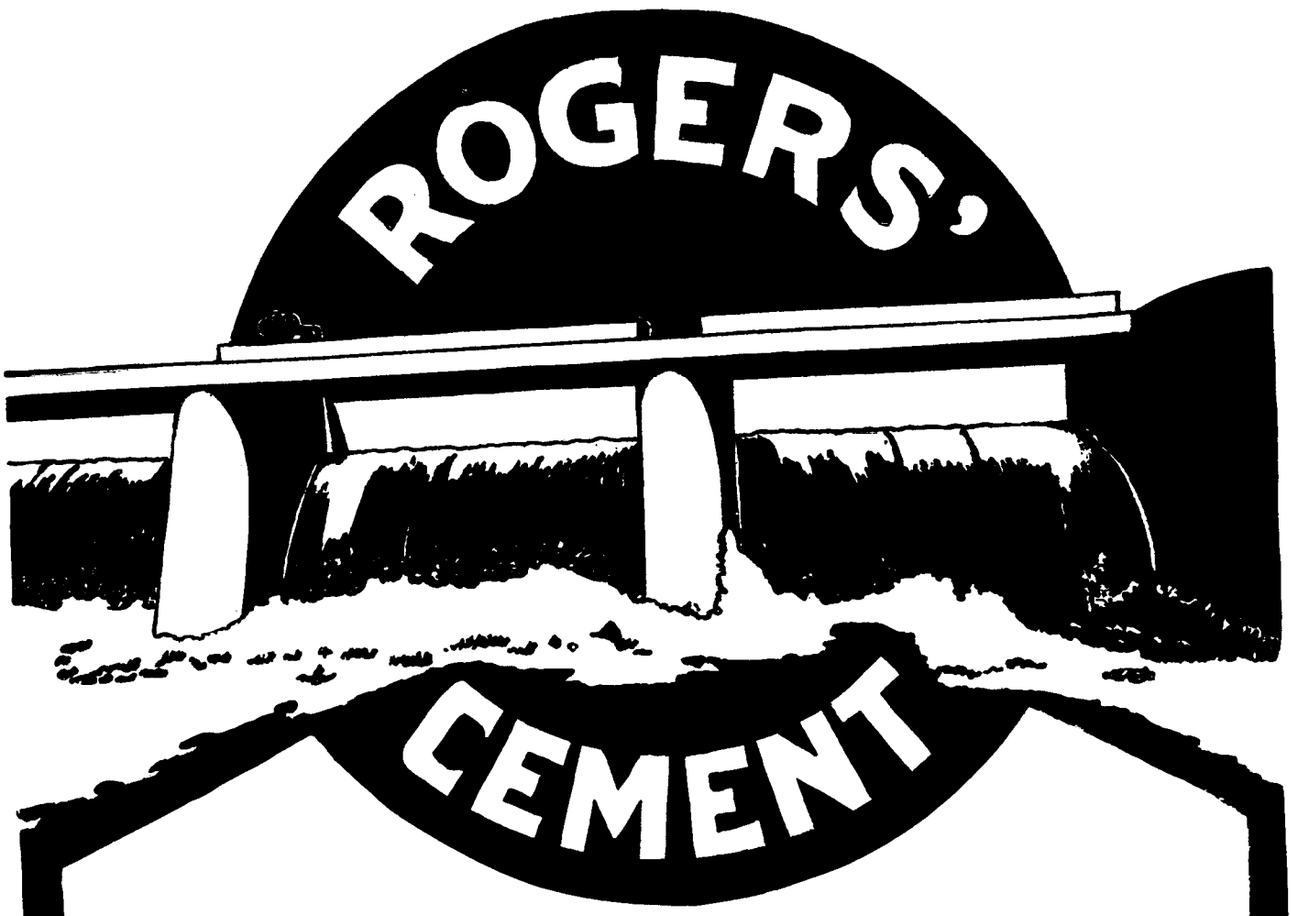

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Cement (Fireproof.)
Alex. McArthur & Co., Ltd.
Canada Portland Cement Co.
Dartnell, E. F..
H. W. Johns-Manville Co.
McGill, David.
Rogers, Alfred.
Stinson Reeb Builders' Supply Co., Ltd.

