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CONSTRUCTION

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

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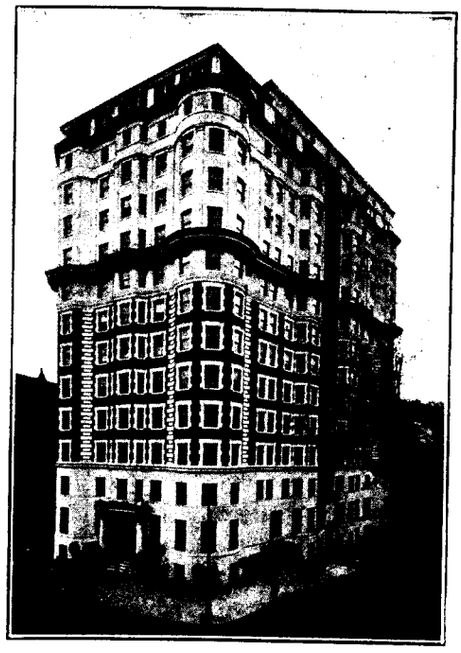

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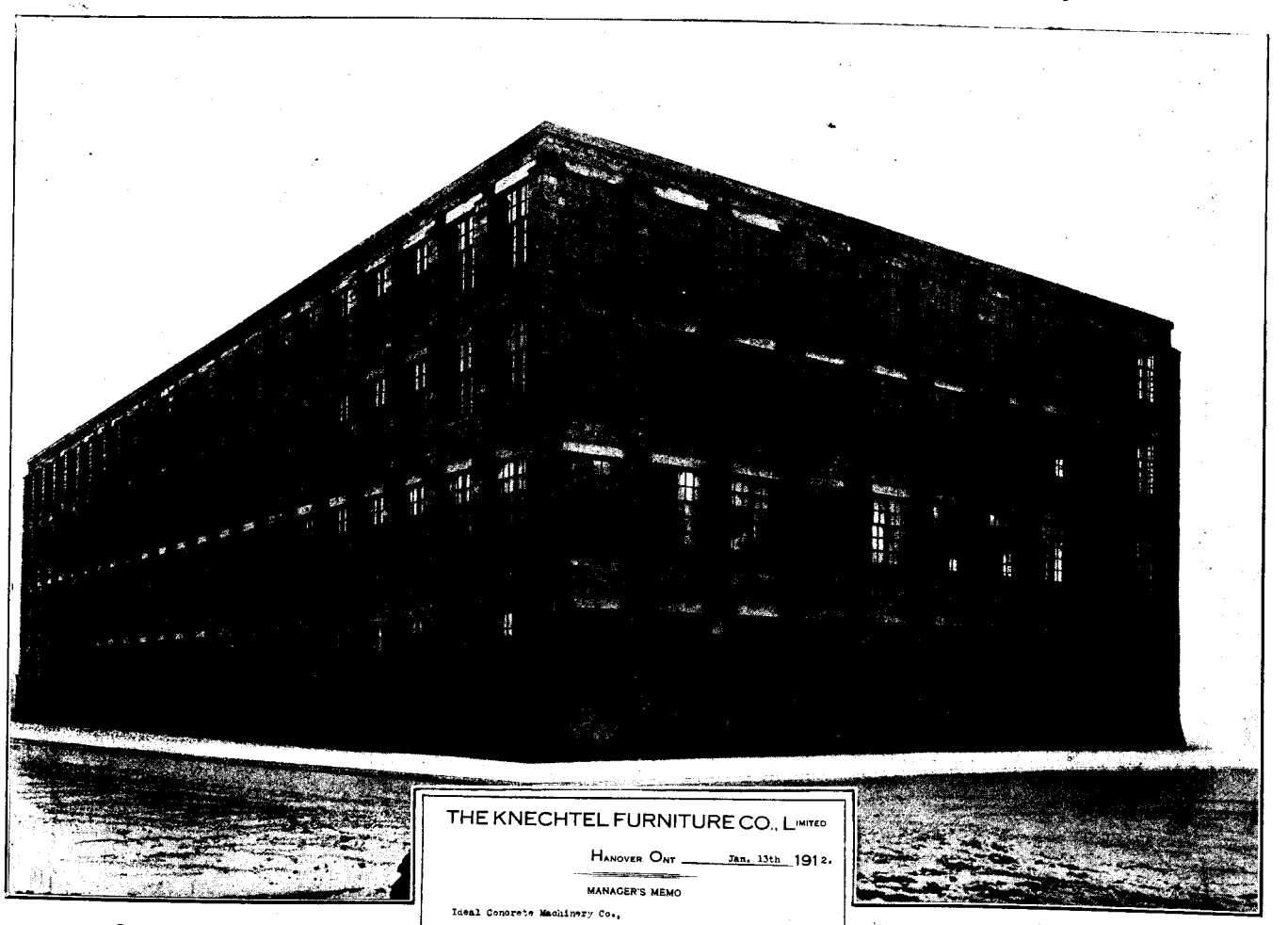

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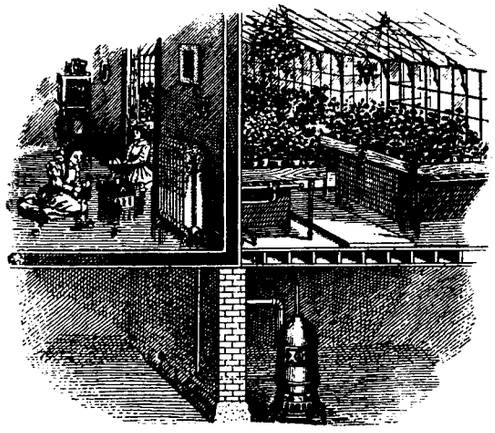

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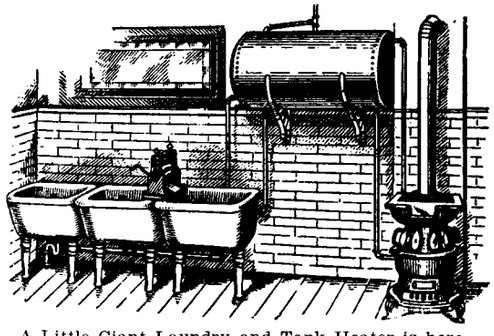

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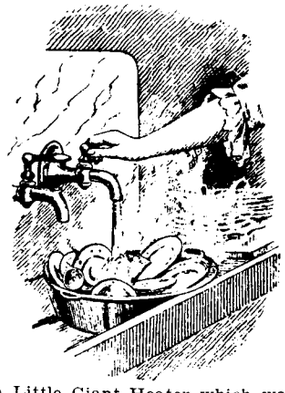

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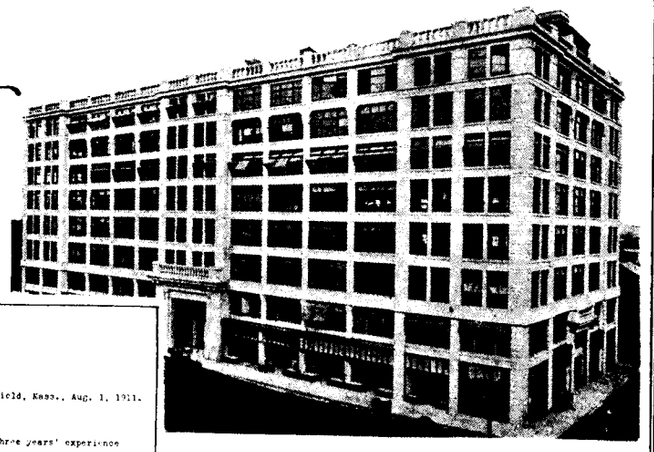

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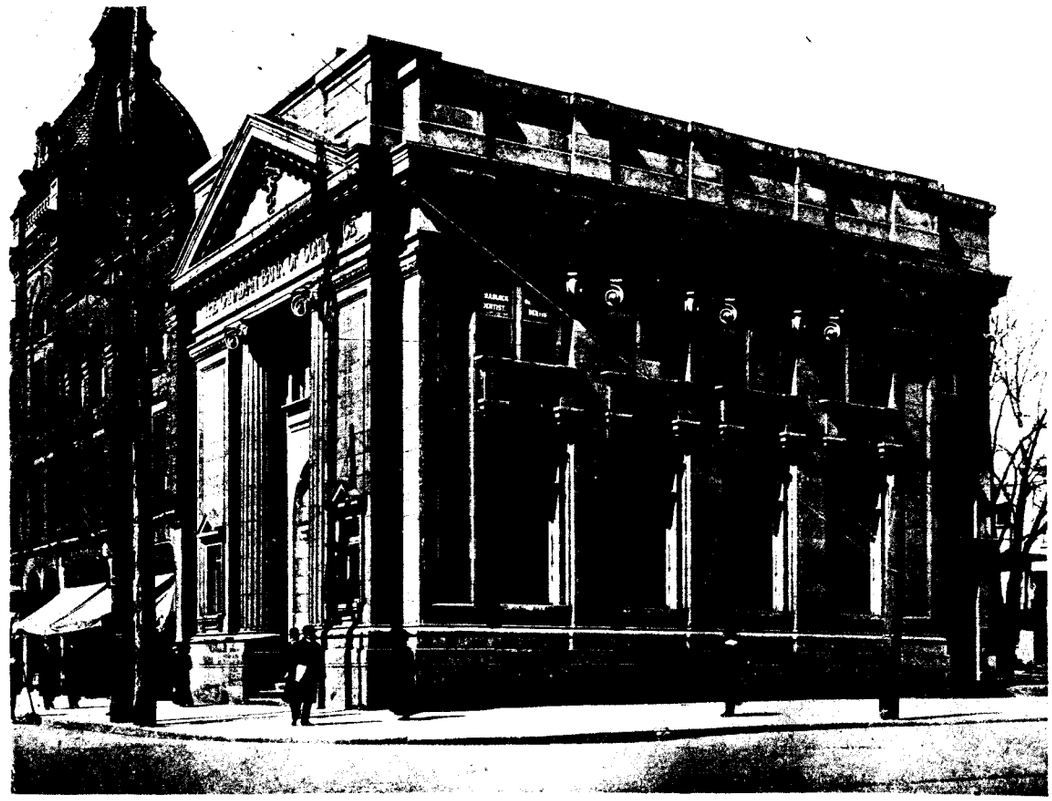

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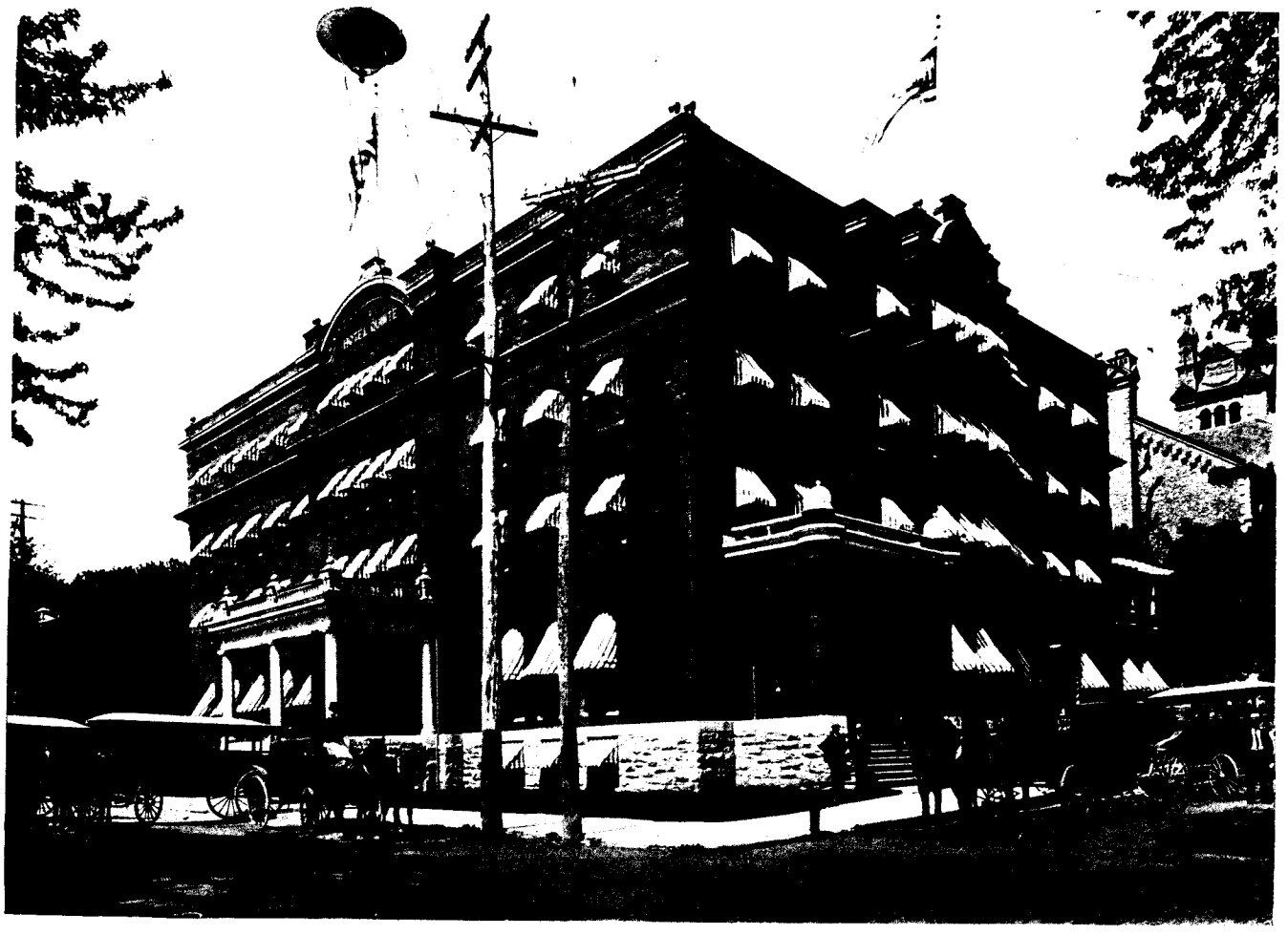

Quinte Hotel, Belleville. F. H. Herbert, Architect, Toronto; Elliott Bros., Plumbers, Kingston.

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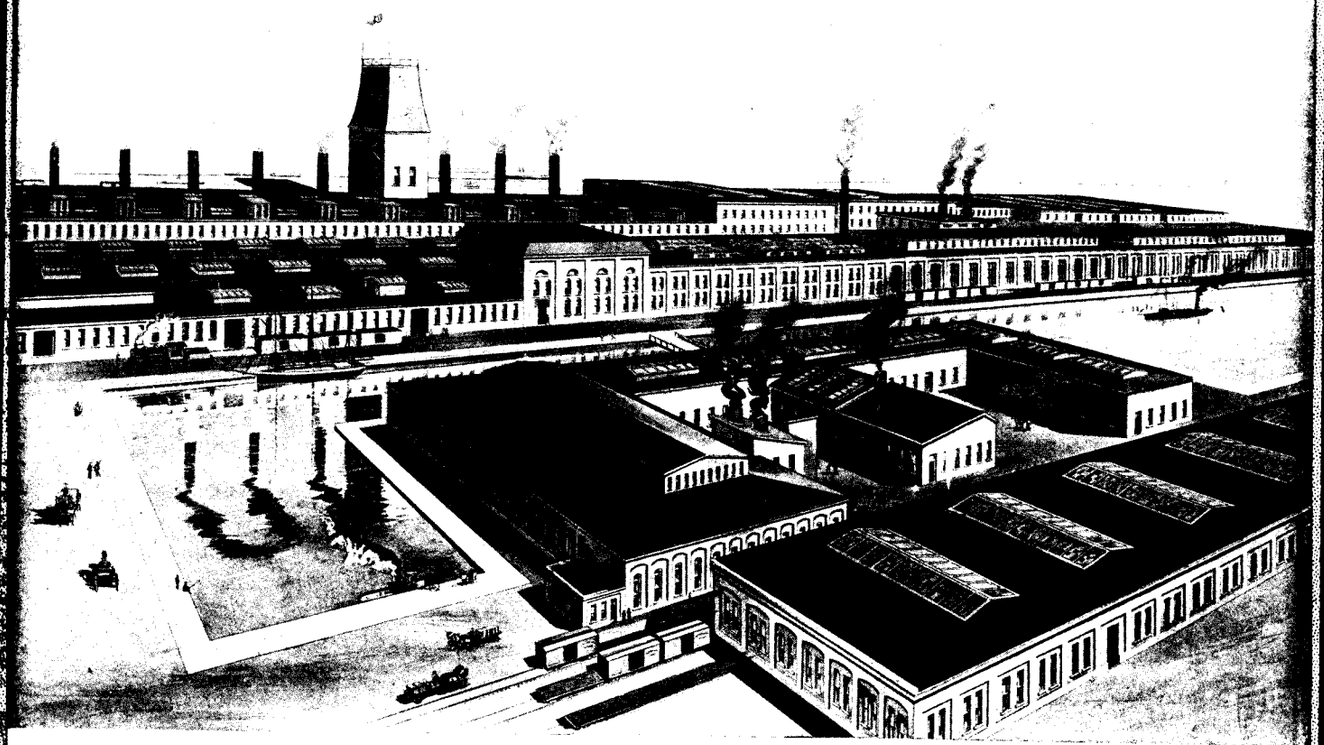

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CONSTRUCTION

VOL. V NO. 3

CONTENTS FOR FEBRUARY, 1912

ILLUSTRATIONS

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SATURDAY NIGHT BUILDING, TORONTO, CANADA

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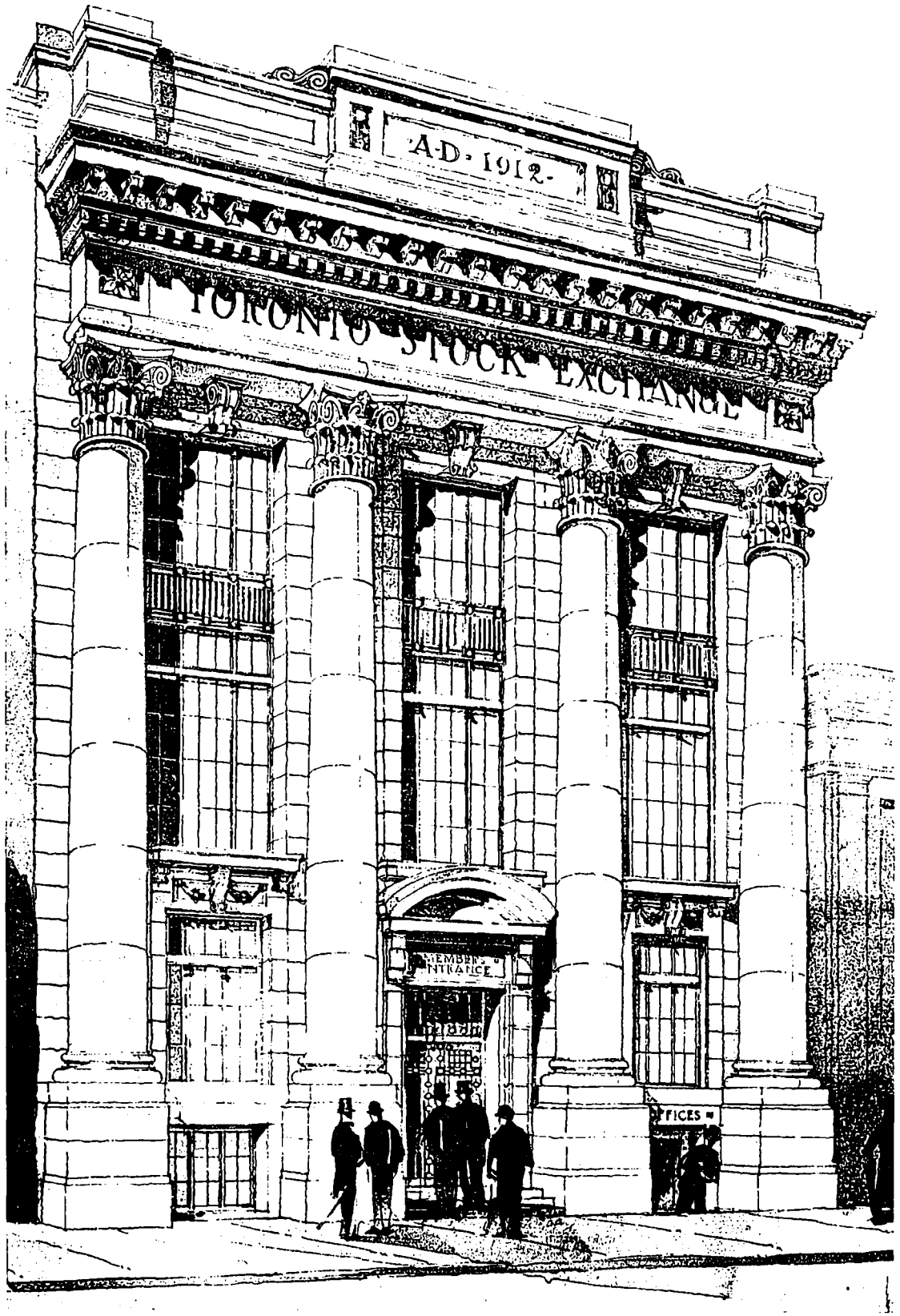


Exterior Perspective.
Accepted Competition Design for Stock Exchange Building, Toronto, Ontario. John M. Lyle, Architect.

¶ *The inherent evil in competitions rapidly improving under the active educational work of Architectural Societies.*

IN presenting in this issue the competition to select an architect for the Stock Exchange at Toronto, CONSTRUCTION intends to call attention to the high character of the programme upon which it was based. The evil character of competitions, and there are many inherent qualities in even the best of competitions that make them an evil, has not in any way changed, but their operation is improving rapidly through the systematic educational work of the Royal Architectural Institute and the federated provincial societies. The change is in that, while in the past there was no settled code and the best advisors were apt to allow insidious errors to creep into programmes through ignorance, at present there is no excuse for such error. If a programme is not equitable and according to rules of perfect fairness, it is because the promoter does not wish to be fair. It is always best to select an architect for a building direct. Because a corporation or a committee cannot agree on one individual, or some law that was made when lawmakers thought (as many of them do now), that an architect was some kind of a contractor, calls for a competition, then it must be held. Many of these promoters do not yet realize that the competition is for the selection of an architect and the drawings submitted are only to show his familiarity with the problem. And this is honest ignorance. On the other hand, every man is supposed to be acquainted with the principles of abstract honesty and fair dealing. so that we can assert that when a competition is based on unfairness in its provisions, there is a deliberate plan behind it to take advantage of somebody. The architect first, and then the public that is served. No matter how specious the argument, that the law compels, or the architect cannot dictate to a commission, for instance, these men know that the law can be changed and that the architect as an expert knows. It is almost certain, when an inequitable programme is presented, that a cloak of ignorance is put on to avoid the fair competition that will secure a reliable architect, and hence one that cannot be manipulated by designing representatives of the people who pay. The Toronto Stock Exchange, it is presumed, could not agree on one individual, and so several individuals were invited to present plans in competition. It is probable that if any one of the competitors had been selected individually, a satisfactory building would have been obtained. By meeting the architects half way, a programme was issued to which no practitioner could object if he wished to spend his time and money betting on a twenty to one chance. The result is that, theoretically at least, the promoters have received the consensus of opinion of all the competitors in regard to what the building they required should be in design and plan. In that the promoters have the best of it, for they will, besides, get a well-designed structure appropriately planned. The competitors have their drawings returned and their compensation is a feeling that their chance was an equitable one and that as far as a programme could conserve their rights they received fair treatment. It is hoped that the business men of Canada who have watched this competition will realize that the architect who competes is not all a gambler in presenting plans, but a more dominating spirit is to meet the requirements that his profession places upon him in aiding all well intentioned efforts to procure buildings of good design and adequate plan. In the competition under consideration it is well to call attention to the fact that while it employed the president of the Royal Architectural Institute of Canada as a member of the Board of Assessors, the remainder of the board consisted of the managing committee of the promoters. A model competition would have gone further and made Mr. Baker the expert advisor, and selected a jury of architects of high standing to act as assessors, features that made the last two notable competitions in the United States, those for the Perry Memorial and the Minneapolis Museum of Fine Arts, model competitions.

¶ *A model programme marks the final regulation of architectural competitions in the United States.*

THE competition just closed for the Perry Memorial at Put-in-Bay is significant in its general import, though it is only interesting to CONSTRUCTION in its architectural aspect. The structure is designed as a memorial to one hundred years of peace between Great Britain and the United States and as an earnest of perpetual amity

between those powers. While it is to be constructed in commemoration of a victory and in celebration of the centennial of the war of 1812, that victory was a fortune of war and a necessary settlement of territorial lines that up to that time had been disputed by French, English and Americans alike. As such it was as much a victory for Canada, which was the subsequent beneficiary, as for the United States that captured a few ships. Its true value was establishing for each country definite territorial lines that have never since been in dispute. Of as great significance is the competition which in its ethical perfection ends the long struggle architects of repute have endured with the guerrilla tactics of the irresponsible architect aiding the ignorance or cupidity of the owner or investor. The programme is the last word in establishing competitions upon a substantial basis of equality and probity and will be used as a basis for those offered by public bodies in the future, when they cannot decide upon an individual and seek selection of an architect through a competition. The advisor to the building committee was Frank Miles Day, of Philadelphia, a past president of the American Institute of Architects. The judges were the members of the Commission of the Fine Arts, which is a national commission appointed by the President in accordance with an Act of Congress. The commission, which is the adjudicating committee of the competition, is composed of D. H. Burnham, chairman; Thomas Hastings, Daniel C. French, Frederick Law Olmsted, Charles Moore, Cass Gilbert, and Francis D. Millet. After the many vicissitudes which have attended the efforts of architects to make competitions equitable and professionally creditable, in thus giving to the profession a model competition with a semi-governmental sanction a precedent is established that is of inestimable value not only to the profession, but the public which it serves.

¶ *The Manitoba Parliament Buildings competition programme objectionable to Construction and should be to architects generally.*

ACCORDING to the tentative programme for the Manitoba Parliament buildings announced some time ago, it seemed as though that province would not only have a creditable competition, but as a result buildings to which future Manitobans could point with pride in point of design. Now that the printed programme is received and carefully scanned, few of these excellent features which were promised seem to have been incorporated, and the chances are that the same old mediocrity will characterize the Government buildings in Manitoba that prevails, except in one or two cases, like Saskatchewan, throughout the Dominion, and for the same general cause, Governmental ignorance and incapability where it touches building design. Instead of an empire-wide competition, the time limit (February 16) confines the competition almost to Manitoba, and even there the time is at least a month too short for anything but a thrown-together design. Then the inherent defects in the printed programme should bar out practitioners who care anything for the ethics of their profession, and this would mean the absence from the competition of every architect of standing in Canada. The expert judges or the expert advisor, all of whom should be architects of national reputation, are not named in the programme so that competitors are not assured of intelligent or even fair treatment. The time limit for adjudication is also far too short for justice being done to all the plans submitted. It is therefore a foregone conclusion that the competition will be a failure, even though some designs are received and an architect appointed. The whole matter seems to be one of ignorance on the part of the building commissioners. If so, their only course is to withdraw this competition programme, call in expert advise, such as a member of the council of the Royal Architectural Institute, and formulate another programme along recognized professional lines. Otherwise CONSTRUCTION assures the Manitoba Government that the people they serve will live to denounce them as unfaithful to their trust. For bad design, bad plan, wastefulness in construction, and extravagance in expenditure are all legitimate results of this kind of competition, and any or all will be the outcome in Manitoba unless the selection of an architect is made along lines that are recognized as proper by the architectural profession, which alone has had experience and knows. The result in Pennsylvania of just this sort of a competition should be a warning to all governmental bodies contemplating the design and erection of capital buildings. It never fails to work out along the lines that made the building of the Pennsylvania capitol infamous in which a venal commission made a scapegoat of the architect who took a chance at an irregular competition.

As CONSTRUCTION goes to press notification comes from the Minister of Public Works for Manitoba that the date for receiving the competition plans has been extended to March 31. Also that the competition has the approval of the Royal Architectural Institute. CONSTRUCTION must maintain the position it takes in this matter because the defects pointed out are inherent and we cannot compromise even though the members of the Institute are satisfied. We would not deter one of them from doing all they can to make this competition creditable to the profession, but if disaster should come through programme looseness, we wish to maintain the position to say 'We told you so." It is probable that in the interests of good competitions the Institute overlooks the defects for the sake of the good qualities in the programme, harmony and the good intentions of the Manitoba Government in formulating the competition. The least the Government can do in return for this architectural confidence is to appoint a jury approved of or suggested by the Institute, as this absence of the names of the jury is the main and most dangerous defect in the programme.

¶ *Candid expression by the Minister of Public Works for the Dominion prophesies a better architecture for Government buildings.*

WITH SOME slight encouragement from the architectural profession in Canada, the Hon. F. D. Monk, Minister of Public Works, may see fit to inaugurate an architectural reform in his department in the interest of well-designed Government buildings. In the House recently that gentleman in the course of a discussion upon needed Government buildings, said:

> "I believe there was a competition for plans, and we had a plan of the Justice building and the Supreme Court competed for, and the prize was won by one of our most eminent architects in Montreal, Mr. Maxwell. I have not seen that plan, nor am I a good judge of plans, but I should imagine that we could avail ourselves of that plan."

As CONSTRUCTION, as well as many of the daily papers of the Dominion, protested against the abandonment of that plan by the former administration, we now hope that Mr. Monk's wise suggestion will be acted upon in the interest of good Government architecture. The former administration in throwing aside a plan which it obtained through a competition (in which the inference, which was a guarantee, that the accepted plan would be used, made it obligatory upon honorable men) said it would "have one prepared by its own architects." As a matter of fact, the former administration never had, nor has this, "its own architects." The chief architect who has occupied the position for twenty years, is the only architect in the Government employ. The rest of the employes of the office are draftsmen. The chief architect has been a faithful servant and has given the department close attention, and in that his occupancy has been honorable and above criticism. His office contains some draftsmen of ability and on them has depended the design and construction work of the Dominion. But the immediate future of Government architecture in Canada demands, and CONSTRUCTION insists, that no design but the best that Canadian architects can produce should be considered for a Government building. We would prefer that competitions be held similar to that which was so successful in point of design for the Justice building. But that the contract, which all competition programmes are in fact, should be carried out. Under the constructive direction of the chief architect, co-operating with the designer, the work could go on to a satisfactory conclusion both in design and construction. The candid remark of the Minister of Public Works in regard to his judgment of plans indicates that he is a judge of other things and that he will see the sense of employing good architects if the Government is to have good architecture, and that the best to be procured will cost no more, and as a matter of fact much less, than structures of unsightly appearance, bad arrangement and defective constructive plan. Abstract justice demands that the Justice building when erected will be according to the plans which were accepted for it by the Government. The future impression Canadian Government architecture will make on the world demands that the Minister of Public Works of this and successive administrations procure the best architectural talent in the Dominion for their designing.

¶ *The importance of good street car service to cities and an example familiar to people of Toronto.*

THE street car problem is of interest to CONSTRUCTION because upon it largely depends a city's development. Internal growth as well as suburban expansion is commensurate with the facility with which the different residence districts, urban and suburban, can be reached by the electric car system. This operation of street car systems can be accomplished with less cost and give better service in the hands of corporations than when operated by the municipality. But in order to obtain the best service, these public service corporations should be subject to the control, but not the interference, of the State or the municipality through commissions representing the people. Of all the cities in Canada, Toronto is said by its newspapers and the man on the street to possess the worst street car service. The initial reason for this is because in population that city has most rapidly increased since the present system was installed, and no preparation has been made in the past by city or corporation to meet the demand. If there is a sincere desire for such betterment in the line of street transportation by the people of Toronto, and a wish to compare conditions with other cities of similar population, an example can be found in the street car service of the "Twin Cities," St. Paul and Minneapolis, familiar to the investing public through the large amount of Toronto capital invested in that street car company. With the service referred to, the people often exhibit a similar dissatisfaction, but without the valid reasons for complaint that exist in Toronto and retard its growth. We can, therefore, point to the street car service of the "Twin Cities" as normal, if not extraordinary or ideal. There are several causes contributing to this condition beyond a well-intentioned and capably managed corporation, that having a monopoly does not abuse it, contributing to this condition. The streets run in continuous lines through the city and are of good width, especially in Minneapolis. The different districts, business, manufacturing and residence, are logically related. But aside from these advantageous features that Toronto does not possess and the most capable management would have to contend with, the remainder lies with that management. The cars themselves are largely of obsolete type. In the Twin Cities the entire service is of uniform standard size, forty-six feet long and of more than ordinary width. The three hundred and eighty-three miles of trackage is laid with 90 pound rails generally embedded in concrete like the civic track on Adelaide street. In the down town district the cars invariably loop, and

at the suburban ends a loop is made so that the run is continuous. And, of course, every line is double tracked. This installation for a foundation and a capable and progressive management, supported by a civic control which can demand details in operation where it seems deficient, make for a system that does not retard but encourages suburban expansion. The Toronto street car service seems to be hampered by a lack in every advantageous quality named, and it will not be improved until this is recognized. On the part of the city, streets must be cut through and widened. On the part of the company, the dividend earning capacity must be for a time curtailed, and more and better cars, better laid and double tracks, loop terminals installed, and the cars themselves in their manufacture contain those components that the best car building practice now demands. The city should act first. Give to the company the necessary streets, wide and direct, and then see that the company obtains capable operators And then to prevent accidents the rule that a car must stop and not pass another that is stationary saves enough money in damages to build a new car every month of the year. These features in operation and a live, progressive and broadminded management, are the details that make the Twin City lines a credit to the cities of St. Paul and Minneapolis and attractive to Toronto investors.

¶ *Louis H. Sullivan and Frank Lloyd Wright, the exponents of individual style, are compared in two residences just completed.*

IN A SERIES of comparative illustrations, the Architectural Record presents two houses recently completed and in the same neighborhood with the same general landscape surroundings, by Louis H. Sullivan and Frank Lloyd Wright. In the description of these houses accompanying the illustrations, the writer is as kind to Mr. Wright as he can be, and as analytically just to Mr. Sullivan as the "invidious comparison" will allow. He does not say so in words, but in effect, that the house of Mr. Wright, while startlingly beautiful as a sketch, is practically a freak in its livable quality, while that by Mr. Sullivan bears out that architect's theory of natural growth from inherent purpose in design. Mr. Sullivan, of all the architects in the United States, says a recent editorial in the Western Architect, has seemingly departed farthest from tradition, while holding closely to the canons of architectural art. Of all the architects in the United States who have graduated from the Ecole des Beaux Arts, Mr. Sullivan has retained only the training of that school and added to it an individual genius which permits him to do the most daring things in design and "get away with it." No other architect would have "dared" to produce the polychromatic entrance to the Transportation Building of the Columbian Exposition, or nailed onto the second story of the house under discussion an open-air room, and in each case so successfully that each structure was made artistically complete by these, in other hands bizarre innovations. Mr. Wright has an undoubted genius for design. He developed under Mr. Sullivan's direction as a draftsman, and was the only one Mr. Sullivan ever found who could enter into the spirit of his ornament and carry it out from Mr. Sullivan's sketch. On entering the field of practice he soon attracted attention through a new departure in design which seemed to be founded, and was to an extent, upon a logical basis. This basis or theory or school, each term will apply, soon found followers, and a coterie of some of the brightest draftsmen Chicago has produced has followed it in line and precept. None have gone so far into the realm of the picturesque or failed so signally in the production of livable houses as Frank Lloyd Wright. When the architectural history of this generation is written his name will be mentioned as one who saw a light in the direction of a national style in design but failed to understand the direction by which it must be reached. Mr. Sullivan will remain a guide to the sane following of that quality we call inspiration, in which there is no precedent but the precedent of the tree or the flower, and the necessities of climate, material, and the use which, added to training and experience, makes the sum of practical architecture.

¶ *An instance of an architects' examination and license law before the courts that may be of some interest to provincial practitioners.*

WHILE NOT as direct in circumstances as could be wished for a final ruling, the Supreme Court of Illinois has handed down a decision defeating another attempt of a serious character to violate the law of the State governing the practice of architecture. There was a vacancy in the office of city architect of the city of Chicago, June 15, 1910, and the Commissioner of the Department of Public Works had made a requisition on the Civil Service Commission for eligibles to fill the position. An examination was held, June 21, 1910, and Theodore F. Laist received the highest rating, and on August 10, 1910, he was certified to the Department of Public Works. The Civil Service Commission revoked the certificate because Laist was not a licensed architect under the requirements of an Act providing for the licensing of architects and regulating the practice of architecture as a profession. Laist reported for duty at the Department of Public Works, and claimed the right to the office of city architect, but the commission refused to allow him to assume office because his certificate had been revoked. Laist filed his petition, in the name of the people, in the Circuit Court of Cook country, praying for a writ of mandamus directing the Civil Service Commission forthwith to certify him for appointment as city architect. The Circuit Court dismissed the petition and the relator was allowed an appeal to the Illinois Supreme Court on the ground that the validity of the Act to provide for the licensing of architects is involved. The judgment of the Circuit Court was affirmed and again the soundness of the legal status of the examination and license law of Illinois has been sustained.

THE TORONTO STOCK EXCHANGE COMPETITION

Three schemes presented in a recent competition at Toronto, a programme for which was representative of the best architectural practice.

IN SELECTING an architect to design a building for the Stock Exchange of Toronto, the directors decided to ask for competition drawings. For this purpose, F. S. Baker, architect, of Toronto, president of the Royal Architectural Institute of Canada, was retained as counsel to prepare a competition programme, that would meet the requirements of professional practice, and to act as adviser in the adjudication of the competition. Seventeen competitors presented plans. The terms of the programme, and author's description of the accepted design, are as follows:

TERMS OF COMPETITION.

1. The Toronto Stock Exchange are the promoters of this competition.

2. Competitors must be Toronto architects who have resided in the city for at least one year previous to the issuing of these conditions.

3. The first prize in this competition shall, if the competitor be acceptable to the promoters, be the commission for the designing and supervising the erection of proposed building at such time as the same shall be proceeded with on the usual terms. In any event within one week of the award four hundred dollars is to be paid to the winner, this sum being merged in the amount of fees when the work goes on, if the commission be granted.

4. The authors of the two designs which the assessors consider the best, after the award of the first prize (and these designs are to be regarded in their report as equal), shall be paid two hundred dollars each within one week of the announcement of the award.

5. The Board of Assessors shall consist of the following: F. S. Baker, Esq., architect, of Toronto, together with the Managing Committee of the Toronto Stock Exchange. The award of the assessors shall be accepted by the promoters.

6. The award shall be made within thirty days of the date for the sending in of the drawings. The promoters reserve the right to exhibit the drawings with the author's name attached, immediately subsequent to the award, if they should so wish, after which all drawings shall be returned to the various competitors.

7. The promoters desire to receive in this competition a carefully studied general scheme, the complete character of which shall be intelligibly illustrated in the competition drawings, and reasonably providing for the requirements herein set forth.

8. The drawings shall be made to a scale of one-eighth inch to one foot, and shall comprise the following only:

Floor plan of each story, including basement and roof;

Elevations to illustrate the frontages;

Sufficient sections to illustrate the scheme proposed.

A perspective drawing showing the street frontage of the building, and another perspective showing the interior of the Stock Exchange room.

These drawings may be executed in whatever manner the competitor prefers and no objection will be raised to any further sketches which the competitor may wish to submit.

9. Drawings shall be made in India ink on white paper, delivered flat in portfolios.

The walls and partitions may be blacked solid.

The external elevations may be washed in with cast shadows.

All rooms and corridors shall be figured for dimensions and area.

No color to be used on any of the drawings.

The size of each sheet of drawing will be 22 ins. x 30 ins. and two plans may be shown on one sheet if desired.

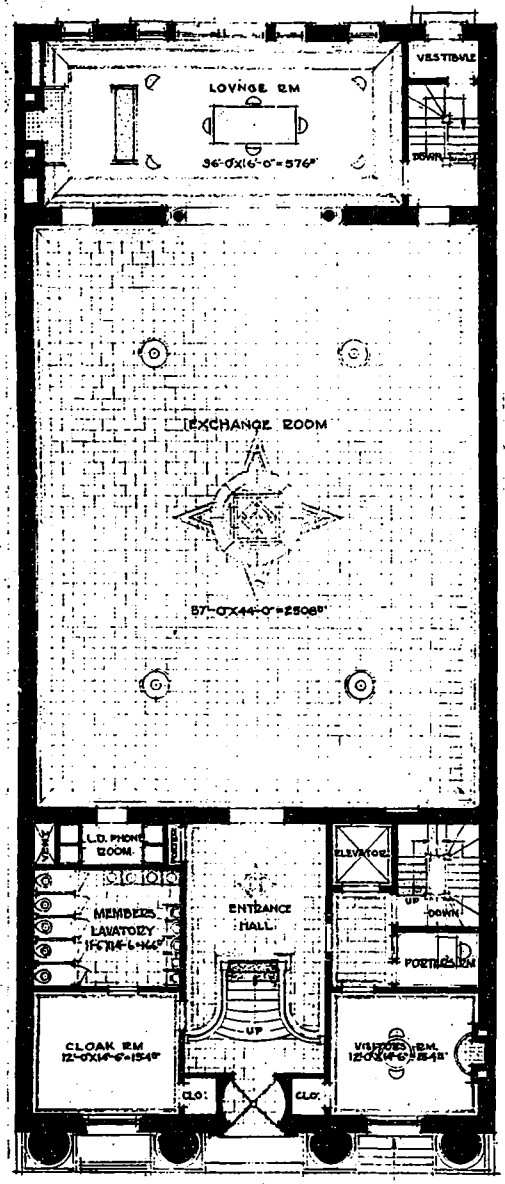
10. Each competitor shall submit with his drawings a typewritten statement describing the arrangement of the building, its construction and materials. He should also state the rate of cost at which the building is expected to cube, and a guaranteed computation of the number of cubic feet in the building, properly worked out, with a description of the method followed. This statement should include the heating, lighting and ventilation proposed.

11. The competitive drawings must have no mark or any kind, or other means of identification. Each competitor is to enclose with his drawings a blank sealed envelope containing the name of the author, together with a statement that the designs and drawhave been prepared by himself or under his personal supervision. These envelopes will not be opened until after the award has been made.

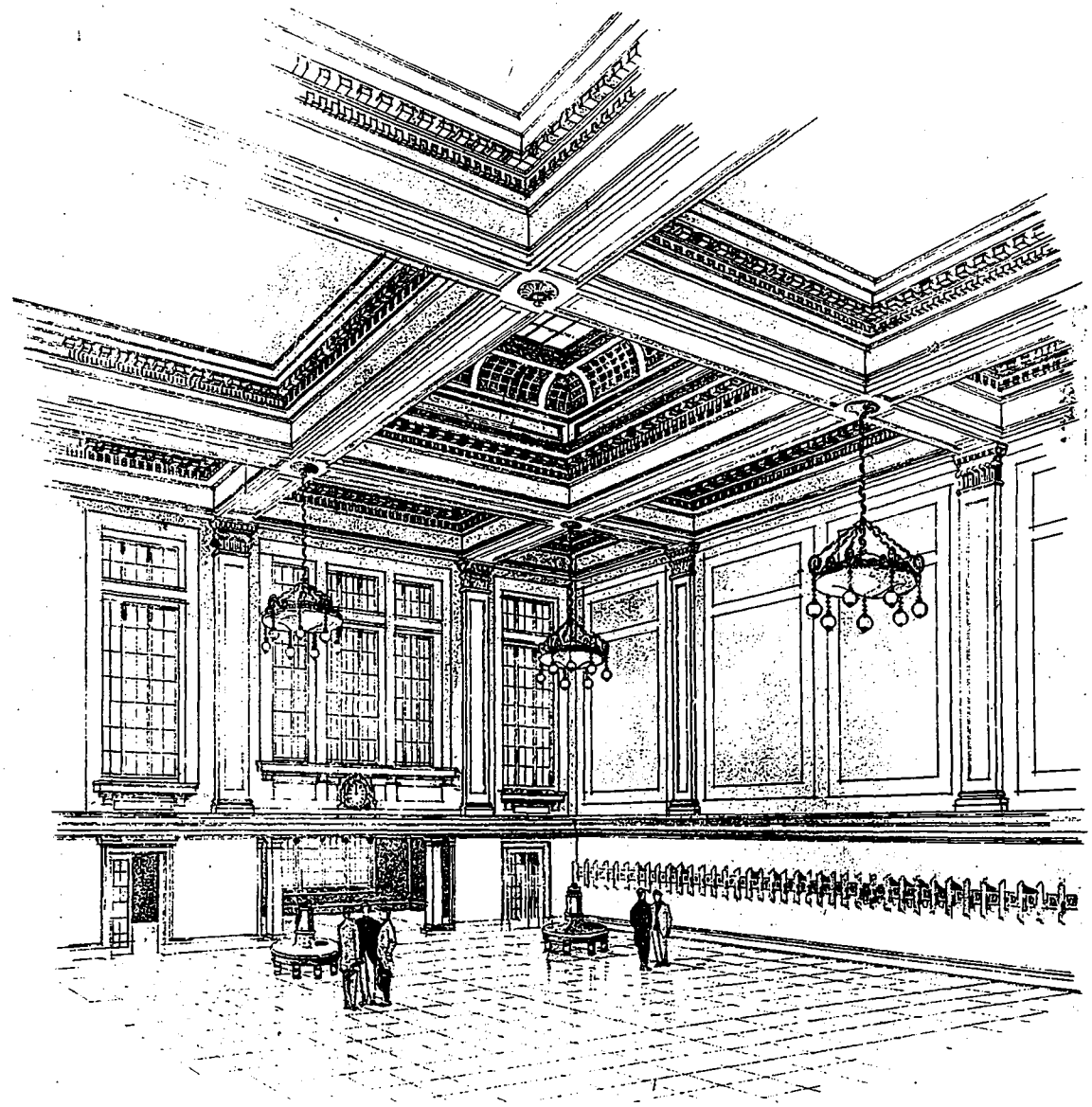
12. Should any competitor disclose his identity or in any way infringe these regulations, it will be taken as sufficient grounds to exclude him from the competition.

13. The drawings and descriptive statement with the blank envelope, shall be enclosed in a sealed envelope addressed to the president of the Toronto Stock Exchange, and delivered at the Exchange during the forenoon of Tuesday, January 2nd., 1912.

14. A survey plan of the property is attached to

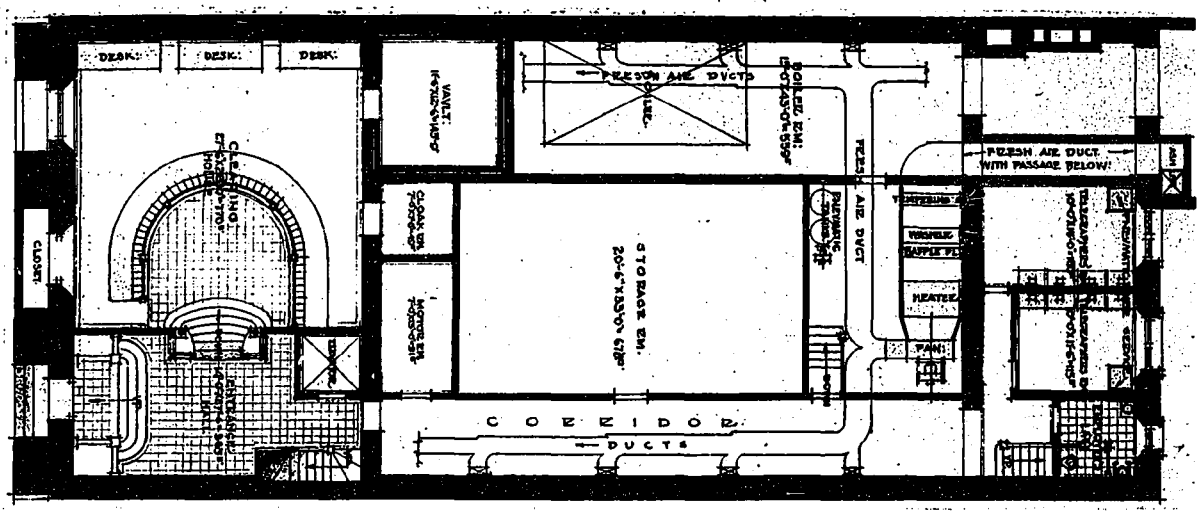


Ground Floor Plan.