Cement Block Machinery.
Ideal Concrete Machinery Co.
London Concrete Machinery Co.
Mussens, Ltd.

Cement Brick Machinery.
Ideal Concrete Machinery Co
London Concrete Machinery Co.
Mussens, Ltd.

Cement Machinery.
Steel & Radiation, Ltd.
Ideal Concrete Machinery Co.
London Concrete Machinery Co.
Mussens, Ltd.

Cement Tile Machinery.
Mussens, Ltd.
Ideal Concrete Machinery Co.
London Concrete Machinery Co.
Stinson-Reeb Builders' Supply Co.

Chimney Construction.
Waite-Fullerton Co., Ltd., Winnipeg.
Eadie-Douglas Co.

Church Furniture.
de Vigan and du Saillant.

Coal Chutes.
E. F. Dartnell.

Cold Storage and Refrigerator Insulation.
Kent Company, Limited.
Linde British Refrigerator Co.
F. W. Bird & Son.

Columns (Staved).
Batts, Ltd.

Concrete Contractors.
Bowes & Francis.
Leach Concrete Co.

Concrete Construction (Reinforced)..
Canadian Seigwart Beam Co.
Steel & Radiation, Ltd.
The Pedlar People.
Trussed Concrete Steel Co.

Concrete Mixers.
Canada Foundry Co.
E. F. Dartnell.
Goold, Shapley & Muir.
Ideal Concrete Machinery Co.
London Concrete Machinery Co.
Mussens, Ltd.

Concrete Steel.
B. Greening Wire Co., Ltd.
Clarence W. Noble.
Dennis Wire & Iron Co.
Steel & Radiation, Ltd.
Page Wire Fence Co.
The Pedlar People.
Trussed Concrete Steel Co.

Conduits.
Conduits Co., Ltd.
The Pedlar People.

Contractors' Machinery.
Mussens, Ltd.

Contractors' Supplies.
Waite-Fullerton Co., Ltd.,
B. Greening Wire Co., Ltd.
Eadie-Douglas Co.
E. F. Dartnell.
David McGill.
Kent Company, Limited.
Mussens, Ltd.
Stinson Reeb Builders' Supply Co., Ltd.

Cork Board.
Kent Company, Ltd.
The Can. H. W. Johns-Manville Co., Ltd.

Corner Beads.
Steel & Radiation, L
The Pedlar People.

Cranes.
Dominion Bridge Co., Ltd
Mussens, Ltd.

Crushed Granite.
Sand and Supplies, Ltd.

Crushed Stone.
Sand and Supplies, Ltd.
John Maloney & Co.
Stimson-Reeb Builders' Supply Co.

Cut Stone Contractors.
The Canadian Art Stone Co
E. F. Dartnell.
Fred Holmes & Sons, Ltd.
The Roman Stone Co., Ltd.

Damp Proofing.
R. J. W. Damp Resisting Paint Co.
Ault and Wiborg Co.
Benjamin Moore Co.
Glidden Varnish Co.
Machen and Hebron.

Decorators.
Fred G. Roberts & Co.

Deposit Boxes.
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J. & J. Taylor.

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Mussens, Ltd.

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Otis-Fensom Elevator Co.,
Turnbull Elevator Co.

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de Vigan and du Saillant.
Toronto Electric Light Co.

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James Robertson Co., Ltd.

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Turnbull Elevator Co.

Elevator Enclosures.
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Dennis Wire and Iron Works
Meadows, Geo. B. Co., Ltd.
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Benjamin Moore Co.
Berry Bros.
International Varnish Co.

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Mussens, Ltd.
Goldie & McCulloch Co., Ltd.
Goold, Shapley & Muir.
Sheldons, Limited.

Engineers.
Standard Structural Co.
Duckworth Boyer Co.

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James Robertson Co., Ltd.
Sheldons, Limited.
Kerr Engine Company.
Mussens, Ltd.

Exhaust Fans.
Sheldons, Limited.
Consumers' Gas Co.

Engineers and Contractors.
Bishop Construction Co.

Expanded Metal.
Clarence W. Noble.
Steel & Radiation, Ltd.
Galt Art Metal Co.
Stinson-Reeb Builders' Supply Co.
The Pedlar People.
Trussed Concrete Steel Co.
A. C. Leslie & Co., Ltd.

Fire Brick.
David McGill.
E. F. Dartnell.
Stinson-Reeb Builders' Supply Co.

Fire Sprinklers.
General Fire Equipment Co.
Vogel Co., of Canada, Ltd.

Fire Extinguishers.
A. B. Ormsby, Ltd.
Vogel Co., of Canada, Ltd.
General Fire Equipment Co.,

Fire Escapes.
Canada Foundry Co.
Page Wire Fence Co.
Dennis Wire and Iron Works
Meadows, Geo. B. Co.

Fire-Place Goods.
Carter & Co., Ltd.
Dennis Wire & Iron Co., Ltd.

Fireproofing.
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Clarence W. Noble.
David McGill.
Don Valley Brick Works.
E. F. Dartnell.
Eadie-Douglas Co.
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Page Wire Fence Co.
Port Credit Brick Co.
The Pedlar People.
Trussel Concrete Steel Co.

Fireproof Steel Doors..
Dennis Wire & Iron Co., Ltd.
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Allith Mfg. Co.
A. B. Ormsby, Ltd.
Stinson-Reeb Builders' Supply Co.
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Steel & Radiation, Ltd.

Fireproof Windows.
A. B. Ormsby, Ltd.
Galt Art Metal Co.
Hobbs Mfg. Co.
Pilkington Brothers, Ltd.
Stinson-Reeb Builders' Supply Co.
The Pedlar People.
Pilkington Bros., Ltd.

Flooring.
Bird, F. W. & Son, Hamilton.
Eadie-Douglas Co.
Seaman Kent Co., Limited.
Siemon Bros.

Furnaces and Ranges.
Geo. R. Prowse Range Co.,
Steel & Radiation, Ltd.
Clare Bros.
Pease Foundry Co., Ltd.
Taylor-Forbes Co., Ltd.
Consumers' Gas Co.

Galvanized Iron Works.
A. B. Ormsby, Limited.
Galt Art Metal Co.
Sheldons, Limited.
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Galvanized Iron.
A. C. Leslie & Co., Ltd.

Glass.
de Vigan and du Saillant.
Consolidated Plate Glass Co.
Hobbs Mfg. Co.
Pilkington Bros., Ltd.
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General Contractors.
Bowes & Francis.

Grille Work.
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Siemon Bros.

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Consumers' Gas Co.
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Clare Bros.
Dominion Radiator Co., Ltd.,
C. A. Dunham Co.
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Goldie & McCulloch Co., Ltd.
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Heating Engineers and Contractors.
Sheldons, Ltd.

Hoists.
Goold, Shapley & Muir.

Hoisting Machinery.
Mussens, Ltd.
Otis-Fensom Elevator Co.,

Hinges.
Taylor-Forbes Co., Ltd.

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Iron Doors and Shutters.
J. & J. Taylor.
Dennis Wire & Iron Co

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Dennis Wire and Iron Works
Meadows, Geo. B. Co.

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Kerr Engine Company.

Illuminating Engineers.
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Burton & Baldwin.
Seaman Kent Co., Limited.
Siemon Bros.

Jail Cells and Gates.
Dennis Wire and Iron Works Co., Limited.
Goldie & McCulloch, Ltd.
J. & J. Taylor.

Joist Hangers
David McGill.
Taylor-Forbes Co., Ltd.
Trussed Concrete Steel Co.

Lamp Standards.
Canada Foundry Co.
Dennis Wire and Iron Works
Canadian Tungsten Lamp Co.
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Blonde Lumber & Mfg. Co.