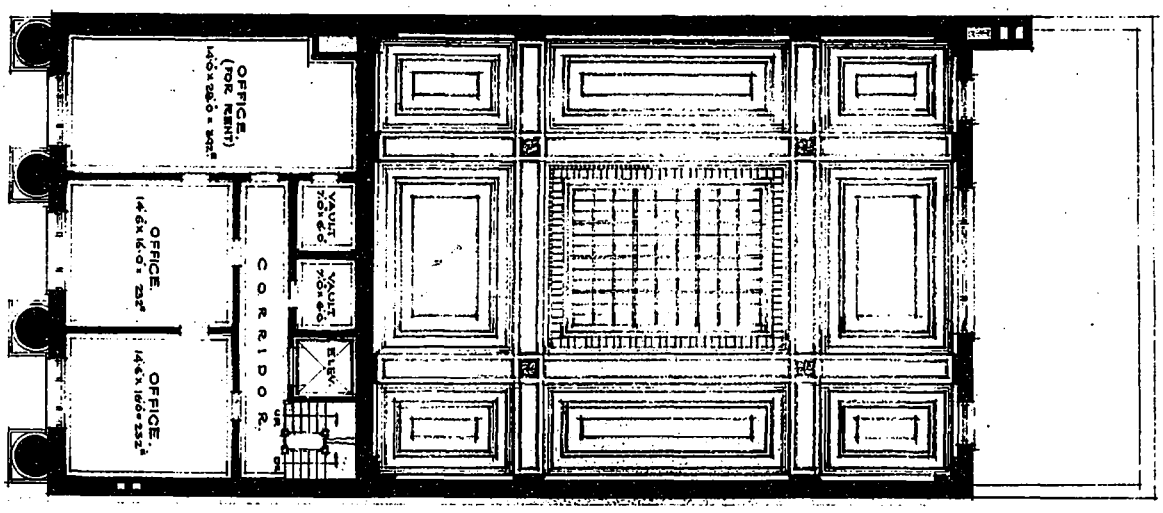


Interior Perspective.

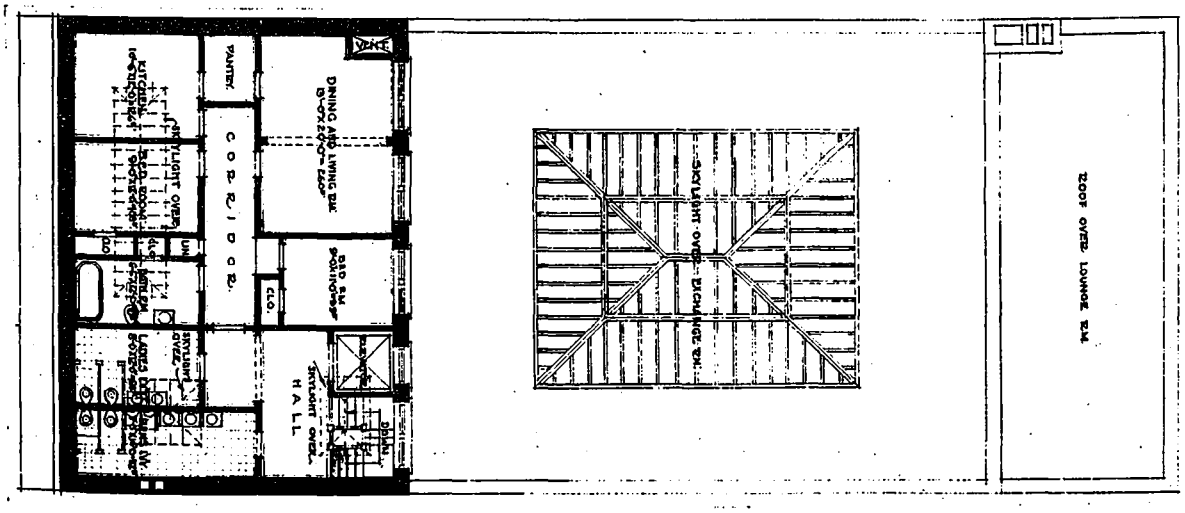
Accepted Competition Design for Stock Exchange Building, Toronto, Ontario. John M. Lyle, Architect.



Basement Plan.



Second Floor Plan.



Third Floor Plan.

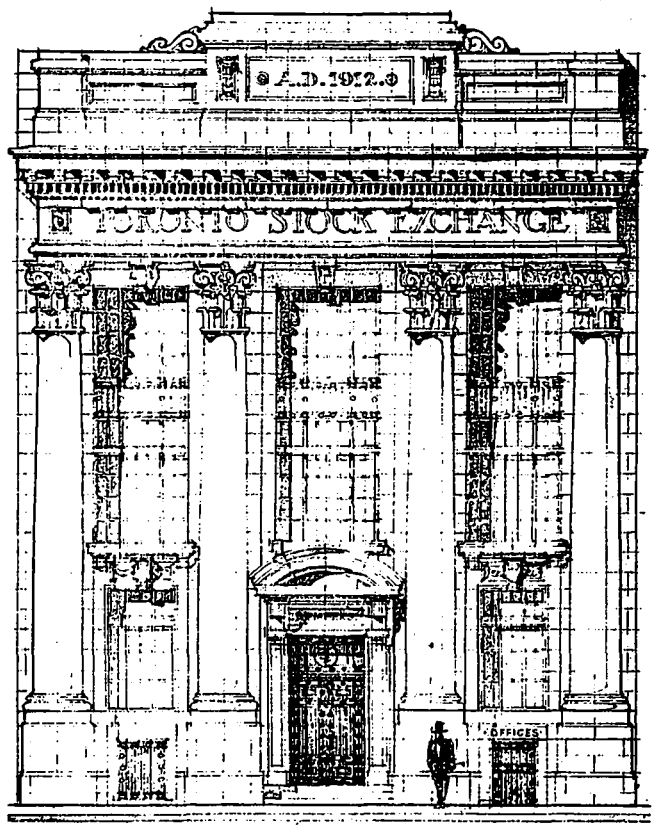
Accepted Competition Design for Stock Exchange Building, Toronto, Ontario. John M. Lyle, Architect.

these conditions and also a copy of an agreement relating to the wall at the southerly boundary of the property.

15. The total cost of the building, exclusive of equipment, is not to exceed seventy-five thousand dollars ($75,000), which sum is to include architect's fees, and competitors are requested to state the additional cost if the building is to be so constructed as to permit of two additional stories being added without varying the construction.

16. The building is to be of what is known as fireproof construction, and is to have at least four floors and basement on the street front. The main floor is to be placed at least six feet above the street line. One of these floors to be arranged for renting offices in two suites.

17. The Exchange room should be on the ground floor and have a floor area of not less than 2,500 sq. ft. and a height of not less than thirty feet, exclusive of dome. Provision is to be made for the introduction of ample daylight. Provision is to be made for an entrance to the staircase hall, as well as the members' entrance to the Exchange. Near the latter entrance should be a space for hall porter, visitors' room (area about 150 square feet), and a cloak room. A members' "Lounge" (area about 600 square feet) should be provided, with direct access from the Stock Exchange room. Provision should be made for a passenger elevator to reach the upper floors, where a space for the committee and secretary's and other offices, and the Toronto Stock Exchange Clearing House (area about 750 square feet), also caretaekr's apartments are to be provided in upper story. Provide sufficient vault accommodation.



Elevation of Accepted Design. John M. Lyle, Architect.

Ample lavatory accommodation for members and separate accommodation for employees and women. The telegraph operators to be provided for in the basement with two small rooms. A small entrance and provision for fuel delivery to be made from Mincing Lane.

18. Any competitor desiring further information should write before December 15th, 1911, to

W. H. BROUSE, ESQ.,
President the Toronto Stock Exchange.

The answer to such question will be mailed concurrently to each applicant.

Description of Accepted Design.
John M. Lyle, Architect.

We beg herewith to submit the accompanying drawings for the proposed new building for the Toronto Stock Exchange.

We have endeavored to design a building which shall first of all meet the actual needs of the members of the Toronto Stock Exchange, and at the same time be of architectural merit.

Special care has been taken to give ample lighting to the Exchange proper and the offices.

Subjoined we have noted certain points which we consider of merit in our scheme. Also subjoined you will please find a cube of the building and description of the heating and ventilating system proposed.

1st. The construction suggested is what is known as modern fireproof construction, similar to first class office construction. The exterior façade on Bay street is shown in stone, the balance of the walls in brick.

2nd. The Exchange room proper is lit from a skylight and also from the rear. The lounge room is placed at the rear, with large openings directly on the Exchange. Our reasons for placing the lounge room in this position are as follows:

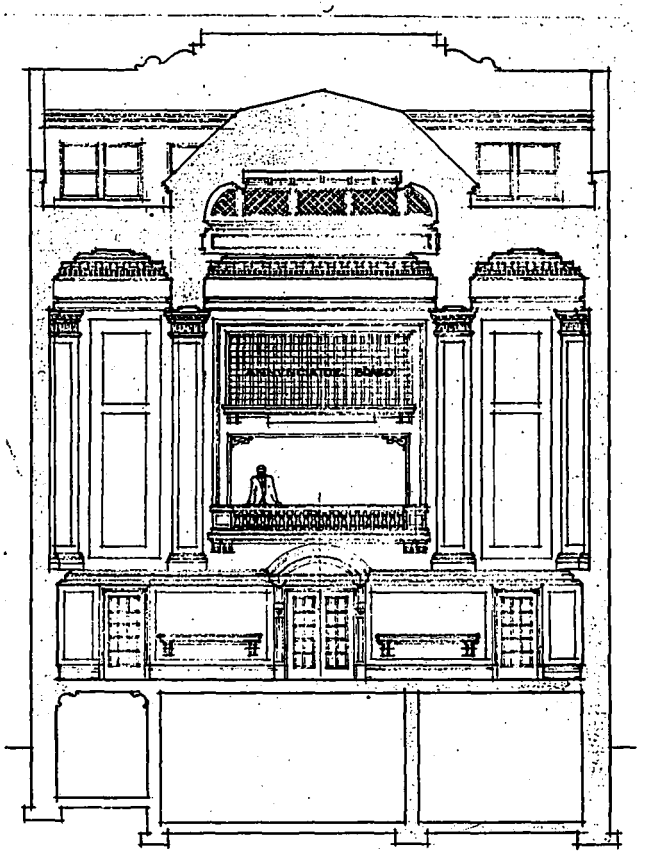
We have suggested an annunciator board which would signal to the members whether they were wanted by telephone or for interview. This annunciator board we have placed so that it would be well lit and could be seen from the lounge room and from any point of the Exchange floor. It is placed directly above the visitors' gallery, without any cross lights at the side and can be seen to advantage.

The openings from the lounge room are made ample so that the members of the Exchange can not only see the annunciator board, but can see any transactions that are taking place on the floor of the Exchange. This lounge room would be well lit from the rear. The height of this room is shown ten feet six inches, which will allow for ample windows over the roof of same, giving light to the Exchange.

3rd. The scheme suggested for the Exchange floor is to have the quotation boards along sides of the wall; the individual telephones arranged on the opposite wall, so that the board can be distinctly seen from the telephones without any interruption. We would suggest for the quotation boards that the system similar to the new boards lately installed in the Montreal Stock Exchange be adopted.

The long distance telephones are shown in a separate room directly off the Exchange room proper. Pneumatic tube service should be installed with tube sconnecting the main floor of the Exchange to the telegraph rooms in the basement. This would obviate the necessity of having messenger clerks to deliver telegrams, etc.

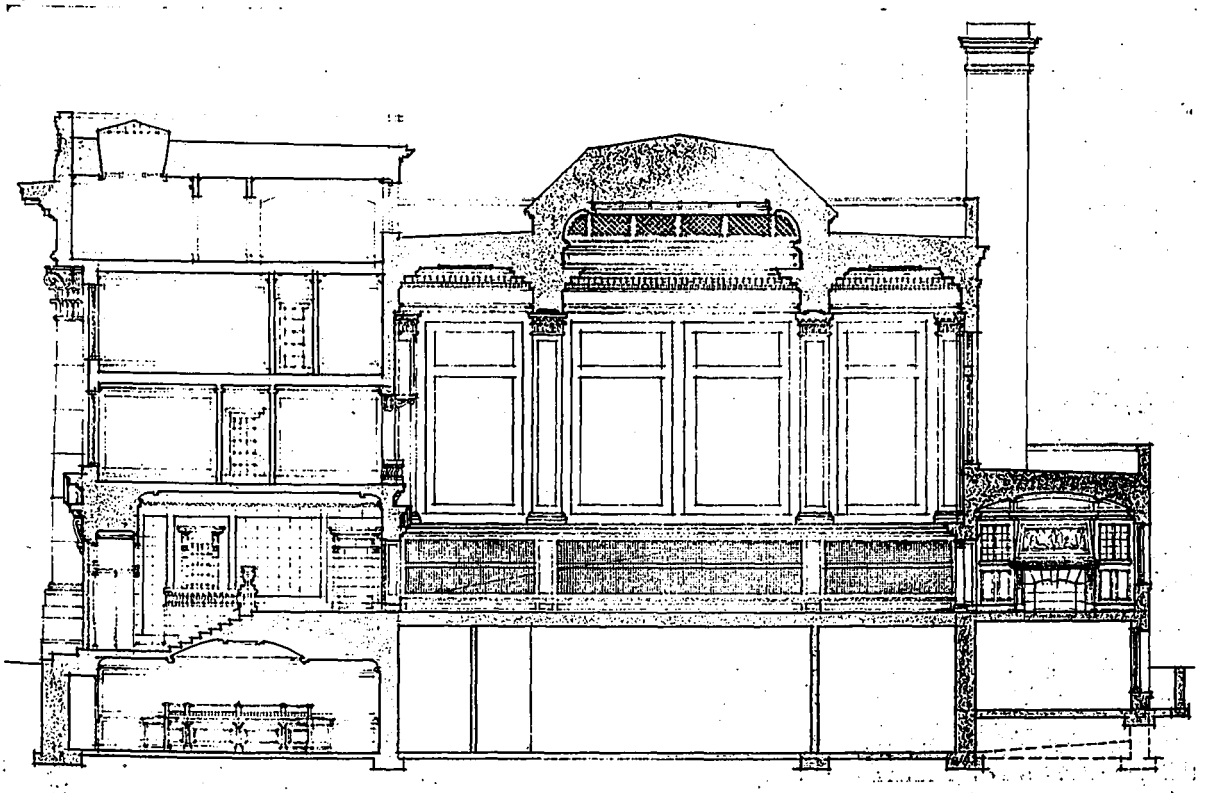
4th. The cloak room and lavatories are shown to the left of the main entrance—the lavatories being placed there in order to be in as close proximity as possible to the Exchange floor.



Section looking toward Entrance.

5th. The clearing house we have placed in the front part of the basement instead of placing it on the upper floor, as suggested in the programme. We think this location is preferable, as it is convenient of access to the street and for the delivery of certificates. We have indicated a circular box scheme similar to that in use in the New York Exchange. We understand that a similar scheme to this is to be installed in the Montreal Exchange.

By placing the clearing house in this position, we not only make it very convenient of access to the street and to the Exchange floor, avoiding elevator service, but it also enables us to gain extra renting space for offices in the floors above.



Longitudinal Section, Accepted Design. John M. Lyle, Archi tect.

Accepted Competition Design for Stock Exchange Building, Toronto, Ontario. John M. Lyle, Architect.

6th. The lavatories for offices, etc., and women's lavatories are placed in the top floor.
7th. The members' entrance to the Exchange floor is shown directly in the centre—entrance to the office is shown to the right of this, and is made secondary in importance.

Heating and Ventilating.

We propose a combination system of heating and ventilation, using direct radiation where possible—for instance, in the upper storeys of the front building—and hot blast ventilation for the following portions.
Stock Exchange, lounge room, clearing house, cloak rooms and lavatories, entrance hall, etc. This arrangement will give heat and ventilation in winter, and by using the fan and air washer in summer, the comfort of the members will be ensured.
The general arrangement of boilers, fresh air, inlet, air washer, heater and fan is indicated on the basement plan.
Special provision would be made to provide moisture to the air to be delivered, to avoid the atmospheric dryness of the ordinary plenum system.

Cubing Estimate.

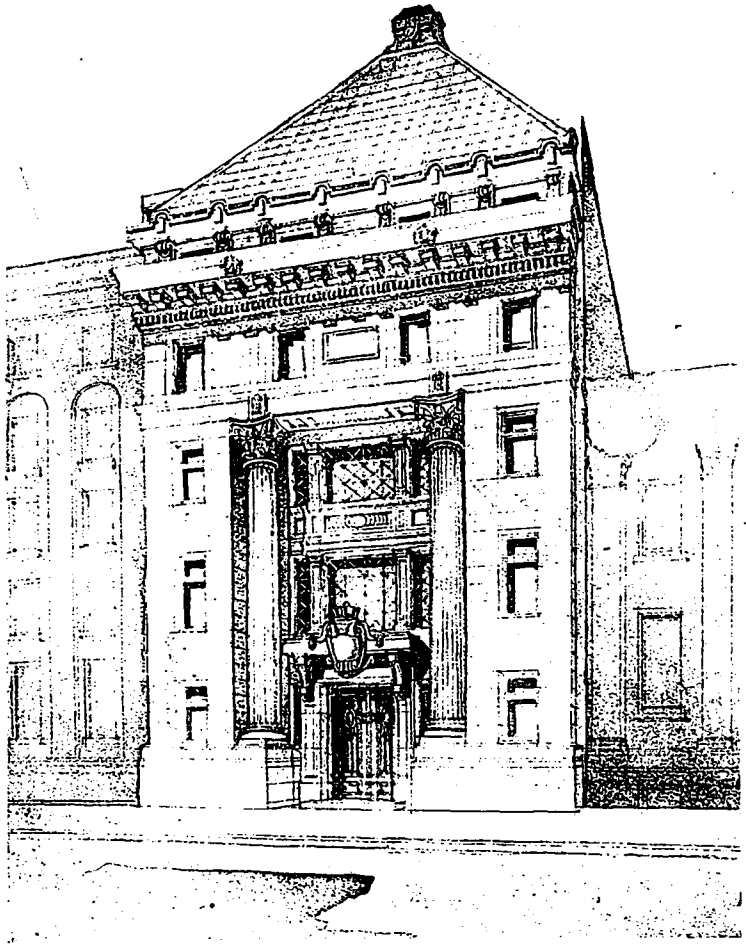
Front Building.			
Basement and ground floors, Cubic ft.			Cost.
46.0 x 35.0 x 28.0—	45,080	.40	$18,032.00
Upper floors,			
46.0 x 35.0 x 36.0—	57,960	.30	17,388.00
Stock Exchange.			
Auditorium,			
57.6 x 46.0 x 39.0—	103,155	.20	20,631.00
Skylight,			
25.0 x 30.0 x 8.0—	6,000	.10	600.00
Rear Building.			
Ground floor,			
17.6 x 46.0 x 14.0—	11,270	.30	3,381.00
Basement.			
Low part,			
75.6 x 14.0 x 15.0—	15,855		
22.0 x 17.0 x 15.0—	4,114		
Coal storage,			
18.6 x 12.0 x 9.0—	1,998		
High part,			
31.0 x 17.6 x 11.0—	5,967		
41.0 x 21.6 x 11.0—	9,697		
58.0 x 10.0 x 11.0—	6,380		
	44,011	.25	11,025.00
			$71,057.00
Architect's commission, 5 per cent.			3,552.00
			$74,609.00

Description of Premiated Design No. 27.
Williams & Ferguson, Architects.

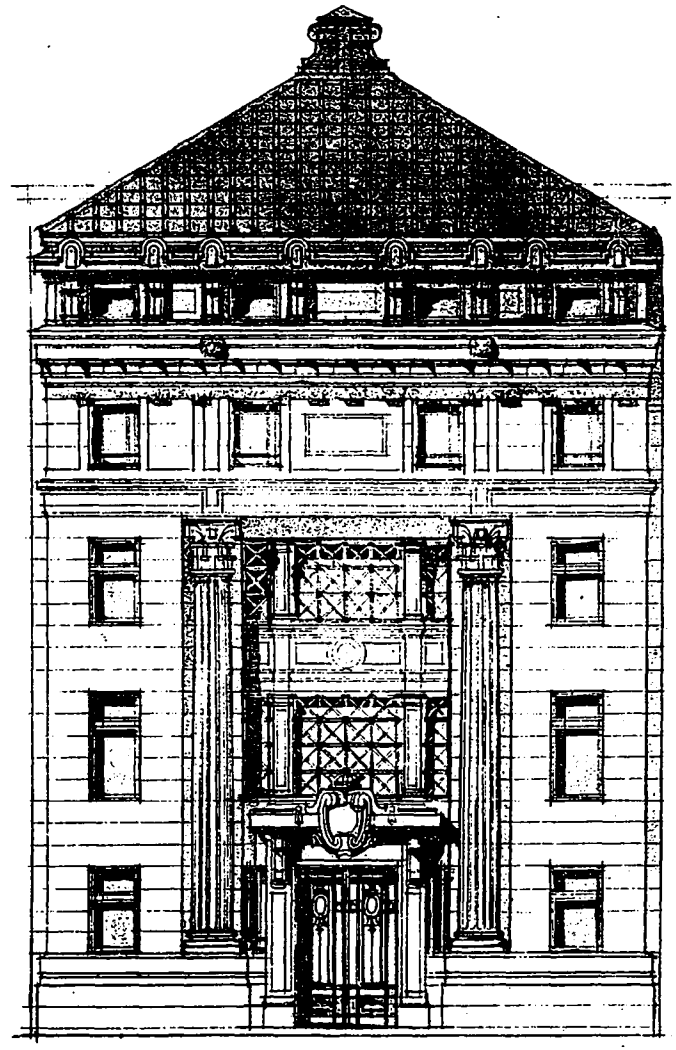
In designing and planning the accompanying scheme for the Toronto Stock Exchange, the principal problems which presented themselves to the authors were:

1—The necessity for separate entrances to the Stock Exchange and the offices above.
2—The provision of a lounge room adjacent to the Exchange room commanding a full view and within hearing of the Exchange, conveniently within reach of the entrance, but yet so isolated as to be inaccessible to any persons but members of the Exchange.
v—The provision of ample daylight to all portions of the building on the narrow, restricted site.
4—To provide a building sufficiently dignified for a Stock Exchange in our large and rapidly growing city for the sum of money available.

In our solution of these and the many other problems presenting themselves we believe we have met with considerable success; in all cases the comfort of the members has been considered of primary importance, but in no case have the office and other portions of the scheme been sacrificed in any way.
The required space for all rooms has been given, and in addition we have thought it desirable to provide what we have called a lounge clubroom for the further convenience of those members who might wish to be further removed from the Exchange than the lounge room proper, for reading, writing, conversational purposes, and yet be convenient to the Exchange in case of emergency. This room is very happily situated on the street front and would add greatly to the comfort and enjoyment of the members.
The ground floor plan shows a main entrance to the building in the centre of the street façade; this leads into an entrance hall from which the entrances for the Stock Exchange members and the entrance to the staircase leading to the offices above are separate and distinct.
Inside the entrance for the Stock Exchange members the situation of the porter's desk ensures the exclusion of all but those entitled to entrance. The members' coat room and lavatory is placed to one side of the Exchange entrance hall, and the visitors' room to the other.
A few steps up from the hall give access to the Exchange.
The remainder of this floor is utilized for the telegraph operators' rooms, lavatory, motor room, space for heating and air washing apparatus, a storage room, vault, etc. An entrance from rear lane is provided for telegraph operators, janitor, etc.
The Exchange room is amply lit from the central dome, and subsidiary skylights. The stock board will be placed in the centre of the rear wall, with members' annunciator boards on either side. These would be within full view from the whole Exchange room floor, the members' telephones alone the two sides of Exchange, the long distance telephones at either side of the Exchange room entrance, the lounge room and even the lounge clubroom itself.
The lounge room floor is placed slightly above the level of the Exchange floor (about five and one-half feet) and is reached by steps on either side of the Exchange room entrance. This arrangement provides ideal command of the Exchange room and the boards.
It is within easy reach of the visitors' room, the coat room, lavatory and the porter, and is nevertheless sufficiently private. The lounge clubroom on the same level as the lounge room and has the advantages already noted.
The second floor plan shows the committee room,

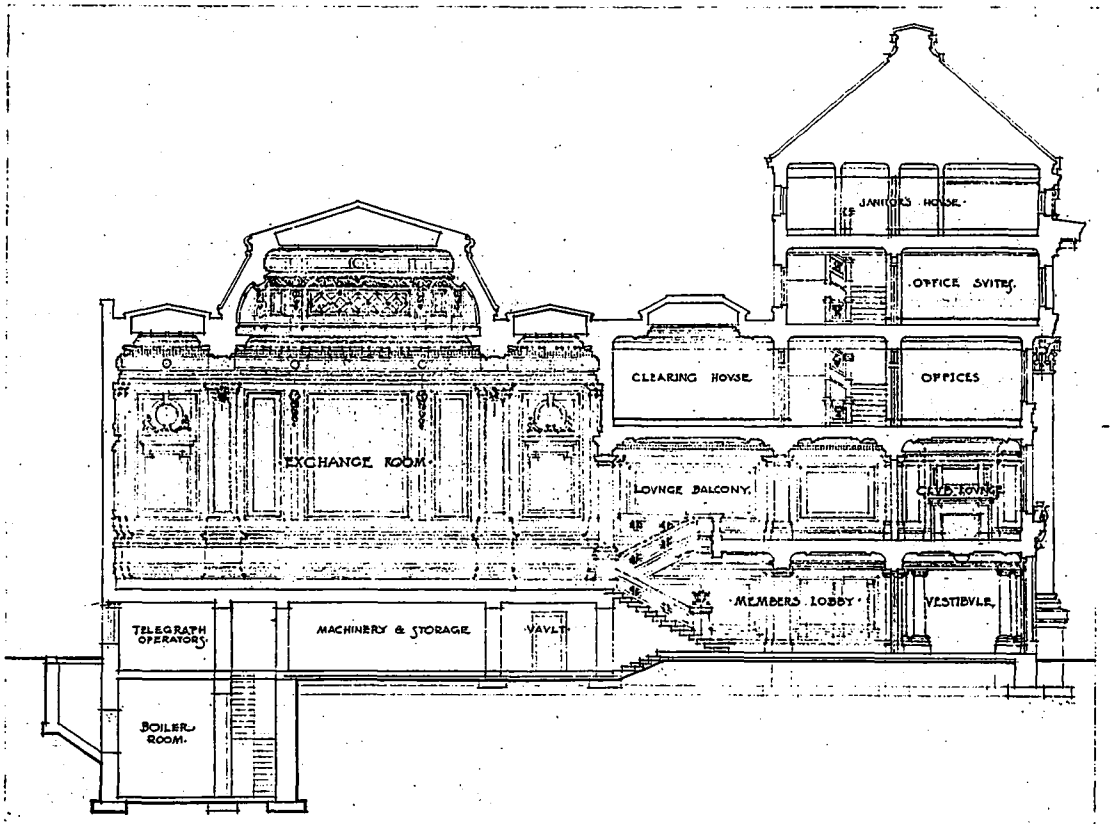


Front Perspective.

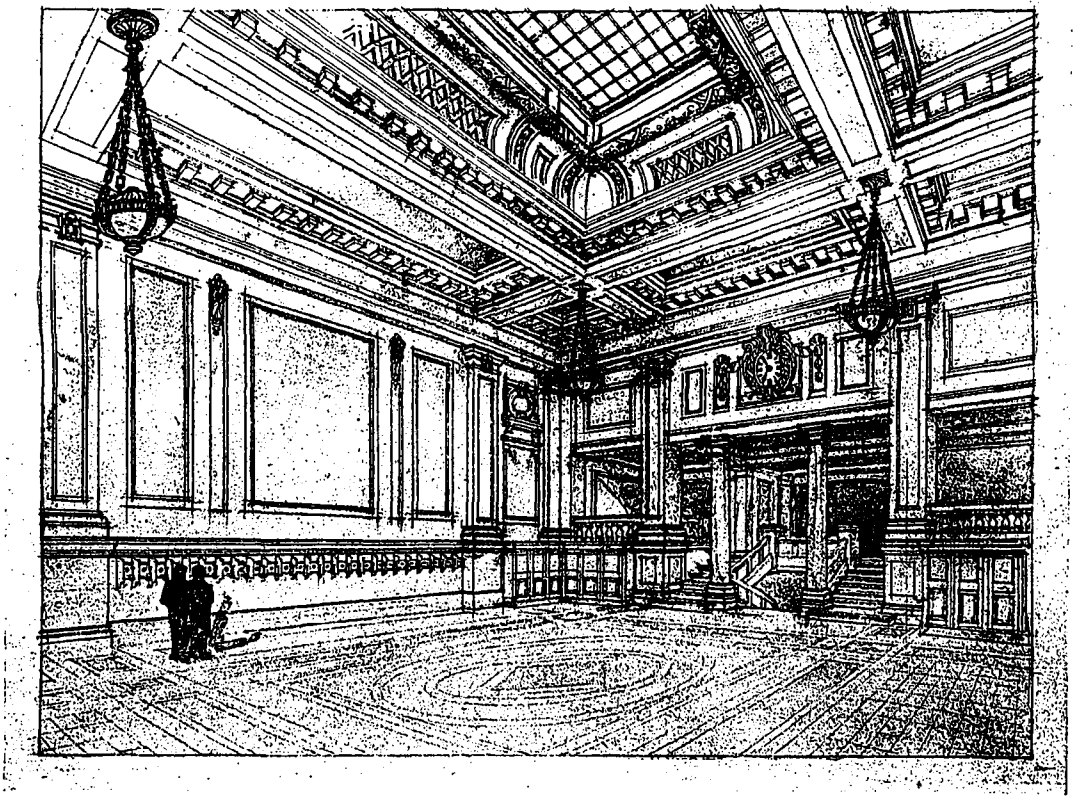


Front Elevation.

Premiated Competition Design for Stock Exchange Building, Toronto, Ontario. Williams & Ferguson, Architects.

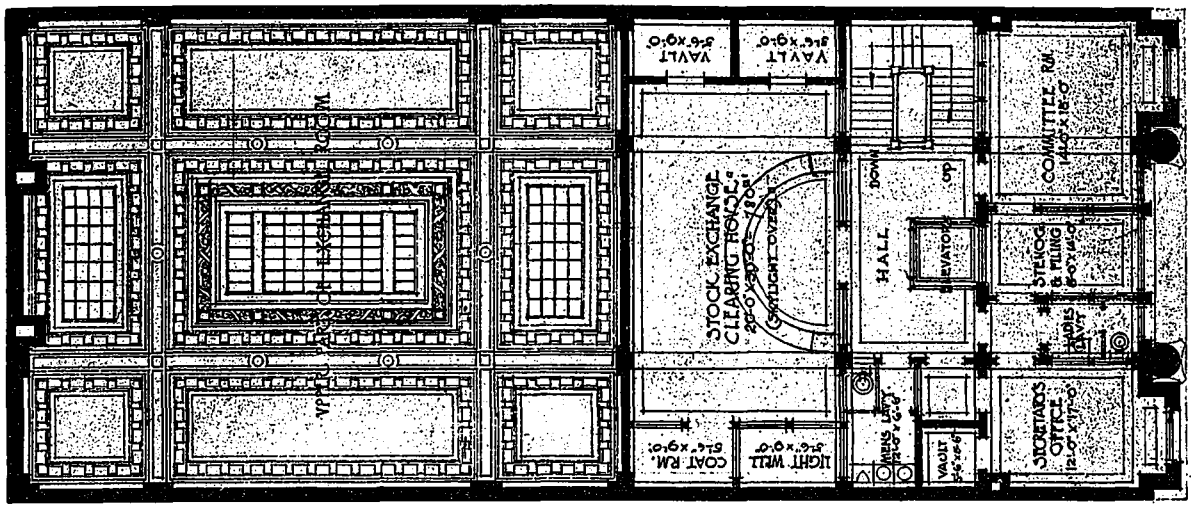


Longitudinal Section.

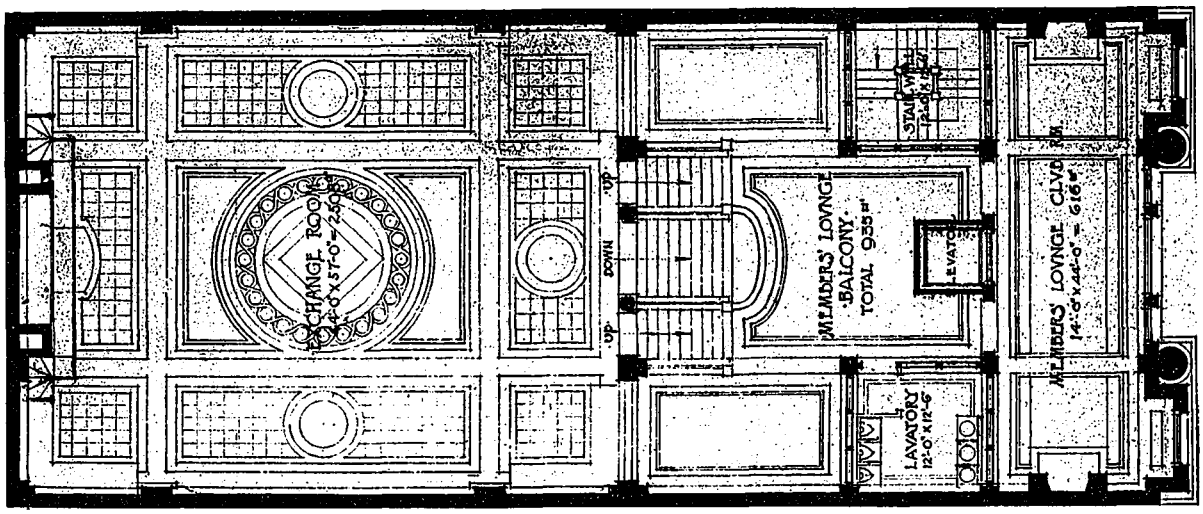


Interior Perspective.

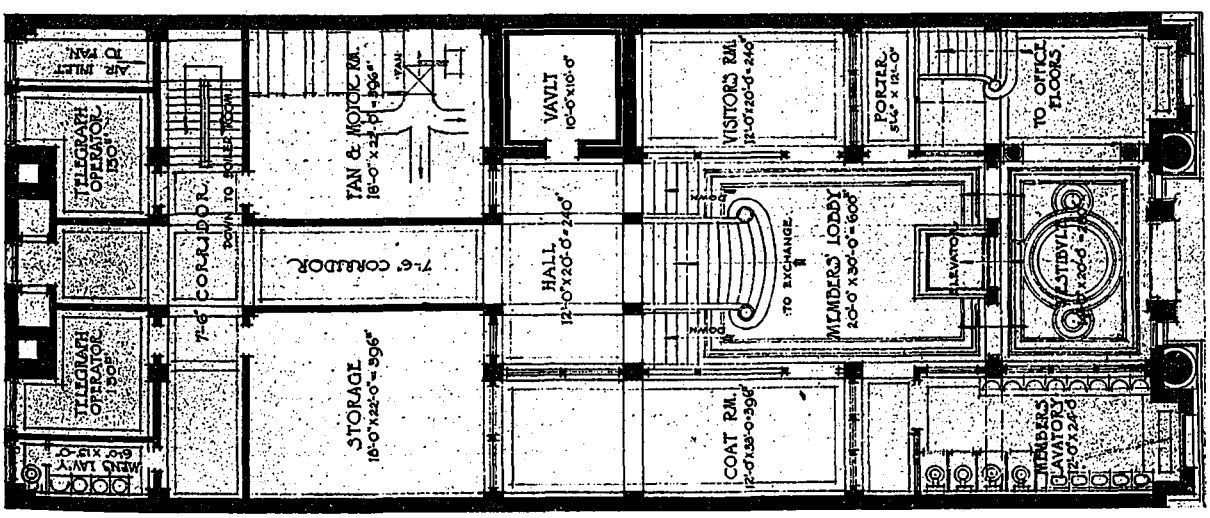
Premiated Competition Design for Stock Exchange Building, Toronto, Ontario. Williams & Ferguson, Architects.



Second Floor Plan.



Exchange Floor Plan.



Ground Floor Plan.

Premiated Competition Design for Stock Exchange Building, Toronto, Ontario. Williams & Ferguson, Architects.

secretary's office, with stenographers' room between; and the clearing house with ample vault and lavatory and coat room accommodation. We desire especially to call attention to the lighting of the clearing house from the skylight above.

The third floor plan shows two suites of good offices for renting purposes. These have ample lavatory and vault space.

The fourth floor shows good caretaker's accommodation, with windows towards the street over the main cornice, and also to the rear, thus doing away with any necessity for interior rooms with skylights.

The elevation and section indicate that we desire to provide a dignified, rich, but not too elaborate, building, expressive of its purpose.

The materials to be used on the front would be stone facing with bronze infilling at windows. The attic storey all above the large main cornice will be faced with copper.

The interior construction would be a combination of brick walls with steel girders and columns where required. All steel work and all floors would be fireproofed.

The interior finish for the most part would be of hard plaster, with a limited use of wood panelling and marble dadoes, etc. The Stock Exchange room and lounge room floor would be finished in cork tile to give the necessary quietness and to assist acoustically.

Heating and Ventilation.—In considering the heating and ventilating scheme the chief requirements are:

1—The proper circulation of air winter and summer.

2—Easy control of heat, to separate parts of building, which are not occupied all the time. These demands immediately suggest a plenum system for all parts of the building connected with the Stock Exchange proper, viz., the Stock Exchange room, lounge room, club room, clearing house, lavatories, coat room, halls, etc., and direct radiation for the upper storeys of the front building, staircase, etc.

We have indicated the position of cold air inlet from the lane, and the necessary tempering coils, air washer and cleaner, heating coils, and fan through which the air would be passed to duct leading to the various apartments.

The use of the air wash and fan in the summer time would provide for the supply of cool, fresh air necessary for comfort during warm weather. In addition, there would be an arrangement to provide moisture to the air to give the required humidity. Exhaust ventilating flues would ensure the removal of foul air, smoke, etc., from the Exchange, lounge rooms, clearing house, lavatories, coat rooms, etc.

The accompanying cubing estimate shows that the cost of the building would come within the amount available, too great elaboration should not be attempted.

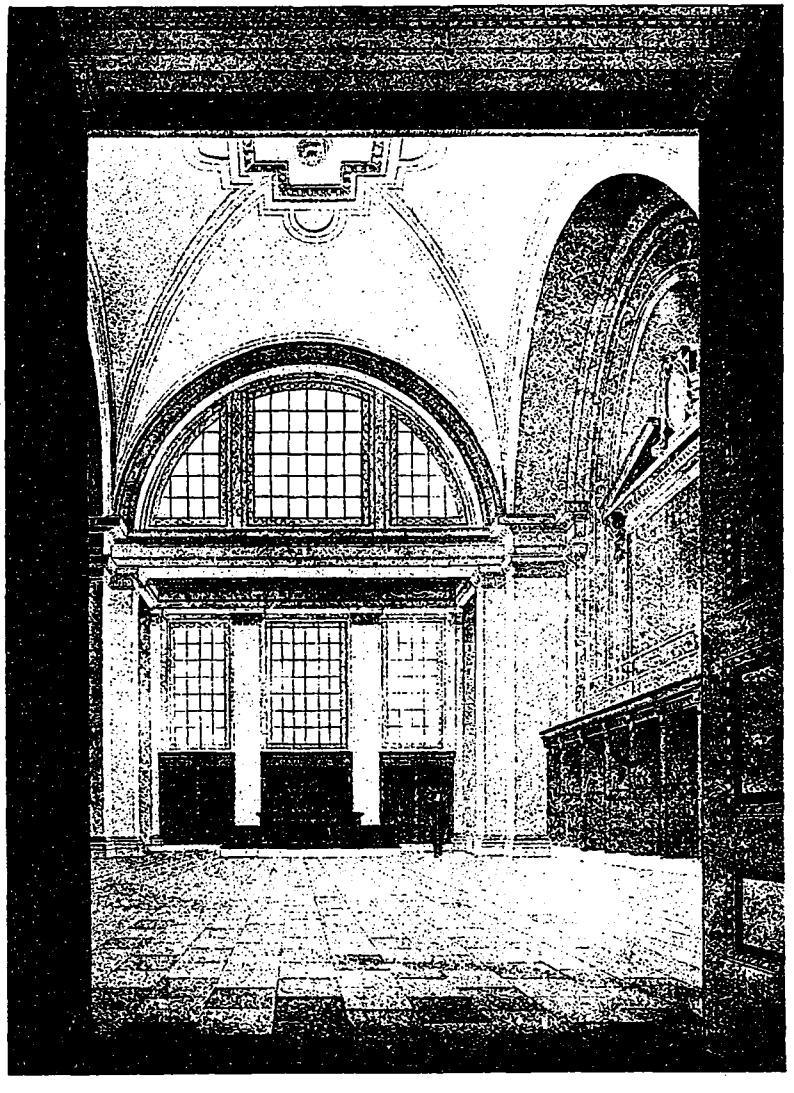
In conclusion, we can assure the promoters of the competition that if we are entrusted with the erection of the building from our designs, we shall always endeavor to meet their wishes, and to meet their approval in dealing with all parties concerned in a prompt and businesslike manner.

Description of Premiated Design No. 34.
Chapman & McGiffin, Architects.

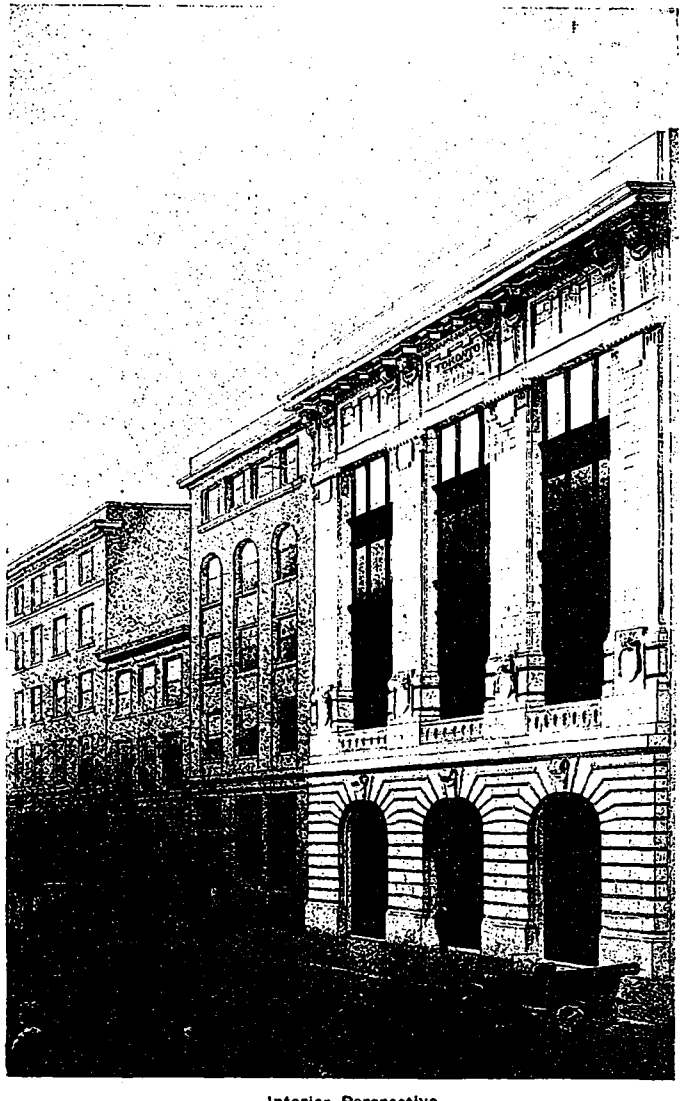
The effort of the author of the accompanying plans has been to obtain the best possible Exchange Room in regard to the acoustics, lighting and convenience in rapidly transacting business. It has been the endeavor to give the maximum area the lot would permit to the Exchange Room, and by economical arrangement in the planning of this floor an area in excess of that called for by the programme has been obtained.

The Exchange Room is lighted by large windows both at the east and west ends, thus avoiding the disadvantage on account of the heat in summer, snow in winter, and the danger of leakage of a skylight. With this arrangement a perfectly diffused light all over the room is obtained, and it is a light whose intensity can be easily controlled. Attention might be drawn to the manner in which the ceiling and architectural order of the Exchange floor has been continued along through the clearing house floor so as to make the architectural elements of the Exchange Room and the Stock Exchange Clearing House carry right through from front to rear of the lot. This feature will greatly improve the architectural effect of the whole interior and will express the relationship of the different elements pertaining to the Stock Exchange. A gallery has been shown entering off the clearing house floor, which, although not demanded by the programme, was considered by the author desirable for visitors and special occasions. If this gallery was not desired it could easily be omitted from the plans. Panels for the bulletin board and for the quotation board with gallery have been arranged on either side of the large Exchange Room, and telephones have been planned in the recesses around the room, with the switchboard operators and other clerks at a counter in the rear of the room, from which pneumatic tubes would go to service in the basement, just below. These operators have their own means of access to the rear of the Exchange Room, thus avoiding their having to cross the Exchange floor or entering into any other part of the building. The simplest and most direct communication from the Exchange floor to the clearing house and offices, above, has been arranged.

The visitors' room has been placed on the main floor, but it has been arranged so as to be perfectly easy of access from either entrance. The porter, who has a booth placed between members' entrance and public entrance, thus controlling both entrances, can easily direct or usher the visitors up the short flight of stairs on the north side of the public entrance, which leads to the visitors' room. This arrangement gives a more presentable room without the expenditure of raising the whole main floor necessary to give the proper ceiling height on the street level floor, and has the additional advantage of permitting members to consult with a visitor without

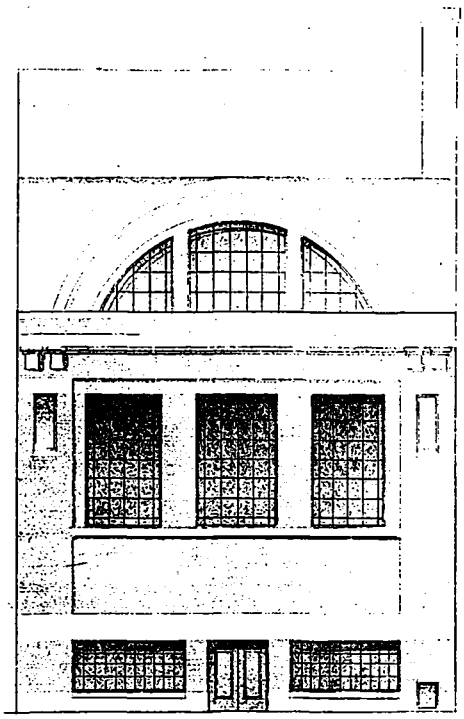


Exterior Perspective.

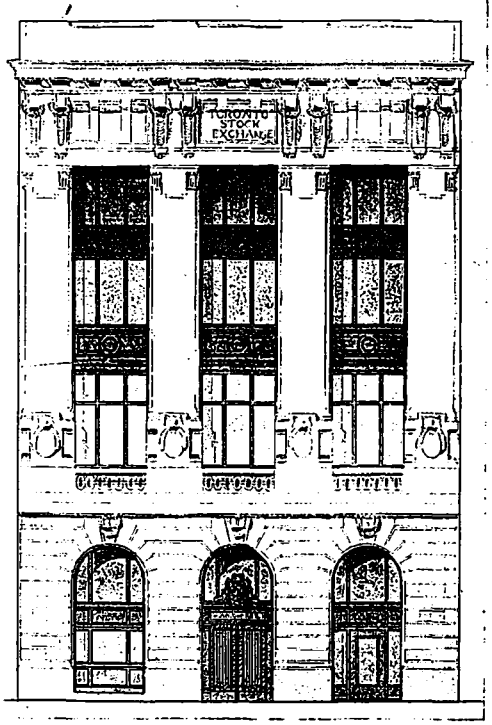


Interior Perspective.

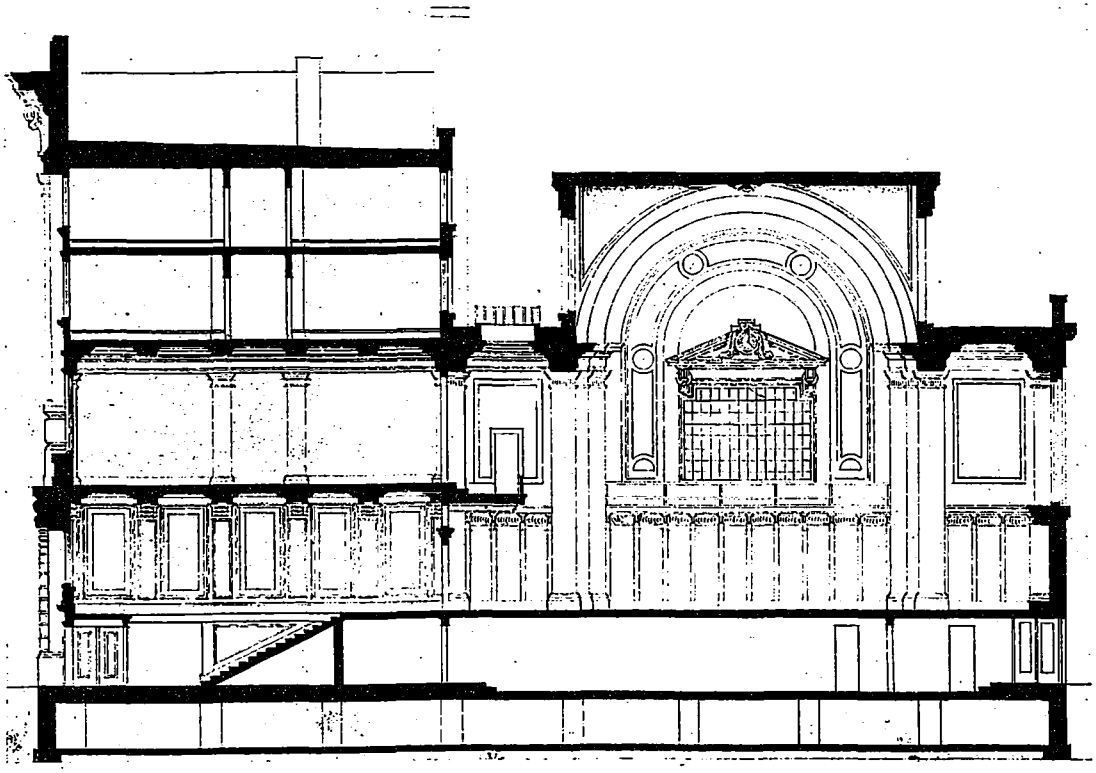
Premiated Competition Design for Stock Exchange Building, Toronto, Ontario. Chapman & McGiffin, Architects.