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B. Greening Wire Co., Ltd.
Clarence W. Noble.
Steel & Radiation, Ltd.
Galt Art Metal Co
Page Wire Fence Co.
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Laundry Tubs.
H. C. Bedlington & Co
Toronto Laundry Machinery Co.

Leaded Glass.
Hobbs Mfg. Co.
McGill, David.

Lumber Dealers.
Gold Medal Furniture Mfg Co., Ltd.
Siemon Bros.

Marble.
James Robertson Co., Ltd.
E. F. Dartnell.
Missisquoi Marble Company.
The Hoidge Marble Co., Ltd.

Metallic Sasn.
Steel & Radiation, Ltd.
Hobbs Mfg. Co.

Metal Shingles.
Galt Art Metal Co.
The Pedlar People.

Metal Store Fronts.
E. F. Dartnell.
Dennis Wire & Iron Co.
Hobbs Mfg. Co.

Metal Walls and Ceilings..
A. B. Ormsby, Limited.
C. W Noble.
Galt Art Metal Co.
The Pedlar People.

Municipal Supplies.
Mussens, Ltd.
Non-Conducting Coverings. .
Ault & Wiborg.
H. W. Johns-Manville Co.
Ornamental Iron Work.
Turnbull Elevator Co.
Steel & Radiation, Ltd.
Canada Foundry Co.
Dennis Wire & Iron Co., Limited.
Meadows, Geo. B., Ltd.
Packing (Steam).
H. W. Johns-Manville Co.
Packing.
Gutta Percha & Rubber Mfg. Co.
Paints—(Steel and Iron).
Glidden Varnish Co.
R. I. W. Damp Resisting Paint Co.
Benjamin Moore Co.
E. F. Dartnell.
Machan and Hebron.
Paints and Stains
E. F. Dartnell.
James Robertson Co., Ltd.
Berry Bros. Ltd.
Benjamin Moore Co.
International Varnish Co.
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B. Greening Wire Co.
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Canadian Johns-Manville Co.
Kent Company, Limited.
Plasters.
de Vigan and du Saillant.
W. J. Hynes.
Plaster Corner Beads.
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Plate and Window Glass.
Consolidated Glass Co.
Hobbs Mfg. Co. .
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Steel & Radiation, Ltd.
James Robertson Co., Ltd.
Standard Ideal Co., Limited.
Plumbing Fixtures.
James Robertson Co., Ltd.
Standard Ideal Co., Limited.
Pneumatic Tools.
Mussens, Ltd.
Porcelain Enamel Baths.
James Robertson Co., Ltd.
Standard Ideal Co., Limited.
Radiators.
Gurney, Tilden & Co., Ltd.
Steel & Radiation, Ltd.
Dominion Radiator Co., Ltd., Taylor-Forbes Co., limited.
Refrigerating Machinery.
Kent Company, Limited.
Linde British Refrigeration Co., Limited.
Refrigerator Insulation.
Bird, F. W. & Son, Hamilton.
Kent Company, Limited.
The Can. H. W. Johns-Manville Co., Ltd.
Reinforced Concrete.
Steel & Radiation, Ltd.
McGill, David.
Noble, Clarence W.
Page Wire Fence Co.
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The Canadian Siegwart Beam Co., Ltd.
Trussed Concrete Steel Co.,
Relief Decoration.
W. J. Hynes.
Roofing Paper.
Alex. McArthur & Co., Ltd.
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F. W. Bird & Son.
Roofing.
Asbestos Mfg. Co.
Bird, F. W. & Son, Hamilton.
H. W. Johns-Manville Co.
Paterson Mfg. Co.
Roofing (Slate).
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Roofing (Tile).
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Rubber Tiling.
Gutta Percha & Rubber Mfg. Co., Limited.
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Sanitary Plumbing Appliances.
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Sand and Gravel.
Sand and Supplies, Ltd.
Sand Screens.
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B. Greening Wire Co. Limited