Rear Elevation.

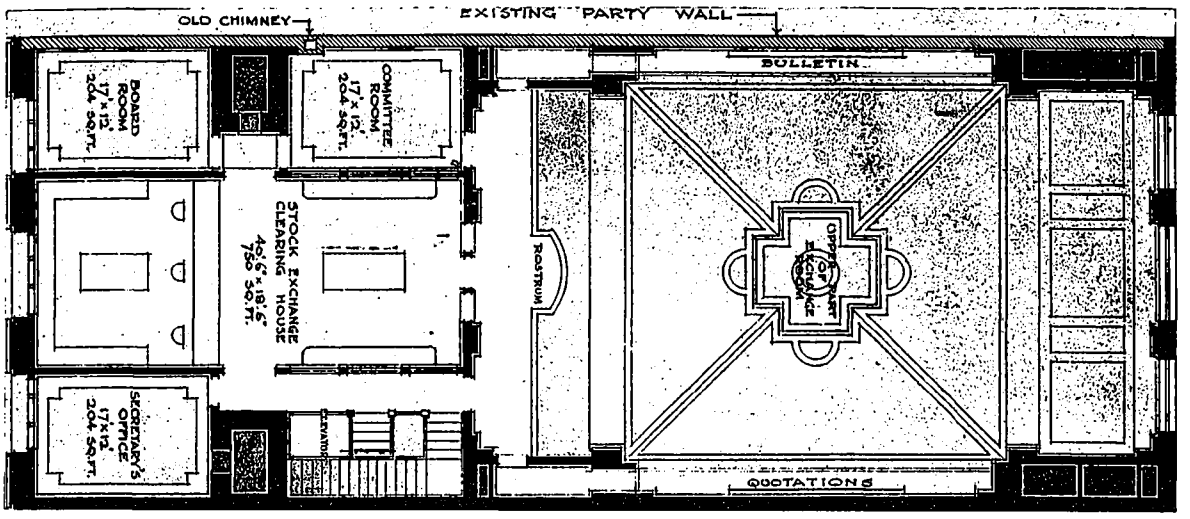


Front Elevation.

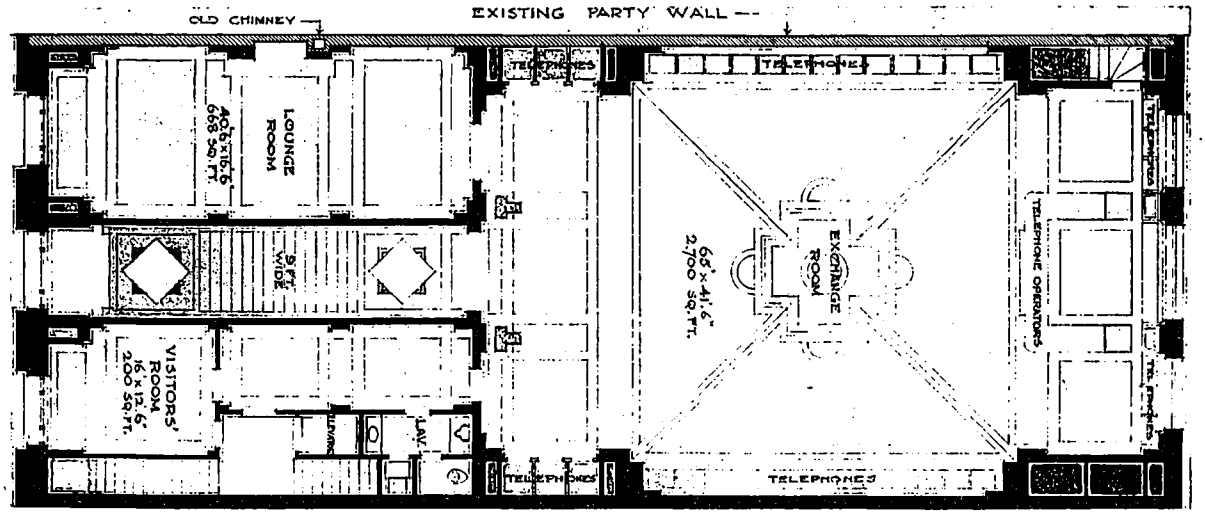


Longitudinal Section.

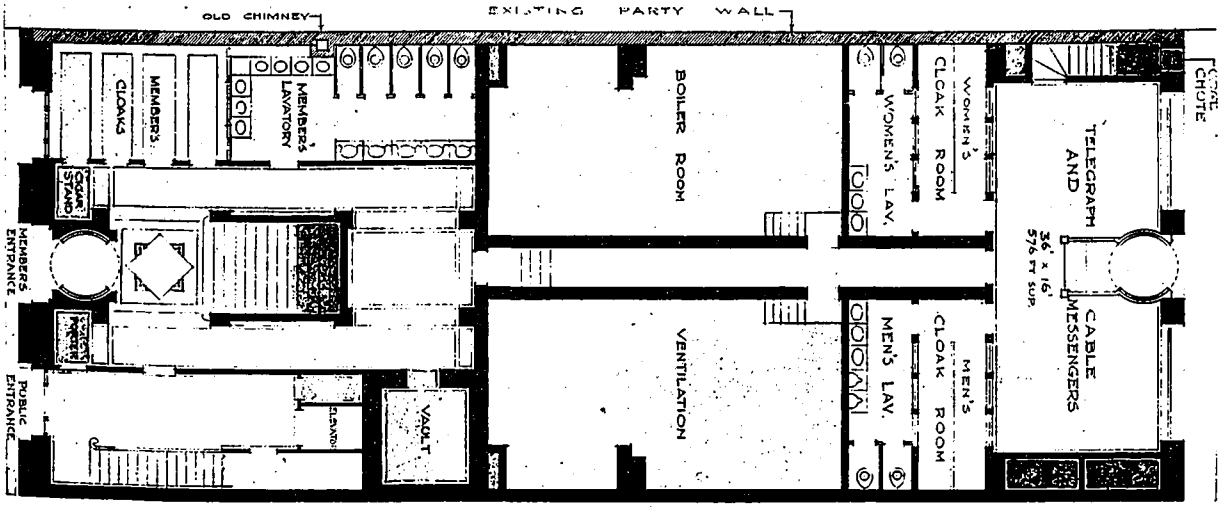
Premiated Competition Design for Stock Exchange Building, Toronto, Ontario. Chapman & McGiffin, Architects.



Second Floor Plan.



First Floor Plan.



Ground Floor and Basement Plan.

Premiated Competition Design for Stock Exchange Building, Toronto, Ontario. Chapman & McGiffin, Architects.

leaving the main floor. This room is also in communication with the visitors' gallery, above.

With regard to the exterior, it has been the endeavor to obtain a monumental character consistent with the important function of the building, without the extravagance of columns, which are impractical to construct in cheaper materials, and which waste a large area if worked out on a sufficiently monumental scale. The broad pilasters shown on the elevations and sections are designed so that they will be executed in semi-glazed terra-cotta, and also so as to give a broad and substantial monumental effect that will hold its own with any building that may be erected on the adjoining lots, no matter how high they may go.

The materials of the exterior will be white marble for the sub-structure and semi-glazed terra cotta to match in color the base from the second storey up. The window and door frames and spandrils will be of cast iron. The interior walls and ceilings will be constructed of cement and ordinary plaster, and the different rooms will be colored in a suitable manner. The floor of the Exchange Room will be in cork tiling. The advantages in acoustics, appearance and comfort for this one room justifying the expenditure in this particular place. The floor of the entrance hall and the main stairs will be marble; the lavatories, public entrance hall, etc., will be of terrazzo.

With regard to the ventilation, the general scheme is to draw fresh air in from the large duct, shown at the rear of the building, down to the washer and tempering coils in the basement, and thence forced by the fan up the various ducts located in the corners of the Exchange room and also in the common room. The fresh air would be discharged near the cornice in the Exchange room and the foul air taken out at the floors so that there would be a down pressure of fresh air, which would tend to lay the dust and keep the room perfectly fresh. There would also be a supply of fresh air forced into the clearing house room. The lavatories and cloak rooms would be ventilated by exhaust flues without any supplies so that there would always be a current of air into the lavatories without any danger of one in the opposite direction.

The whole scheme has been studied to get a maximum amount of accommodation together with a minimum amount of cubical contents consistent with the necessary architectural proportions for a building of this character. The cubical contents of the building are 294,012 c. ft. This allows twenty-five and a half cents (25½ cts.) per cubic foot, which is practicable, owing to the largest part of the building being the open space of the Exchange room, and also on account of the curtain wall, on the south side, being already constructed. It might be added, here, that the supports for the dome would be built up independently of the party wall. The method adopted for estimating the cubical contents has been to the top of the roof, outside dimensions being taken take the height from the bottom of the footings to in every case with the exception of parapets. It might be noted, here, that the dome, shown for the Exchange floor has not been figured square across, as the receding angles at the intersection cut off considerable cubical contents, and, incidentally, it might be noted that these receding angles help to give a much more efficient light for the space between the dome and office building, than is indicated on the sections. The old party wall has not been figured in the cubical contents.

The programme asks for an estimate of additional cost in making the structure strong enough to add a couple of stories in the future. Unfortunately, the calculations necessary to give an intelligent answer to this question have not been completed, but the additional cost would be small as the two additional stories completed would cost about eight thousand dollars ($8,000.00). The supports for the curtain wall for the two additional floors would have to be carried up from the basement as the party wall could not be utilized for a greater height than that planned for, but this would not be much additional expense, and provision for these supports has been made in the planning, and, also, in the designing of the elevation. In the latter case the freize on the top storey has been designed in such a manner that it can be easily pierced for windows at any future time, and the attic storey could be easily arranged in a parapet above the cornice.

THE MANUFACTURE of building stone from smelter and blast-furnace slag is an industry of considerable importance in Germany and is carried on to a greater or lesser extent at nearly all such plants. The process is not patented and is very simple in details. Practically all blast-furnace and smelter slag is suitable for stone making. Slag for this purpose must, however, be in granulated state. All attempts to utilize slag that has been crushed or ground, after having once hardened, have failed to result in a solid stone. The slag is granulated by the addition of water as it flows hot from oven or furnace. It is then mixed with lime—pulverized slaked lime or milk of lime—in the proportions of 7 to 10 parts of slag to 1 of lime, according to the nature of the slag, and while moist in this condition is subjected to pressure in moulds of the desired size and shape. A special type of press, with pressure power of 22,000 to 50,000 kilos (kilo equals 2.2 pounds), is used. An improved type of press of this kind costs about $3,000. Practically any form of power may be used and any desired shape of mould. The granulated slag, after being thoroughly mixed with the required proportion of lime, is allowed to stand one hour before being put through the press. After being pressed, the stones are stacked in the open air, where, after three or four weeks, according to the weather, they are ready for use. Under low temperature they harden slowly. If subjected to frost before thoroughly hardened, they are crumbled and destroyed. Operations may, however, be continued in the winter, the stones being hardened in steam-heated drying rooms. These stones grow constantly harder with time and after several years show a resistance of 100 kilos per square centimeter.

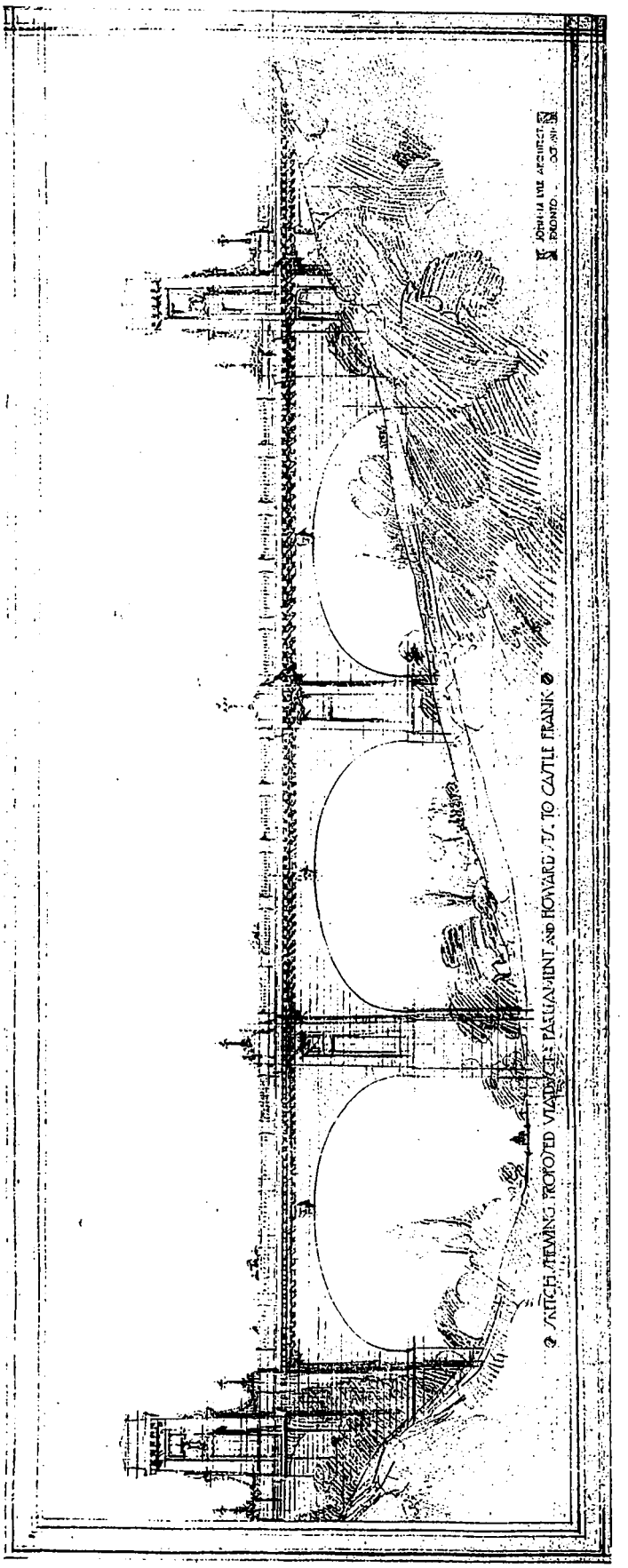
DANFORTH AVENUE AND BLOOR ST. CONNECTION

Architectural plans that give a logical solution to a problem on lines of greatest utility, and adding to the natural beauty of the Rosedale section in Toronto.

CONSTRUCTION had occasion recently to call attention to a case of street extension in Toronto in which mere utility as expressed by the plans of a thoroughly competent engineer in a straight line viaduct jeopardized the conservation of natural beauty, and indicated that the same result could be attained and the utility served as well by careful architectural planning.

While CONSTRUCTION sympathises with not only the necessity for this improvement in the circulatory arteries of Toronto, but the same situation in all cities, it does not believe that any permanent good can be accomplished by the mere relief afforded in a specific case, unless it joins logically with a general plan. A city engineer can build a stable viaduct or a subway and it will stand the traffic to which it is subjected. But the time has come, and every city in Canada or anywhere else, must recognize the fact, when there are more factors than mere strength, directness and general utility to be considered in all municipal problems. The reason most cities in their down town aspect are so arranged that one utility gets in the way of another, and the result is costly service and wasteful business conditions, is because the art side of the construction of that city was never thought of by its builders. If the construction of the individual unit was adequate for its direct purpose, no thought of its relation to its neighbor was considered. The idea is that art, which means a joining of one plan with another and especially a consideration of neighboring requirements, and their relationship has been held to be a mere sentiment and therefore valueless.

In the agitation for the connection of Bloor street with Danforth avenue, across the intervening Don river valley, the rights of the city as a whole are wholly ignored by the advocates of a straight line viaduct connection from point to point. Of the many other factors, the destruction of values of individual property would in itself be allowable, if necessary, to accomplish real public good. The destruction of the beauty of a section of the city that has attracted strangers to its gates and has been a constant pleasure to the people,



places the matter in an entirely different light. The entire principle is based upon the greatest good to the greatest number, and the entire good in a street is not that it facilitates the transportation of one section with another. As the controversy over this particular improvement in Toronto is typical of similar situations elsewhere and the lessons learned from this may be applied in other cities, CONSTRUCTION presents a plan by which the straight line viaduct can be avoided and the same transportation facility obtained and at the same time the natural beauty of the section be enhanced instead of ruined and at a lesser financial outlay.

The sketch drawings for the proposed viaduct scheme connecting Bloor street with Danforth avenue, Toronto, which are here shown, have been prepared by John M. Lyle, architect.

This terrace scheme is similar to that proposed by the Civic Improvement Committee.

The proposed improvement has been under discussion in Toronto for some years, and has twice been voted on as a by-law and twice defeated, and there has been much discussion as to the best method of crossing the Rosedale ravine and the Don valley. The levels of Bloor street and Danforth avenue are approximately the same; they are also on a direct line one with the other. The three principal routes suggested as as follows:

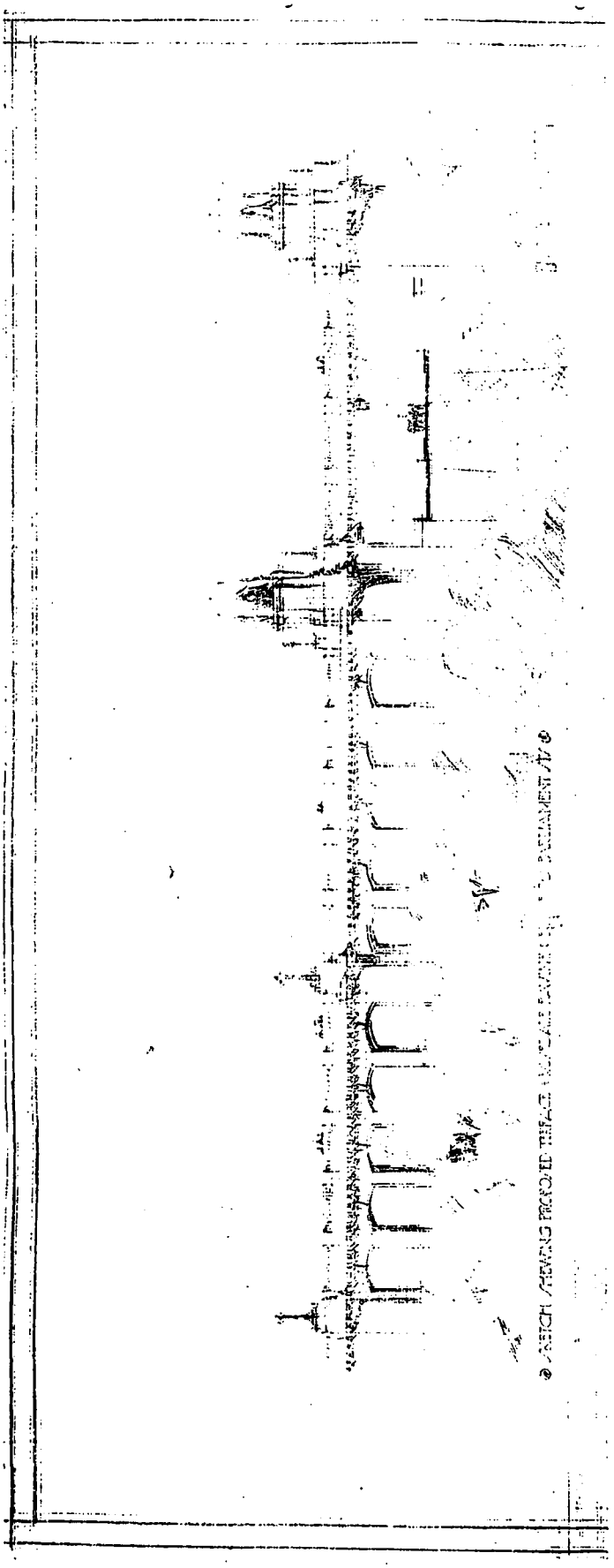
1st. That proposed by the City Engineer, viz., a straight viaduct in a direct line at high level, connecting Bloor street and anforth avenue, with a connecting viaduct at right angles from Parliament street.

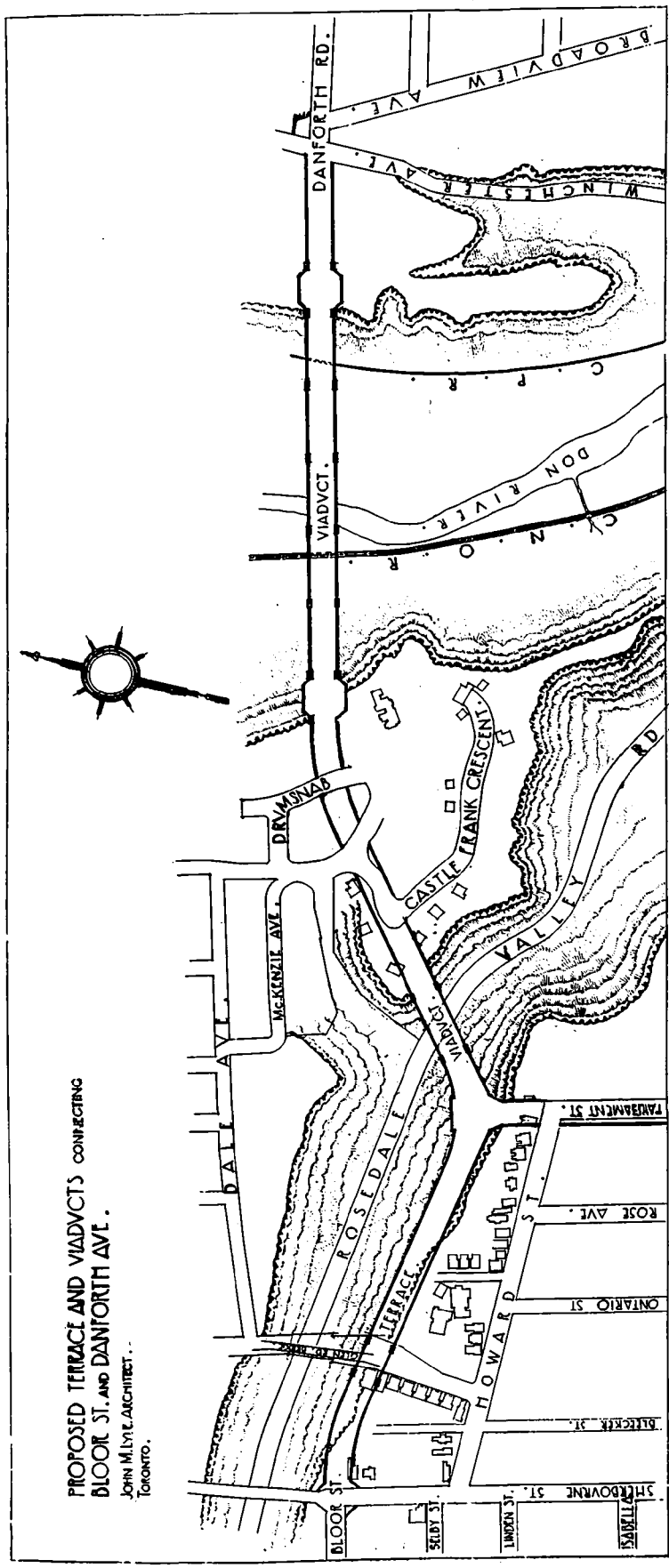
2nd. A viaduct connecting at high level from the head of Parliament street across to Castle Frank crescent, Rosedale, and thence in a direct line to Danforth avenue connection to Bloor street via Howard street.

3rd. Terrace route connecting Bloor street by means of a terrace along the southerly side of Rosedale ravine to a viaduct at Parliament street and thence to Castle Frank crescent and Danforth avenue.

The sketch drawings published in this issue illustrate this last mentioned scheme.

The great objection to the first scheme, viz., the straight viaduct, is the fact that its construction will practically ruin the scenic beauty of the Rosedale ravine, as it would run almost parallel to the two banks for some 1,800 feet. It would also cut through some of the finest residential property in Toronto and would make its construction enormously costly. The land damages would certainly be very heavy.





The city authorities in advocating the straight route did not contemplate reimbursing any of the property holders except those whose properties are directly affected. If the straight viaduct runs down the centre of the ravine, the people on the south side of the ravine and also those living on Dale avenue, would have the value of their property very materially decreased, but would not receive one cent of damages from the city. In other words, the actual damages by the straight viaduct would be enormously high, as would also be the sentimental damages.

The objection to the second, or Howard street, route would be the number of turns and greater distance to be traversed between Danforth avenue and Bloor street. It would mean that there would practically be four sharp street car turns, not to speak of the fifth slight turn in from Danforth avenue line at Castle Frank crescent. This latter, of course, would practically be a cuvre, but the street car turnings from the viaduct into Parliament street, from Parliament street into Howard street, from Howard street into Sherbourne street, and from Sherbourne street into Bloor street, would certainly be a very great objection to this scheme. While it is true that the construction of this viaduct would enable the people to get down town via Parliament street to advantage, the connection with Bloor street would be decidedly bad. The terrace scheme would seem to have many advantages over the other two schemes. First of all, by this route the distance between Bloor and Sherbourne streets and Danforth avenue would be only 190 feet longer than by the straight viaduct, and it would be cheaper than the straight viaduct. A retaining wall could be built along the southerly side of the ravine, and the earth filled in between this retaining wall to form a fine boulevard. The boulevard would run along in an easy curve to the Parliament street viaduct and thence by easy curve to Castle Frank crescent. There would practically be no land damages except two or three houses. The construction of this boulevard would place St. Simon's Church and other properties on a splendid street and would materially enhance the value of much of the property in the neighborhood.

If this boulevard were built 86 feet wide as shown with it as a beautiful walk. Bandstands and con- on the drawings, it would make a promenade similar to the Riverside drive, New York. In fact, there would be nothing in Toronto which could compete necting terrace walks with the ravine could be provided. If the tube system were adopted, this scheme would lend itself to the economical construction of a subway, as there would be much less filling to be done.

The drawings show only a portion of the terrace scheme, namely, some hundred feet at the Glen road bridge. The viaduct across from Parliament street and the terrace are suggested as being built in concrete. It would be possible with the use of concrete and stone to make both terrace and bridge interesting architecturally as well as structurally. A great man yconcrete bridges and viaducts have been built in recent years, both in the Sattes and in Europe, with great success, and it is to be hoped that in the event of the construction of this viaduct that there will not be erected another of the hideous steel bridges which now cross the Rosedale ravine at different points. While the initial cost of these steel structures may be somewhat less than the concrete, their upkeep and repair is very heavy. They are also extremely noisy.

SELECTING A PROFESSION

CIVIL ENGINEERING and Architecture are closely allied, says The Engineer. Indeed long ago the engineer was an architect and the architect an engineer. In modern days a difference exists, well marked and clearly defined. None the less, it is bridged over here and there. So much in common may be found that in certain respects that which is true of one profession may be taken as true of both. Under the conditions a useful lesson may be drawn by would-be engineers from the experience of would-be architects, very clearly, and withal gloomily, set forth in a warning just issued by the Executive Council of the Guild of Architects' Assistants. The Council desires to draw the attention of the public "to the present overcrowded state of the architectural profession, and to warn parents of the inadvisability of placing their sons as pupils to the profession at the present juncture, unless they are fully satisfied of their ability, sufficiency of capital, and social position in order to form a practice of their own on completion of their articles, or that an official appointment of some kind is assured." The construction of the warning leaves something to be desired; but its meaning is perfectly clear. There is no such thing as a Guild of Engineers' Assistants. If there were its executive council might with equal propriety frame a similar warning.

Architects of experience, aware of all the facts, have cast about for a remedy. There is, of course, only one. To wit, a limitation of the number of architects, or rather of men who claim to be architects. The sole way that suggests itself is registration. This means that no one shall pretend to the practice of architecture until he has passed an examination and received a diploma from some adequate authority. The question what is an architect remains untouched. It is questionable if registration would cure the evil. It certainly would not unless some means existed of punishing pretenders. The Society of Architects has been trying to get a Bill through Parliament. It holds that an architect should be placed under the same rules as medical men and lawyers, and be punishable if he practises without registration. The Bill has been opposed, however, on the ground that it is unworkable, because it is impossible to scheme a system of examination that would fairly test the knowledge of a candidate. Be that as it may, the fact remains that many young men who have passed the highest examination of the Royal Institute of British Architects are glad to earn thirty shillings a week. Precisely the same thing may be said of hundreds of young engineers who have passed high examinations—civil, mechanical and electrical.

Any one undertaking to effect improvements must, furthermore, bear in mind that those who have to spend money have an abundant lack of faith in the passing of examinations as a guarantee of ability to spend it rightly. Knowledge is of no avail unless the possessor of it is able to apply it in practice

It so happens that about fifty boys out of every hundred want to be engineers. Very few, we think, desire to become architects. It seems curious, therefore, that the profession should be overstocked. Doubtless the plethora is comparative. There is too little work to go round. To most men, however, comes at some time opportunity. It is the turning point in their career. It is well that those responsible for a boy's future should weigh well the question whether he is of that brand which sooner or later claims recognition by its inherent ability. Much of the crowding of the lower ranks, or, shall we say, the junior ranks, of all professions is due to want of recognition of the importance of the part played by the man himself. It is simply impossible that some boys should ever make competent engineers or architects, examinations to the contrary notwithstanding. But parents and guardians do not know this; they have no means of knowing. The working of the rules of the medical profession supply an instructive lesson. Here we have a splendid system of education and stiff examination. But it is a matter of common knowledge that there are competent and incompetent doctors and surgeons, and that the profession is very much over-crowded. The truth is that parents and guardians are at their wits end. No matter what they select, they are certain to regret in a few years that they had not made a different choice. But the necessity for making thorough inquiry cannot be too strongly enforced. It would, we think, often prevent the commission of a fatal mistake. In the words of a leading architect, "To send a half-trained youth into it is to ensure poverty for him for the rest of his life." We are not sure that complete training would make much difference; there are so many fully trained men lacking employment.

RECENT DEVELOPMENTS IN PAINT TECHNOLOGY

An exhaustive article on Paint, read before the forty-fifth annual convention of the American Institute of Architects, held at Washington, December, 1911. Presented by Henry A. Gardner, Assistant Director of the Institute of Industrial Research. Revised for publication by the author for "Construction."

LUMBER AND *Its Relation to Paints.*—The proper choice and treatment of lumber is one of the most important problems which the builder as well as the painter has to face. When about to build a dwelling, barn, or other structure made principally of wood, the question is sure to arise in regard to what variety to select so as to get the maximum service and money value. The locality in which the structure is to be built must often have a bearing upon this question. While it is true that the painting of each type of wood demands the special consideration of the painter, it is also true that the study of paints for wood protection points towards the production of a paint that will give satisfactory results under all conditions and on all grades. It is the writer's opinion that a paint may be made that will be perfectly well suited for the preservation of every species of wood, provided the paint is properly treated in the hands of the skilful and intelligent painter, who can produce lasting results on almost every type, by varying the proportion of thinners and oil in the various coats. The painter who uses the same paint on soft pine and again on hard pine, without making a special study of how to reduce the priming coat for the hard pine, will be likely to get inferior results on the latter. In case of failure, the natural impulse is often to place the blame upon the paint, whereas the real responsibility may rest upon the painter's lack of knowledge.

Signs of Paint Failure.—Those who are responsible for the care and maintenance of property are familiar with the condition of surface presented by almost all wooden buildings or structures which have been improperly painted with inferior paints. "Chalking" or "flouring" are terms used to describe the condition of a paint surface which has deteriorated within the paint film. The formation of minute fissures, generally spoken of as "checking," as well as the effects best described as cracking, scaling, peeling and blistering, are other signs of failure which cause paint coatings to present an unsightly appearance, and which point inevitably either to the use of improperly made paints or to improper application. The cause of these conditions is not difficult to understand when even a brief study of the character of the materials entering into the composition of a paint has been made. It is, however, a fortunate circumstance that the proper admixture of different types of pigments enables us to correct the strong tendency exhibited by special pigments to rapidly deteriorate in an oil film. This point will be more fully discussed in a later paragraph.

Requisites of a Good Paint.—Progressive manufacturers are aiming to produce a paint which will show, under the widest range of conditions, good hiding power, adhesiveness, freedom from internal strains, permanency of color, relatively high imperviousness to moisture, sufficient elasticity to prevent scaling or cracking when subjected to expansion or contraction, and freedom from the chemical action which results in deep checking or excessive chalking. Such a product as this cannot be obtained, in the writer's opinion, by the use of any one pigment in linseed oil. In order to meet all the demands as stated above, there should be in an economical and durable paint a proper percentage of the various pigments which, united, will tend to correct each other's faults, and thus produce a durable paint coating of maximum efficiency.

The Composition of Paints.—As is well known, a paint is a mixture of one or more pigments and a vehicle which acts the part of the spreading and binding medium. Up to the present time the vehicle portion of paints has generally been made of linseed oil, admixed with some volatile thinner, such as turpentine. The subject of oil and paint vehicles will be discussed more fully later on.

Physical Properties of Pigments.—The pigment portion of a paint for use on barns and farm buildings may, if desired, be composed of properly selected iron oxides or other colored pigments, even containing in some cases a moderately high percentage of silica, clay, or other inert materials, and give perfectly satisfactory results. For the preservation and decoration of dwellings, however, the pigment portion of paints is generally made as a whole or in part of the most expensive white pigments, such as white lead and zinc oxide. The relative values and properties of these white base pigments will now be taken up.

White Lead.—White lead, either of the corroded or sublimed type, is perhaps the most generally used of all the white pigments as a paint base. Corroded white lead is a basic carbonate of lead, while sublimed white lead is a basic sulphate of the same metal. Both of these types are white and admirably adapted as painting materials. They take re-

latively the same amount of oil and spread easily, producing paint films which are highly opaque and which, therefore, hide efficiently the surface upon which they are placed. Sublimed white lead is a relatively finer pigment than corroded white lead, and seems to show a tendency to chalk to a greater extent upon exposure to the weather. Corroded white lead is more alkaline, however, than sublimed white lead, and when used alone with linseed oil generally shows a tendency to chalk to a considerable extent in a short time and to show deep checking, thus permitting the admission of moisture. The alkaline nature of this pigment produces considerable action upon certain tinting colors and results in fading or darkening, when mixed with delicate greens or blues.

The use of white lead has been condemned in some parts of this country, as well as abroad, because of its alleged poisonous properties. While it is true that lead poisoning may occasionally occur in some factories where the workman and his conditions are not properly safeguarded, it is, nevertheless, a fact that lead poisoning very seldom occurs among painters of experience and cleanly habits. Carelessness in mixing white lead is, fortunately, a practice almost obsolete among modern painters. The use of paints already ground in oil by means of machinery to a pasty condition, allowing easy working and reducing, obviates the danger of lead poisoning from any such cause as this, even though the percentage of lead in such paints is in preponderance.

Zinc Pigments.—Another pigment which has proved itself of great value to the painter is zinc oxide. The use of this pigment may be said to have almost revolutionized the paint industry of the world, and its increased consumption during the last ten years is sufficient evidence of its value as a painting material. Zinc oxide is producted by oxidation and sublimation of zinc ores and is not only extremely fine, but of great whiteness. It has good hiding power, although not quite so great as that shown by the white leads. It tends to produce a glossy surface, making it especially valuable for use on interior work and in enamels. When used alone it has the effect of hardening the oil film in which it is enveloped, and upon long exposure causes cracking and scaling. However, when the sublimed or corroded white leads are properly combined with zinc oxide, a more durable surface is produced, the shortcomings of each pigment being overbalanced by the good properties of the other. The proper combining properties of zinc oxide with white lead may be said to vary between 20 to 55 per cent. of zinc oxide for paints designed for exterior use. In the opinion of the authors, lead and zinc pigment in the above percentage, properly blended and ground, make paints of far better wearing value than can be produced with either white lead or zinc oxide used alone.

Zinc Lead.—Zinc lead, a pigment sublimed from mixed lead and zinc ores, and containing about equal proportions of zinc oxide and lead sulphate intimately combined, as well as leaded zinc, a product similarly produced, but with zinc oxide running about 75 per cent., are white base pigments of value, which are used to a considerable extent. They are generally slightly off color, however, and are therefore used most largely in paints which are to be tinted in various colors.

Lithophone.—Lithophone, a pigment produced by precipitation, and consisting of zinc sulphide and barium sulphate, is of great value in the manufacture of interior paints. On account of its liability to darken and disintegrate, however, it is seldom used on exterior work, although recent tests have shown that when used in combination with zinc oxide and whiting, it gives very promising results.

Crystalline Pigments and Their Use.—Barytes (barium sulphate), silex (silica) whiting (calcium carbonate), gypsum (calcium sulphate), asbestine (silicate of magnesia), and china clay (silicate of alumina) are white crystalline pigments which, when ground in oil, become transparent. All of these pigments possess the property of strengthening a paint film made of white lead and zinc oxide, and often increase the durability of such a paint. Barytes, silica, and china clay are especially valuable for this purpose. Asbestine because of its needle-like structure and low gravity, prevents settling and acts as a reinforcer of paint films. Whiting or calcium carbonate should be used when zinc oxide is in excess in a paint, so that the hardness of the paint may be overcome.

A white paint must be possessed of sufficient capacity to efficiently hide the surface upon which it is placed, when three coats are applied for new work or two coats for repainting work. Mixtures of the white leads and zinc oxide, with the latter pigment running not over 55 per cent., will easily produce such a result and wear well. It is generally deemed advisable, however, by most manufacturers to take advantage of the excessive capacity of such mixtures, which allows the introduction of moderate percentages of these inert pigments which give greater strength and other desirable features to a paint. The percentage of natural crystalline inert pigments to add to a white paint made of lead and zinc must, however, be moderate and insufficient to detract materially from the hiding power of the paint.

White Paint Formulas.—From these conclusions, which have come from wide experience in the testing of paints under actual service conditions, there can be recommended to the buyer of paints and to the manufacturer and master painter those machine-mixed paints in white, made by reputable manufacturers, the composition of which will show a mixture of white lead and zinc oxide, with the latter pigment within limits of between 15 to 55 per cent., and especially the same mixtures reinforced with the moderate percentage of crystalline inert pigments referred to above.

Tinted paints possess greater hiding power than white paints, and the above proportions would be somewhat changed for a tinted paint containing any percentage of coloring material. Tinted paints are, moreover, far more serviceable than white paints, as will be shown later.

Mill vs. Paddle.—The mixtures under considera-

tion should be ground in linseed oil by the manufacturer, through stone or steel mills, to a very fine condition, as it is only through proper grinding that the pigments can be properly blended. The mixing of paint by hand is, fortunately, to a large extent, a thing of the past. The uneven lumping of hand-mixed paints is often the cause of their failure. Such ancient and crude practice should be avoided by every painter, for it is more economical to obtain semi-paste paints, properly ground by machinery, to such a condition that they may be easily broken up and tempered. Such paints may be reduced to the proper consistency with oil and volatile thinner for application to any kind of wood.

In the opinion of the writers, a majority of the paints sold by reputable dealers and made by reputable manufacturers in this country are not only made from the best linseed oil and highest grade pigments obtainable, but are put in a form ready for the painter to thin down with full oil or turpentine reductions, either for priming work or to be used without reductions for finishing coats. The large metropolitan painter who wishes to make his own tints and shades may, however, prefer to have his mixed pigment paint ground by the manufacturer in heavy paste form for certain purposes.

Results of Field Tests.—A careful analysis of the results of field tests which have been carried on in different parts of the country would be far too voluminous for insertion in this bulletin. The official findings of special committees of inspection have already been published in special reports. Whereas there may still remain ground for some difference of opinion in regard to the interpretation of the results obtained on the various test fences, there can be no doubt that considerable information of the highest value has been yielded both to the producers and consumers of paints. One of the principal results obtained from these tests has lead to the opinion expressed above by the writers, that better results can be obtained by a proper mixture of selected pigments than by the use of any one pigment in linseed oil. This conclusion has also been reached by engineers of the United States Navy, and, as a result, the specifications of the Bureau of Yards and Docks for paints made of straight white lead and oil have recently been changed to call for white lead combined with upwards of 50 per cent. of zinc oxide. Many engineers and master painters have interpreted the results of the tests in the same way, and the attention of the authors has been called to a number of opinions which show that the tendency of demand among those who are properly informed is for a highgrade combination type of paint rather than for any single pigment paint.

Color.—The selection of the color for a dwelling or other structure is a matter that depends largely upon the good judgment and taste of the owner, combined with the advise of the painter. One point, however, should be impressed upon the mind of both, namely, that *practically all shades or tints made upon a good white paint base, through the use of permanent tinting colors, will better withstand exposure to the atmosphere than the white base used alone.* Owing to the cheerful effect produced by the use of white paints on dwellings, a very large quantity of white will continue to be used. If these white paints are designed in line with the suggestions brought out above—that is to say, if the white lead bases are properly reinforced with zinc oxide and other pigmentary materials—better results will undoubtedly be obtained, as far as appearance and durability is oncerned, than if white lead had been used alone. The consumer should remember, however, that more durable results will be obtained by the use of tinted paints.

Reductions and Thinners.—Turpentine, with its sweet odor, high solvent action, and wonderful oxidizing value, has always taken first place among the volatile liquids used for thinning paints. Wood turpentine, produced from the steam distillation of fine-cut fat pinewood or from the destructive distillation of stumpage and sawdust, have been refined in some cases by elimination of odor and toxic effects, to such purity that they are equally as good as the purest grades of gum turpentine, and their use is bound to increase in the paint industry.

The painter and manufacturer have come to understand that certain grades of asphaltum and paraffine distillates are equally as satisfactory as turpentine for use in paints for exterior purposes. Those volatile oils which are distiller from crude oil with either a paraffine or asphaltum base and possessed of boiling point, color, and evaporative value approximating similar constants of turpentine, are excellently suited to partly, and in some cases wholly, replace turpentine in exterior paints. A little additional dryer added to paints thinned with these materials will cause oxidation to take place in the proper time.

Prominent master painters have shown that benzol, a product obtained from the distillation of coal tar, differing from benzine, a product obtained from the distillation of petroleum, is a valuable thinner to use in the reduction of paints for the priming of resinous lumber such as cypress and yellow pitch pine. The penetrating and solvent value of benzol is high, and it often furnishes a unison between paint and wood that is a prime foundation to subsequent coatings, preventing the usual scaling and sap exudations, which often appear on a painted surface. Because of the great solvent action of benzol, however, this material should never be used in the second and third coatings. These facts will doubtless interest the southern painter, who has so much wood of a refractory nature to paint.

Oils.—The increasing cost of linseed oil has raised the interesting question as to whether or not it is a good practice to use an admixture of other oils in connection with it, in high-grade paint coatings. Strong differences of opinion will probably be found in regard to this question, and undoubtedly further investigation work is necessary in order to decide it. A number of different oils have been proposed for the purpose, of which, perhaps, soya-bean is one which has been most prominently discussed. No definite formulas, however, should be

recommended until the results of investigations which are now being carried on are in hand. A systematic series of test panels is now being erected in Washington, D.C., on the grounds of the Institute of Industrial Research, which are designed to gather data covering just this point.

The flax crop conditions have been most discouraging during the past two years, and the natural shortage of seed has caused a raise in the price of linseed oil, which has necessitated a raise in the price of paint. The added protection to be secured, however, through the frequent application of paint far outweighs any increased cost which has been caused by the raise in price of the raw commodities entering into the composition of paint.

Paints for Interior of Dwellings and Buildings.—The proper decoration of the interior of dwellings and public buildings has become of even greater importance than the protection and decoration of exteriors. There is, moreover, an increased demand for harmonious effects and the production of more sanitary conditions than have prevailed in the past. Up until a few years ago, a great variety of wall papers of more or less pleasing appearance were almost exclusively used for the decoration of walls in the interior of buildings, and their application was commonly considered the most effective means of wall decoration. There seems to be no question, however, that the use of wall paper is steadily decreasing, and that the art of interior decoration is undergoing a transition to the almost universal use of paint.

Modern process demands the maintenance of sanitary conditions for the benefit of the public welfare, and there is no doubt that from the standpoint of sanitation and hygiene, properly painted wall surfaces are far superior to papered walls. There is an abundance of evidence which shows that dust germs may easily be harbored, and thus disease transmitted from wall paper. In the tenement houses which are common to the larger cities, and to a lesser extent in the dwellings found in smaller communities, where tenants are more or less transient, the continued maintenance of sanitary conditions presents a difficult problem. Infectious and epidemic illnesses generally leave behind bacilli of different types, which may find a culture medium in the fibrous and porous surfaces presented by wall paper, backed up as they invariably must be by starch, casein or other organic pastes. Occasionally the restriction of local boards of health provide in such events for proper fumigation, but too often no precautions are taken to destroy the disease germs which are caught in the dust which collects on wall paper. As a rule, both tenant and landlord are obvious to all conditions which cannot be readily seen or detected. Burning sulphur, one of the most effective means of fumigation, will generally cause bleaching and consequent fading of the delicate colors used in printing the designs upon wall paper. Washing of the paper with antiseptic solutions will destroy its adhesiveness to the plaster and often cause bulging and general destruction.

Hospital Practice.—In hospitals, where it is necessary to maintain sanitary conditions, the walls are invariably painted, and requirements should demand the use of paints which can be washed frequently, so that there will be no possibility of uncleanliness. Inquiry made of a prominent surgeon* connected with one of the large metropolitan hospitals substantiated the writer's findings regarding the greater sanitary value of wall paints, and brought forth the information that in hospitals under construction provision had been made for the finishing of walls so that a hard, non-absorbent and washable surface might be obtained. The same authority stated that the common practice, in apartments and tenements, of covering the old wall paper over with a layer of new, each time a tenant moved in, should be condemned, and that from a hygienic standpoint the use of sanitary wall paints should be advocated in all dwellings as well as public buildings.

If such conditions are maintained in hospitals, where special attention is paid to sanitation, it would appear that similar precautions should be equally as necessary in public buildings and in dwellings—wherever, in fact, people congregate to live.

Sanitary Wall Paints.—Cold water paints or kalsomines should not be used, as they often contain glue, casein, dextrine and other binders which are easily destroyed. Oil paints which are thinned with turpentine and other volatile spirits, are the only real sanitary paints to use. There have recently appeared in trade a number of wall paints composed of non-poisonous pigments ground in paint vehicles having valuable water-proofing and binding properties, and of a nature to produce the flat or semi-flat finish that has become so popular. Such paints produce a sanitary, waterproof surface, which permits of frequent washing. By their use it is possible to secure a more permanent and wider range of tints than can be obtained with wall paper, as they are produced in a myriad of shades, tints and solid colors, from which any desired combination can be selected. On the border or on the body of walls decorated with such paints, attractive stencil designs, which bring out in relief the color combinations may be applied.

For the decoration of chambers and living rooms, delicate French grays, light buffs, cream tints and ivory whites may be used, while in the library and other rooms richer and more solid colors, such as greens, reds and blues, may be harmoniously combined.

Defects of Wall Paper.—It recently occurred to the writer to investigate the conditions which obtain in many apartment houses in the larger cities. Inspection of a number of such places, in which wall paper had been exclusively used on the walls, showed generally bad conditions; bulging of the surfaces, caused by dampness in the walls, which had loosened up the binder, as well as peeling and dropping of the paper from the ceilings, were frequently observed. In many cases a shabby appearance was shown, accompanied by an odor

*Dr. F. F. Gwyer, Cornell University Medical College, New York City.

which suggested decomposition of the paste binder used on the paper. The writer was impressed with the fact that such conditions could easily be avoided by the very simple expedient of using properly manufactured wall paints, which are so easily made dustproof and waterproof.

Samples of wall paper, which had been applied to plastered walls for a year or more, were obtained and examination under the microscope showed a most uncleanly surface. Cultures were made of these samples, and bacilli of different types were developed in the culture medium in a short time.