Shafting Pulleys and Hangers.
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Sheet Metal.
A. C. Leslie & Co.
Sheet Metal Workers.
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A. B. Ormsby, Limited.
Galt Art Metal Co.
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Shingle Stains.
James Robertson Co.
Benjamin Moore Co.
International Varnish Co.
Sidewalks, Doors and Grates.
Dennis Wire & Iron Works Co.
Radiator Valves.
Steel & Radiation, Ltd.
Kerr Engine Company.
Sidewalk Lifts.
Otis-Fensom Elevator Co.,
Sidewalk Prisms.
Hobbs Mfg. Co.
International Supply Co.
Slate.
Smith Marble & Construction Co.
James Robertson Co., Ltd.
Stable Fittings.
Dennis Wire & Iron Works Co., Ltd.
Staff and Stucco Work.
W. J. Hynes.
Steam Appliances.
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Kerr Engine Co.
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Taylor-Forbes Co., limited.
Steam and Hot Water Heating.
Steel & Radiation, Ltd. .
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Dominion Radiator Co., Ltd.,
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Steel Casements.
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Structural Iron Contractors..
Canada Foundry Company.
Dennis Wire & Iron Co., Ltd.
Dominion Bridge Co., Ltd.
Hamilton Bridge Co.
Sarnia Bridge Co.
Reid & Brown.
Structural Steel Co., Ltd.
Structural Steel.
Canada Foundry Company.
Sheldons, Ltd.
Mussens, Ltd.
Dennis Wire and Iron Works
Dominion Bridge Co., Ltd.
Hamilton Bridge Co.
Sarnia Bridge Co.
Reid & Brown.
Structural Steel Co., Ltd.
Terra Cotta Fireproofing.
Carter & Co., Ltd.
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David McGill.
Fred Holmes & Sons, Ltd.
Don Valley Brick Works.
Eadie-Douglas Co.
E. F. Dartnell.
International Supply Co.
Missisquoi Marble Company
Store Fixtures.
Burton & Baldwin Mfg. Co.
Tile (Floor and Wall).
de Vigan and du Saillant.
Carter & Co., Ltd.
Waite-Fullerton Co., Ltd.,
David McGill.
E. F. Dartnell.
Smith Marble & Construction Co.
Vacuum Heating Systems.
C. A. Dunham Co.
Varnishes.
Ault & Wiborg Co.
Benjamin Moore Co.
Berry Bros., Ltd.
International Varnish Co.
Randall Bros.
Vaults and Vault Doors, Fireproof and Bankers.
Goldie & McCulloch Co., Ltd.
J. & J. Taylor.
Valves.
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James Robertson Co.
Kerr Engine Co.
Taylor-Forbes Co.
Ventilators. .
Sheldons, Limited.
Wall Finishes.
E. F. Dartnell.
Benjamin Moore Co.
Berry Bros.
International Varnish Co.
Randall Bros.
Wall Hangers.
Taylor-Forbes Co.
Waterproofing.
E. F. Dartnell.
Ideal Concrete Machinery Co.
Mussens, Ltd.
Ault & Wiborg Co.
Bird, F. W. & Son, Hamilton.
Eadie-Douglas, Limited.
Stinson-Reeb Builders' Supply Co.
R. I. W. Damp Resisting Paint Co.
Glidden Varnish Co.
Benjamin Moore Co.
Waterworks Supplies.
James Robertson Co., Ltd.
Kerr Engine Co.
Mussens, Ltd.
Standard Ideal Co., Limited.
Wheelbarrows.
Mussens, Ltd.
White Lead, Putty and Oils.
International Varnish Co.
Benjamin Moore & Co.
Window Guards.
Dennis Wire & Iron Co., Ltd
Steel & Radiation, Ltd.
B. Greening Wire Co. Limited
Page Wire Fence Co.
Wire Rope and Fittings.
B. Greening Wire Co. Limited.
Mussens, Ltd.
Otis-Fensom Elevator Co.

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