Experimental Evidence.—That the above conditions could not have existed, had proper wall paints been used, seemed doubtless, and suggested a carefully conducted experiment to prove the relative sanitary values of wall paper and wall paints. A large sheet of fibre board, such as is occasionally used to replace plastered walls, was painted on one side with a high-grade wall paint, three-coat work. A similar sheet was papered on one side with a clean, new wall paper. These tests panels were placed where unsanitary conditions, such as dampness, foul odors, and a scarcity of air were present. After a short period of exposure, the panels were taken to the bacteriological laboratory, and a small section of the painted surface, about two inches square, as well as a small section of the papered surface of similar size, were removed and used for making cultures. In each case the surface of the section under test was washed with 100 c.c. of distilled, sterilized water. The washings, which dripped from the surface, were collected in a garduated flask. One c.c. of the washings was used in each case, admixed with bullion and again with agar agar. The enormous development of bacteria in the bullion, treated with the washings from the wall papered surface, was sufficient evidence to convince one of the greater sanitary value of the wall paint, the washings from which gave a culture practically free from bacteria. The colonies of bacteria shown in the petridish made of the washings from wall paper further supports these findings. It will be noticed that the tests made from the washings of the wall paint show a practical absence of bacteria, and was clear, as was the bullion-solution test of paint. The washings from the wall paper showed active development of bacteria, both in the bullion and agar tests.

From the Conservation Standpoint.—It would be of interest to sum up in figures the acreage and cordage of wood that annually is transformed into pulp for the manufacture of wall paper. Unfortunately there are no available statistics on this subject. It is clear, however, that from the standpoint of conservation the use of wall paints should take precedence over the use of wall paper.

Paints for the Prevention of Corrosion of Iron.—The protection of structural steel is a subject that most painters have in the past considered of minor importance; any paint that would properly hide the surface of the metal being accepted without much question. The demand, however, for structural steel for office buildings, factories, steel cars, railroad equipment, etc., has doubled the output of structural paints, and created a demand for painters having a knowledge of the proper materials to use in the painting of steel, so that its life may be preserved, and its strength maintained. Such knowledge is as important to the painter as a knowledge of how to properly select materials for the painting of wood, and how to temper these materials to suit the various conditions met with.

Everyone is familiar with the appearance of rust, but few actually understand what causes rust. No attempt will be made here to present even on outline of the many theories advanced to explain the phenomenon of the rusting of iron, for the subject is as diverse as it is interesting. A brief resume, however, will be given of the now generally accepted theory that explains the subject. This theory is called the electrolytic theory.

"Auto-electrolysis" is the term used to define the peculiar tendency of iron to be transformed from a metal possessing a hard lustrous surface, high tensile strength, and other useful properties, to a crumbling oxide that falls to the ground and again becomes part of the earth from which it was originally taken by man.

This "going back to nature" is more readily accomplished by most of the steel produced to-day than by the old hand-made irons produced many years ago. It seems to be a curious fact that the more quickly a product or an article is fashioned by man, the more quickly it tends to return again to its original oxidized condition. Some manufacturers of steel, however, through an understanding of the causes of rust, have progressed in the manufacture of slow-rusting materials, either by the elimination or by the proper distribution of impurities.

When iron is brought into contact with moisture, currents of electricity flow over the surface of the iron between the points that are relatively pure and points that contain impurities. These currents stimulate the natural tendency of the iron to go into solution, and the solution proceeds with vigor at the positive points. The air which the water contains oxidizes the iron which has gone into solution, and precipitates the brown iron rust with which you are all familiar. Thus water, which acts as an acid, and air, which acts as an oxidizer, have combined together to accomplish the downfall of the metal. It is obvious that if means could be devised to stop the solution pressure of iron, and make it resistant to the flow of surface electric currents, rust could be prevented. Materials which prevent the rusting of iron have been called by Dr. Cushman, who first advanced these explanations, rust inhibitors, or materials which inhibit rust. The paint maker, realizing the importance of these rust inhibitors, is incorporating them into paints designed for the protection of iron and steel, and the success which paints of this type have met with from a practical standpoint, is a justification of what was first called the electrolytic theory which suggested their use. The laws of electrolytic corrosion would be a better way of stating what have become facts, and these laws are a direct result of the early pioneer re-

searches of Dr. Cushman, who was formerly for many years in the Government service, but who is now the director of the Institute of Industrial Research in Washington. By placing small, brightly-polished steel plates into a mush of paint pigment and water, a determination may be made of the pigment's effect upon the metal. Some pigments under such conditions cause rapid corrosion of the steel plates. Such pigments are stimulators of corrosion on account of acid impurities which they contain, or because of their effect in stimulating galvanic currents. Many carbonaceous pigments are of this type. Other pigments have the effect of keeping bright the steel plates and preventing rust. Such pigments are of the inhibitive type, and their action is to check or retard the solution pressure of the iron.

Results obtained in many laboratory tests suggested a practical exposure test, and a series of 300 large steel plates were exposed by the writer, acting under the American Society for Testing Materials, at Atlantic City, where the action of the salt air is severe on both paint and metal. In these tests separate plates were painted with nearly all the useful paint pigments, ground in a vehicle of raw and boiled linseed oil. Later in the test it was found that many pigments of the carbonaceous type, as well as those which contained acid impurities, were showing bad results. It was also found that pigments of the inhibitive type, such as chromates of lead, zinc, barium, etc., acted in an almost miraculous way, transforming the surface of the metal upon which they were applied into a practically uncorrodible condition.

The excessive chalking which took place on the corroded white lead coatings began to disappear at the end of a year, being washed away by the rains and carried away by the winds, so that there was left upon the surface thin coatings of pigments, in sufficient to give good protection. Had this white lead been reinforced with sufficient zinc oxide to prevent chalking, much better results would no doubt have been obtained.

The deep cracking of the zinc oxide indicated that such a pigment required a large quantity of oil in order to satisfy its brittle nature, and prevent such effects. White paints containing zinc oxide and zinc oxide products were in excellent condition, and they confirm preliminary tests which showed zinc oxide to be one of the most valuable pigments for protecting iron.

Although sublimed white and blue leads chalked very heavily, the chalked pigment seemed to be tenacious, and adhered to the plate, presenting a good surface with absence of rust. Both these pigments gave very good protection to steel. When admixed in the right proportion with certain other pigments, they still give better results.

Lithophone was early distroyed, as is usual with the pigment when used alone on exterior surfaces. It became rough and discolored, presenting a very blotchy appearance. Red lead and orange mineral both afforded excellent protection to the plates upon which they were applied. They became covered, however, after exposure, with a white coating of carbonate of lead, which was due to the action of the carbonic acid of the atmosphere on the red lead, which is an oxide of lead, and susceptible to chemical action.

The iron oxide gave fair service indeed. In one case, however, there were several eruptions, indicating slight corrosion beneath the surface of the paint. One iron oxide which did wonderfully well was the black oxide of iron which not only possesses great tinting value, but up to the present time has had a high protective value. The graphite was very deeply pitted at certain spots, indicating that galvanic currents had been set up, causing stimulating effects. Barytes and blanc fixe, when used alone, gave very poor service, showing scaling, chalking disintegration, and rust soon after the test was started. Barytes, combined with some other pigments, however, presented a very good surface. Under the paint film of gypsum rust soon appeared, and although the film itself remained fairly intact, rusting progressed throughout the test, indicating that gypsum films were very poor excluders of moisture. Coal tar paints failed in the test, and this was due, no doubt, to the strong action of the sun, which early destroys such products. China clay and asbestine gave excellent service for eighteen months. After that time, howver, indications of corrosion were shown, and the apparent breakdown of the film was predicted. These pigments, however, combined with other pigments, have given excellent service.

American vermilion, zinc chromate, zinc-and-barium chromate, chrome green, Prussian blue, and zinc-and-lead chromate gave most wonderful service, presenting an appearance within two years that was almost identical with their appearance at the start of the test. These pigments with red lead, zinc oxide, litharge, sublimed leads, and combinations of lead and zinc, willow charcoal, neutral oxide of iron and the inert pigments, will allow the design of paints of nearly any color. From their admixture properly adjusted with a good paint vehicle, and tested by the expert, will come the final solution of the problem that has bothered painters and engineers for so many years. The vehicle for such paints should be made of linseed oil with or without the addition of treated linoleates, tungates, and fossil gums, until such a time as a modern research has found a vehicle more suitable.

THE CHINESE people last year spent over a million sterling on the purchase of foreign building material, which is indicative of of a far-reaching change which is taking place in China in regard to building. The dilapidated rows of one-story houses of lath and plaster which formerly did duty as offices, schools, barracks, etc., are rapidly disappearing and are being replaced by fireproof buildings of brick and stone fitted up with modern conveniences.

LARGE REINFORCED CONCRETE GIRDER

A technical description of the designing and placing of a concrete girder supporting a cantilevered concrete balcony.

THE BURNS THEATRE at Colorado Springs, Colo., is an entirely fireproof building, which was completed in the fall of 1910. The architects are Douglas and Hetherington, Colorado Springs, and the contractors, the James Stewart Construction Co., of New York and Denver. The building is somewhat unusual among theatres on account of the extensive use of reinforced concrete in its construction. The balcony and gallery are framed entirely in this material and the balcony girder is, so far as the writer can learn, the largest reinforced concrete beam on the continent.

This building is of particular interest to Canadians owing to the fact that the reinforced concrete design was made in Canada. Although we try to prevent American competition with the Canadian building profession, and although American building operations are many times larger than ours, yet we seldom strike back. In this case, however, the reinforced concrete design was made by Clarence W. Noble, of Toronto, and the reinforcing material, which was square twisted bars, was supplied by him.

A fireproof balcony, if unsupported near the front rail, is usually constructed on a heavy steel girder placed across the room, and crossed by cantilever beams whose fixed ends are held down by being bedded in the rear wall. The large girder must be of a minimum depth in order to avoid interfering with the line of sight, and is, therefore, generally a box section. The cantilevers must either pass across the top of this box girder, which means that the girder must be placed inconveniently low, or else be framed through it, which involves some very expensive and unsatisfactory detail construction.

The fireproofing of these steel members, if done in tile, results in much cutting around the cantilevers on account of their tapering shape, and in considerable areas of poorly anchored tile on the sides of the big girder. The value of such work is always questionable. If the fireproofing is done with concrete anchored to the steel members, the weight of the material necessary to secure an adequate result is so great as to increase to a considerable extent the cost of the steel construction. In fact, the concrete which would be used for fireproofing alone is nearly sufficient, if reinforced, to construct the framework. The logical conclusion, therefore, is that the entire balcony should be of reinforced concrete construction.

In the Burns Theatre the owners would have no interference with the line of sight from supports for either the balcony or gallery. In order to accomplish this, six reinforced concrete columns are placed just behind the last row of seats. These columns support reinforced concrete cantilever beams in the gallery, which pass across their tops and have their rear ends anchored in the brick wall. The horizontal projection of the cantilevers is sixteen feet. There is not enough brickwork above their rear ends to insure their stability, and they are therefore anchored by means of steel rods cased in concrete and extending downwards to beams built in the brick wall at the level of the balcony.

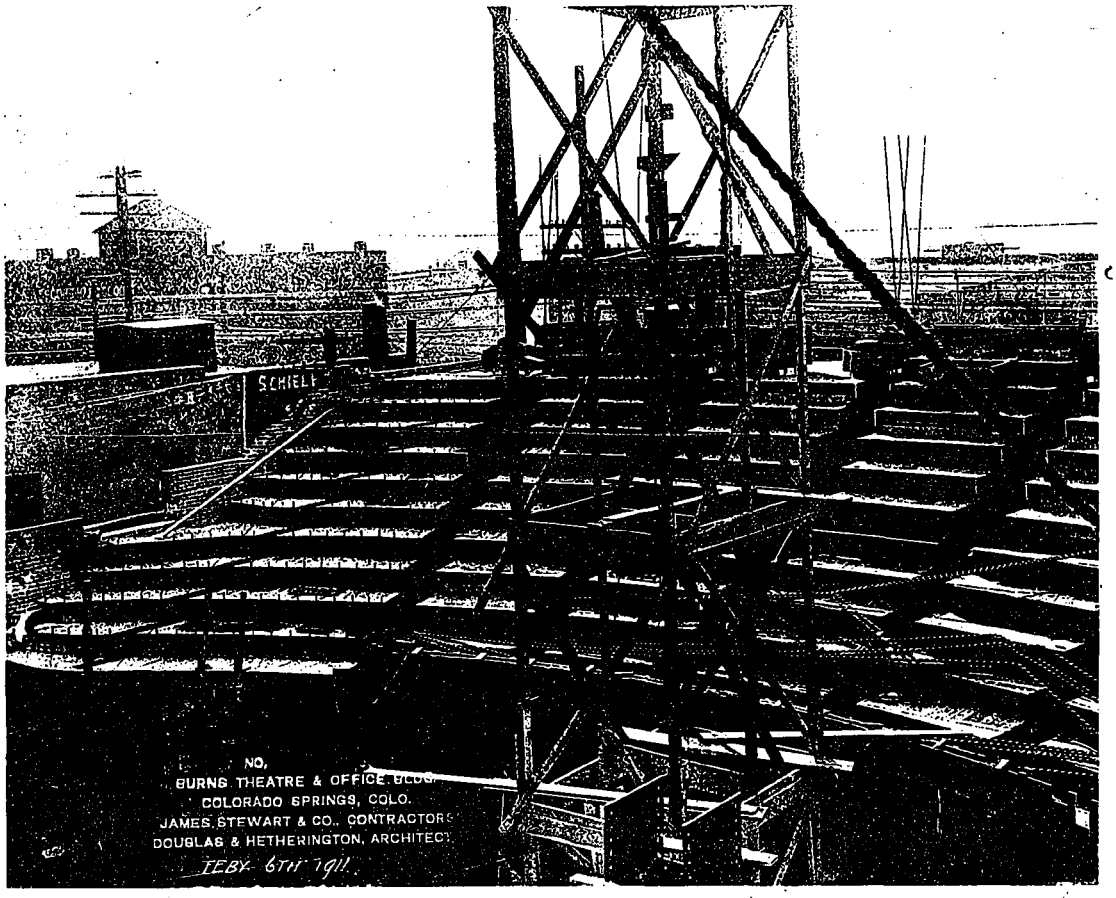
The large balcony girder crosses the building twenty-four feet from the rear wall and is supported on two reinforced concrete columns alongside the outer walls, while the ends pass across these columns and are bedded in the side walls. The span between centres of supports of this girder is thus sixty-three feet, while its length, including the overhanging ends, is seventy-four feet.

This girder is crossed by six cantilever beams of thirty-one feet horizontal span. The rear ends of these cantilevers are bedded in the columns supporting the gallery. The beams nearest the centre of the large girder are approximately balanced on their central support, but the end beams overhang at their outer ends a horizontal distance of twenty feet, and they therefore exert an upward reaction against the gallery columns and place considerably more than their entire load on the large girder. The area supported by the large girder is, therefore, something in excess of sixty-three by thirty-one feet.

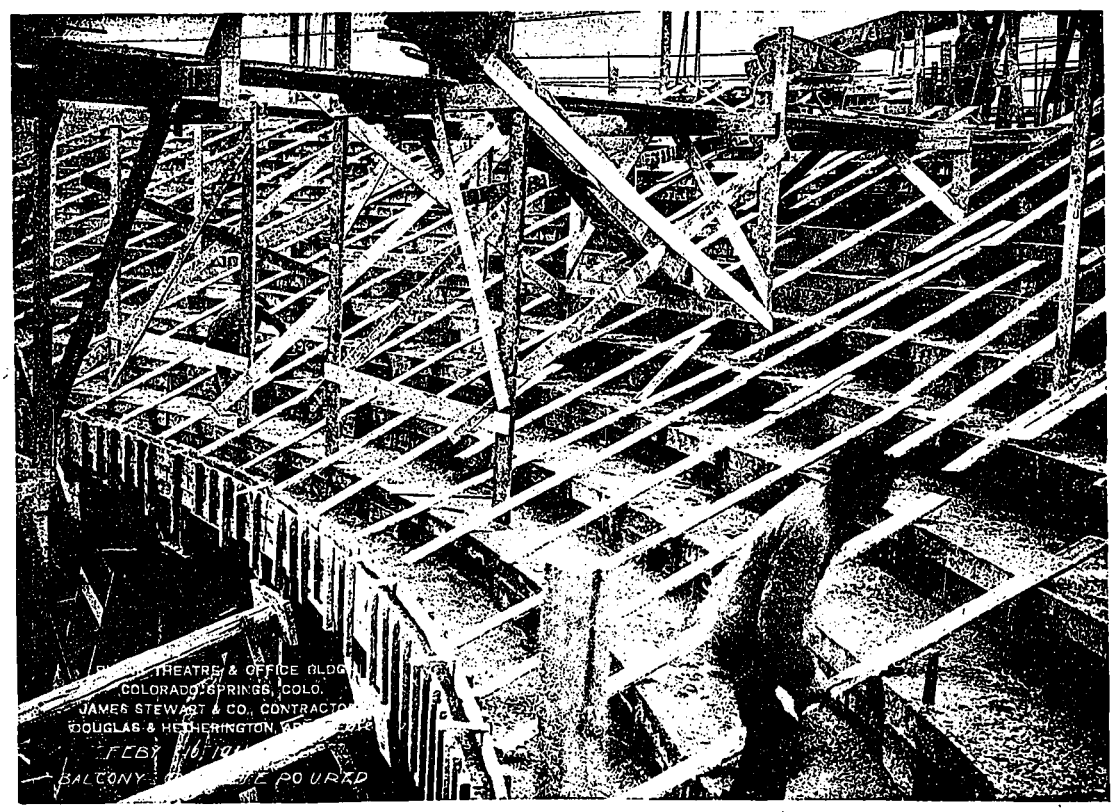
The design of the balcony and gallery floors is made for an assumed live load of 70 lbs. per square feet. In the case of the large girder, however, the impossibility of this load occurring over the entire area of the balcony at one time is recognized, and the live load reduced to forty-five pounds per square foot. This is equivalent to one hundred and ninety pounds per seat.

The ultimate strength of the beam is assumed as being reached when the reinforcing steel is at its elastic limit. The design is worked out in ultimate values with the factor of safety introduced into the working loads. This factor of safety is three for live loads and two and a half for dead loads. As the dead load forms so important a part of the entire calculation, the assumptions in this regard were carefully checked after the design was completed.

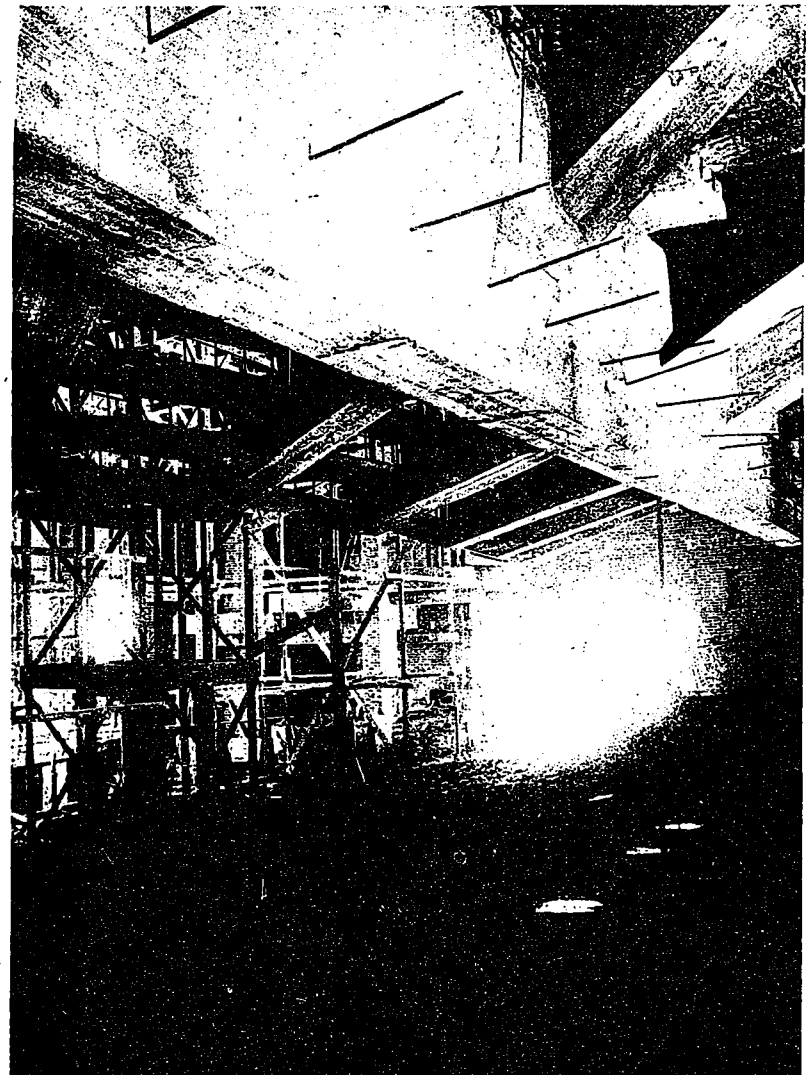
The girder is calculated on the assumption that the span is the distance centre to centre of columns, and that it has only the one span and is free to turn at the ends. Actually the ends are extended across the columns into the brick wall. In order to further fix the direction of the girder at the columns, the ends where they are fixed in the wall are passed under other concrete beams lying in the wall. The intention is to prevent any slight uplift which might occur at this point by increasing the weight of the brickwork which would thus be brought on the beam. It would be, of course, impossible to determine by calculation just to what extent the negative bending moment, thus introduced at the columns, decreases the positive moment at the centre of the span, and thus increases the factor of safety, but this action is, doubtless, considerable. The exact amount depends upon the amount of settlement of the brick work after the girder was cast, and the amount of deflec-



VIEW OF BALCONY BEFORE CONCRETING. The opening for the large girder form is just behind the fifth riser.



VIEW OF BALCONY AFTER CONCRETING. Note metal channels concreted in place to form risers.



ANOTHER VIEW OF LARGE GIRDER. It is impossible to get the entire span in one view.

VIEW OF LARGE GIRDER FROM BENEATH.
One column supporting the girder and one cantilever not shown

tion at the centre of the span when the forms were struck. In making the details, the amount of such action was kept within reasonable limits by arbitrarily fixing the capacity of the wall beam, and then placing sufficient negative reinforcement over the columns to care for the corresponding stresses in the large girder.

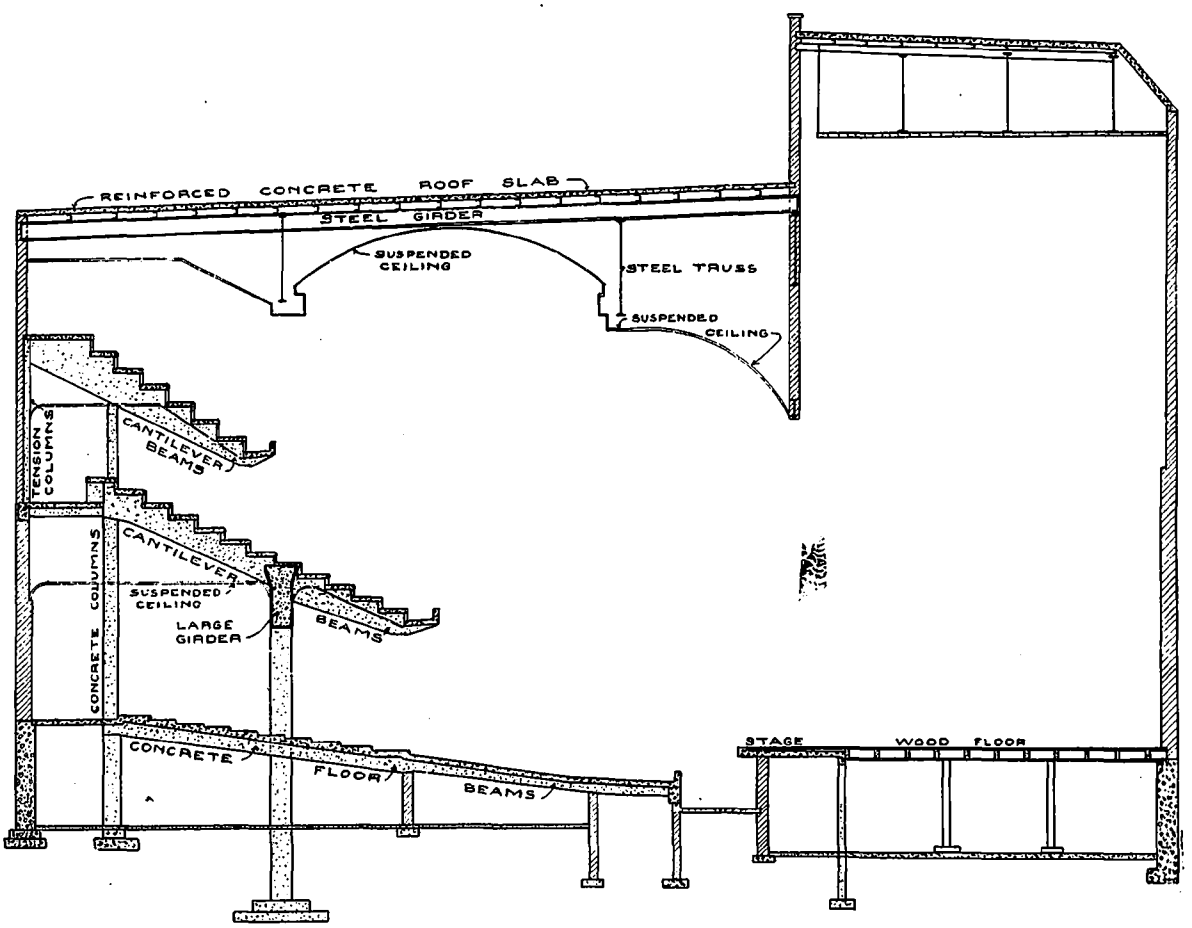
The top of the girder is continuous with one of the treads of the balcony and its front side is tangential with one of the risers. The limiting dimensions of the girder are three feet in width and six feet four and a half inches in depth. It was found that two feet in width is sufficient for the stem, but three feet is not wide enough for an adequate flange. As the balcony treads and rises can not be reasonably counted in section, it is necessary to reinforce the compression side of the girder.

The calculation called for a maximum of thirty-six 1¼ in. twisted bars at the bottom and twenty-five 1¼ in. bars at the top. The need for the top reinforcement is not as great as would appear at the first glance from a comparison of these figures, as the upper reinforcement, being limited in its working stresses by the compression value of the concrete, is much less efficient in compression than the bottom reinforcement is in tension.

The detailing of this girder is complicated by the fact that 1¼ in. bars cannot feasably be delivered at the building site in lengths over forty feet. This makes considerable lapping necessary. In order to study this a bending moment diagram was made on which the stresses at any point could be scaled off, not in terms of foot pounds, but in terms of the required number of 1¼ in. bars. No lap splices are made except at points where there are two bars in excess of the requirements in addition to the bars to be spliced.

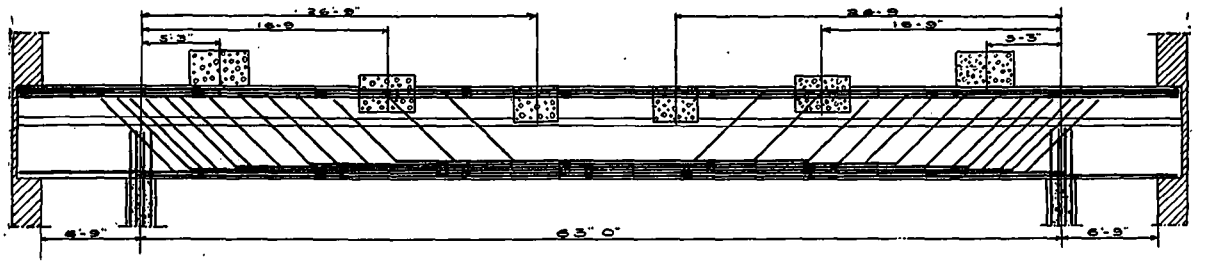
All laps are thirty-eight diameters in length, and the bars are wired together before concreting. It is presumed that this amount of lap in deformed bars makes with the concrete an adequate splice, yet no harm would result if the splices had no value whatever, as they never occur except at points where there are two unspliced bars in excess of the reinforcement.

As the ends of the girder are approached and fewer positive moment bars are therefore necessary, they are bent up as shear bars and passed across the columns as negative reinforcement. Some of them, after being used as shear members, are stopped short of the supports as not being necessary for negative reinforcement. It was found that sufficient shear reinforcement could be provided in this manner to make the use of vertical stirrups entirely unnecessary. The girder is computed for an ultimate breaking load, including its own weight of 886 tons,



SECTION THROUGH THEATRE.

Showing position of the large girder. The uplift of the balcony cantilevers is met by the downward thrust of the balcony columns. The uplift of the gallery cantilevers is met by all the brick work above the gallery level.



WORKING PLAN OF LARGE GIRDER.

The difference in elevation of the cantilevers at the point section is due to the circular shape of the balcony.

which means that considerable shear reinforcement must be provided. Toward the ends two 1¼ in. bars are bent up every foot. The concrete is also regarded as carrying shear.

The tread and riser design of the balcony is somewhat unusual, but is found very satisfactory. The treads are concrete slabs reinforced in the direction of their length to place their load directly on the cantilevers. The risers are built of herringbone lath and metal studs coated with cement plaster. The treads overlap each other horizontally by two inches and the studs are easily concreted into place. After the rough plaster has been applied, the cement top of the treads is put in place and brought down over the risers to finish them also. By this means the expensive curved form work necessary for the risers, if built in the ordinary way, is avoided.

The large girder contains thirty-eight yards of concrete. The forms necessary to hold this mass of wet material were necessarily heavy. They were supported on shores which extended to the basement without any attempt to secure support at the ground floor. Three openings were left in the side to permit access under the top reinforcement during concreting. Otherwise their construction was not unusual.

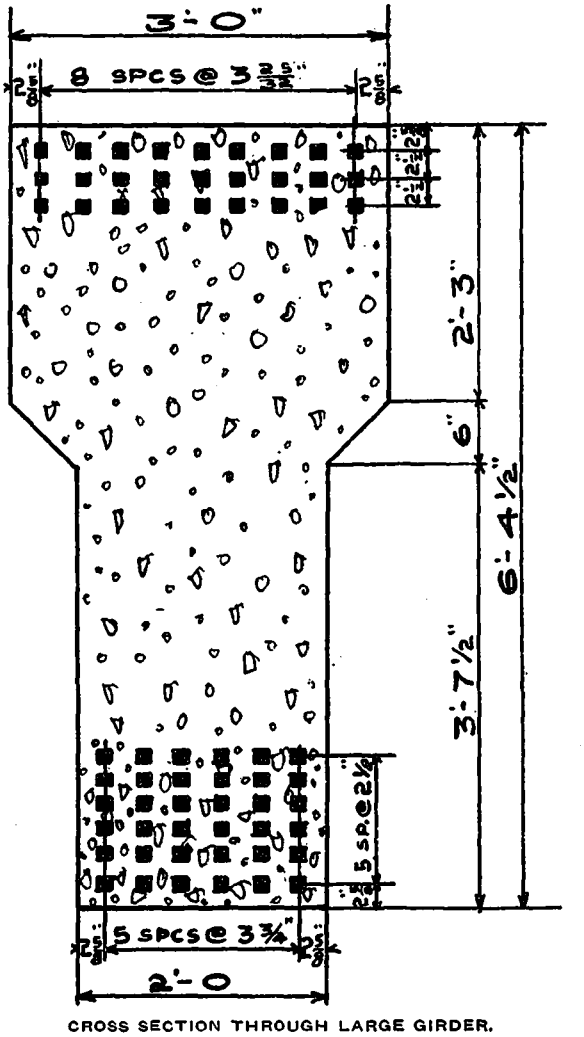
The steel reinforcement of all beams was placed before any concreting was done. The bars in the large girder were held in place by specially designed steel templets made of plates and angles one-quarter inch thick.

As the concrete rose higher in the girder form it soon reached the point where it flowed out again into the overhanging portion of the cantilevers. This movement was assisted by means of hoes. As the lower ends of the cantilevers were filled the material was drawn out into the slabs. It was found that the mass showed no tendency to flow where it was not wanted, yet could readily be pulled down into any required position with very little labor.

The negative movement bars in the two central cantilevers are woven between the top bars of the large girder, forming a mass which was hard to be well imbedded. It was accomplished by pouring cement mortar in such a position that it would rise through the bars from below, thus insuring an absence of air pockets.

The cementing was done on February 13th, 1910. Actual pouring started at about 10.30 a.m., and by 9.30 p.m. was all completed. The weather was mild and sunny, but during the afternoon snow clouds were seen rolling over the shoulders of Pike's Peak, and the concrete was therefore covered with burlap as fast as completed. During the night and next day a heavy wet snow fell, the only snow of the season. The concrete, however, was not injured by the experience.

Before the public were admitted to the building the balcony and gallery construction was tested by loading the entire structure with two hundred pounds per seat. The deflection at the centre of the large girder under the load was one-eighth of an inch.



CROSS SECTION THROUGH LARGE GIRDER.

All bars are one and one-fourth inch twisted. Bars were held in the position shown by steel templets, which were concreted in.

CONSTRUCTION

A JOURNAL FOR THE ARCHITECTURAL ENGINEERING AND CONTRACTING INTERESTS OF CANADA

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Vol. 5 Toronto, February, 1912 No. 3

CURRENT TOPICS

AMONG the contractors to whose installation of materials and appliances the Union Bank of Canada at Toronto, illustrated and described last month, owes its stability, convenience and safety, the name of the firm that installed the vaults was omitted. As in a bank the vaults are its most important feature, it is with pleasure that CONSTRUCTION hastens to supply this omission with the name of J. & J. Taylor of Toronto, whose bank vaults safeguard the deposits of the people in many of the banks throughout Canada. H. C. Hitch & Company were the general contractors.

* * *

DESIGNS FOR the buildings of the Panama-Pacific International Exposition at San Francisco will be procured after the plan adopted and found so successful in the planning of the Columbian Exposition. An architectural commission of California architects, consisting of Willis Polk, William A. Flaville and Clarence A. Ward will be assisted by McKim, Mead & White, Henry Bacon and Thomas Hastings of New York, and Louis C. Mulgardt and George W. Kelham of San Francisco. Under the rules adopted by the Board of Directors, the Architectural Commission will assemble for their first consultation before the plans of the grounds and buildings are submitted for adoption. This meeting is scheduled to take place early in February, and immediately afterwards, work will be commenced upon the designs of the individual buildings. In a short time, there will be another meeting, at which the architects will submit the plans of the buildings designed by them and, as soon thereafter as practicable, the final drawings will be prepared, contracts let, and the work of building commenced. While Mr. Mead is the sole remaining member of the trio that made the firm of Mead & White architecturally famous, and has not during the life of his partners stood in the same limelight of popularity, he is the equal of Mr. McKim in his knowledge of the fundamental principles of purpose and arrangement, and, while not pyrotechnically versatile in design as Mr. White, his has been the spirit behind much of the best classical work produced by the firm. In the same way Mr. Hastings, with his fine artistic conception for design, has merited an equal share of praise with Mr. Carrere for the work of that firm, which the rugged business sense and executive ability of the latter member carried through so successfully. Mr. Flaville is a member of the firm of Bliss & Flaville, which has held an equal position in San Francisco with the firms named in New York. Willis Polk and Louis C. Mulgardt went to San Francisco some ten years ago from Chicago, and are younger men, but both rank among the best draftsmen the West has produced.

* * *

CALGARY, under the able initiation of its parks superintendent, supplemented by a Town Planning Committee, is actively engaged in planning for the future. Even these new towns in our Western Provinces find that some tearing down and reconstruction is necessary to start the plan for future development. But a knowledge of deficiency and a desire for betterment is the most hopeful sign in these enterprising cities, and their inhabitants are fast learning the inadequacy of the original layout and need for immediate correction, at least in city street widths. Calgary takes the position, which is the true and normal one, that each city should not only have one thoroughfare through its centre, but that it should be wide; that it should be intersected by a civic centre, around which all the public buildings of the future should be grouped and from which other streets should radiate. This is the groundwork of any civic plan, and any city that does not meet the question squarely and with a freedom from selfishness and bias will find its property depreciating in value and its population diminishing because the people will choose to inhabit other cities where the surroundings are more desirable. Mr. Iverson tells the people of Calgary that this civic centre should be as large as possible from the start, so that there will be absolutely plenty of room for buildings, such as a new city hall, post office, opera house, museum, stations and first-class hotels, which may be built in the far future. The latter two buildings should be situated on opposite corners of the entrance, should

be built along the same style and should have a corner tower overlooking the centre. Just as London has its Oxford street and continuations, Edinburgh its Princess street, Berlin its Friedrich street, Paris its Champs Elysees, New York its Broadway, Washington its Pennsylvania avenue, and Buffalo its Delaware avenue, Calgary should have its main business thoroughfare, which should intersect the city from one end to the other. This street should at least be 100 ft. wide and should be subjected to special building by-laws, providing for a certain size of building, built after a special style and with a front garden or lawn. His general plan applies to all cities in the Dominion East and West, but to the older cities the cost is more, fortunately because the congestion has already reached an unbearable stage that will stimulate effort, while to the newer town the wisdom and enterprise of the people must act as the instigator of inevitable reconstruction along broad lines.

* * *

FIREPROOF steel construction has developed in many directions, but one would not suppose it could bring about any close relation between the construction of steel buildings for garages, construction camps, and train sheds, and billboards. A very comprehensive and profusely illustrated booklet on the subject of sectional steel construction is issued by the Ruby Manufacturing Company of Jackson, Michigan, which tells all about it. While the true uses of the sectional steel product of this company are so diverse, the material used and machinery employed in each industry are so closely allied that one catalogue is issued to cover the use of each. The losses in garages by fire are so general that a perfect portable steel building in which nothing but structural steel is used is a timely addition to the fire-preventing devices of the time.

* * *

THE ADAPTABILITY of the artificial product favorably known as "Roman Stone" is so great and diverse that it is occupying a large field in the stone market. It not only has the strength of the best limestones, but variety in color, excellence in texture, and pliability in modelling all give to Roman stone a wide field of usefulness that is being very generally recognized and made use of by architects in effective stone design. Its popularity in Ontario is evidenced by the large number of office buildings, residences, and public buildings in which Roman stone has been used the past year. One convenient feature in the furnishing of Roman stone is the ability to manufacture and supply it in winter, about 400 cubic feet of the product being the daily output of the company's works.

* * *

ALTHOUGH Great Britain has a few marble quarries, like those at Purbeck, that have been worked for centuries, this variety of stone is not plentiful in the kingdom, and the domestic supply is far from equaling the demand. Considerable confidence is expressed in a new source of supply on the island of Skye. More or less development work has been going on in a quiet way for the past three or four years, and now three quarries are in operation at the foot of the mountain, Bienn-na-Caillach. A railway has been constructed, leading directly to the quarries from Broadford, and nearly $200,000 worth of machinery of the latest design has been installed. A large force of workmen, mostly Frenchmen and Belgians, are engaged, and cottages have been built for housing them. The marble area is said to be of great extent, and marble of several varieties has been brought to the surface, including perfect white, gray, blue, and the pencilled sorts. Some quantities of alabaster have also been found. The railway is the first that has ever been built in Skye, and some of the inhabitants of the Hebrides have never seen a train.

* * *

THE ELECTRIC-LIGHTING rates finally adopted by the Winnipeg City Council for its municipal plant are said to be the lowest in North America. The schedule is based on the estimated consumption at three cents per kilowatt, and ranges from a minimum monthly cost of fifty cents for an average monthly consumption of twelve kilowatts in a four-room house to two dollars ten cents for an average consumption of seventy kilowatts in a twelve-room house. Following this announcement, the local corporation, which operates a light and power plant in connection with the street railway, reduced its rates to meet those of the city.

* * *

THE COMPETITION for the Perry Memorial at Put-in-Bay, Lake Erie, was decided on January 27. There were fifty-four competitors. J. H. Freedlander and A. D. Seymour, of New York, won the competition. There were three premiums awarded. The first premium of $1,250 went to James Gamble Rogers, New York; the second, $1,000, Paul Cret, Philadelphia; and the third, $750, Dillon, McLellan & Beadel, New York. The award was made by the Fine Arts Commission. The rule under which competition drawings were received was: The competition was open to applicants of established reputation. The building committee (under the advice of Frank Miles Day, its adviser,) having considered such applications, notified those deemed qualified to enter the competition, selected with greatest care and including only those architects in whose ability and integrity they had absolute confidence, and to any one of whom they were willing to entrust the work.

* * *

A COALETTE FACTORY has been added to its long list of industries at Fort William. That city was selected because there the great barge transportation companies have their wharves and coal dumps, and practically all the coal coming from Pennsylvania mines is routed through the Great Lakes to Fort William. This new $100,000 enterprise is financed by Fort William capitalists, and has a contract with the railroad and lake transportation companies for coal dust or screenings collected on the dumps.

Residence of W. H. Carrick, Toronto, Ontario. Langley & Howland, Architects.

SOCIALISM'S VIEW OF DOMESTIC ARCHITECTURE

The warmth, healthfulness, and security of the modern house contrasted with a utopian vision of an unpractical mind.

THE spirit of Socialism (whatever that may mean) seems to be reaching the minds, and changing the imaginations, of the lowly, and those whose lives are simple and viewpoint more or less circumscribed. To all, whatever the details may be, it pictures a utopia of simplicity, equality and general freedom from the ills that flesh, under our present system, is heir to. It seems to have attacked the imagination of the English workman in the direction of housing, as numerous letters on the habitation aspect of Socialism have appeared in the Illustrated Carpenter and Builder. As a side light, that in the abstract has many good suggestions, the following letter is quoted. To controvert the intelligent writer's description of an ideal habitation, "a brick walled space roofed with glass," the illustration above, and the accompanying interiors and plans, may be pointed to. The snow around the house indicates cold weather, and the "kiddies" would need warm clothing and a Lord and Burnham hothouse system of heating to keep from freezing, beside the other conveniences that are shown in the plan for sanitary protection, aside from the purifying sunlight. The visionary view of the writer is, however, interesting. He says:

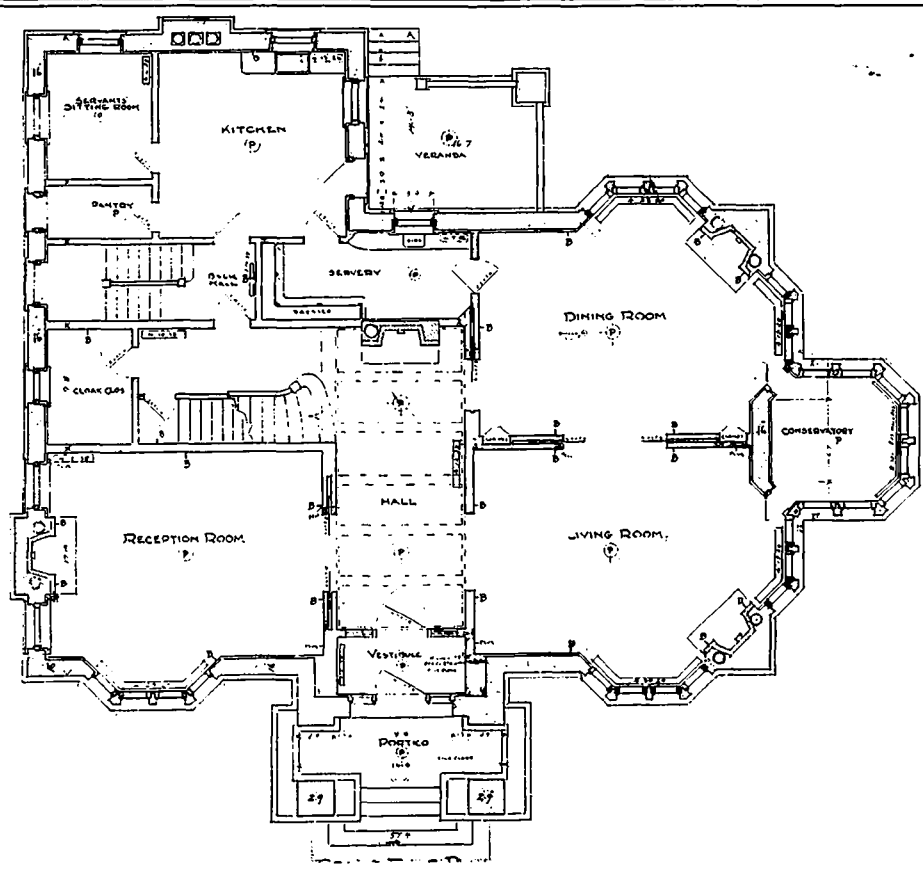
"As a Socialist, I have to thank the little-minded folks for their amusing caricatures of Socialism. To me, Socialism is the application of common sense to the needs and welfare of the community as a whole, not any part or division of it. . . . Now, with regard to architecture, and its status under Socialism, I am inclined to prophesy that domestic architecture, as now understood, will be non est, and the days of the troglodytes numbered. State buildings, on the contrary, will be immeasurably superior to the present barracks, the mostly incongruous piles of building materials, piled up apparently to hold the earth down. What jolly times are in store for the kiddies of the Socialistic State. For when the then common-sense rulers have decided upon the demolition of some of the present 'blots,' they will not employ paid labor to pull them down, but hand them over to the 'kids' for cockshies! (Historical note: The pyramids of Egypt remain where they are, simply because the 'kids' have not had a free hand.)

"Now as to domestic dwellings, the Socialistic citizen, having been educated up to the therapeutic values of fresh air and sunshine, will flatly refuse to live in the brickwork boxes that our present-day architects plan for them. 'Say, yew, what do you take me for, a rabbit?' 'Rabbit! Why this charming residence is a full size copy of the prize cottage of the latest Garden City.' 'Lor, now, is it? Looks more like a collection of cupboards to me. Well, you go and live in it; I have no use for curios.' Now, Mr. Architect, from any and every sanitary

West Elevation.

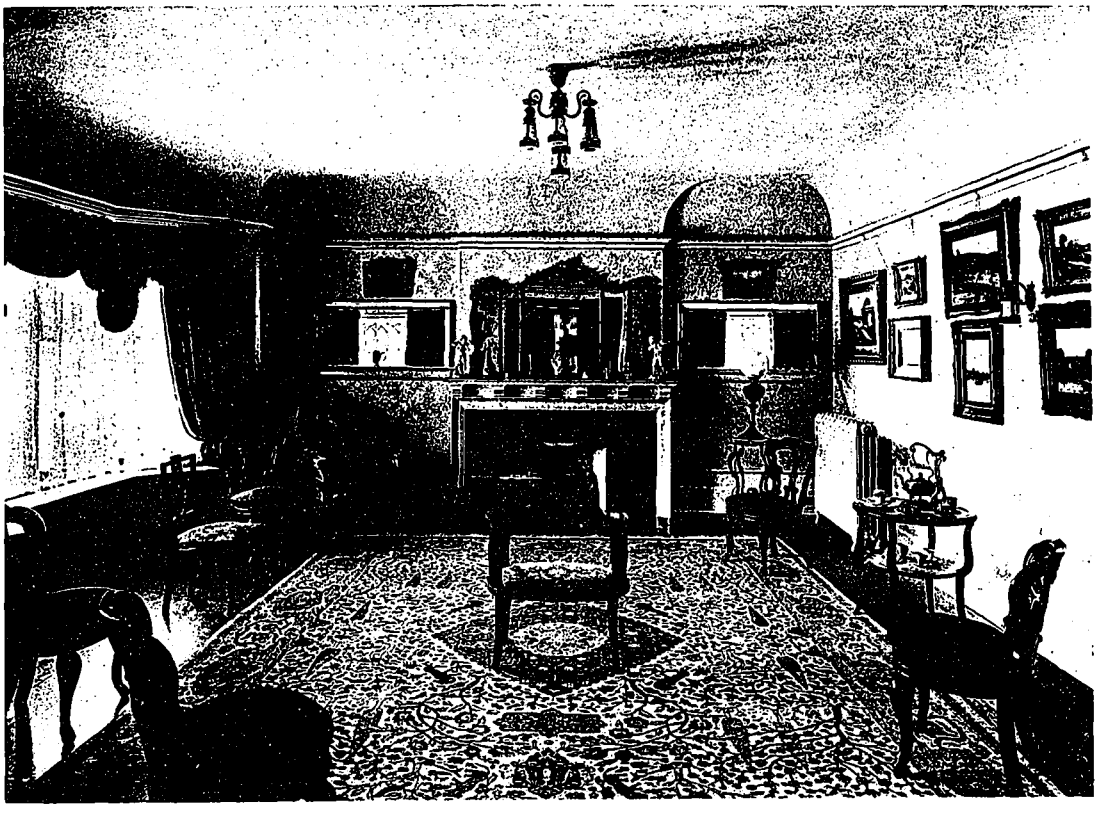
North Elevation.

Residence of W. H. Carrick, Toronto, Ontario. Langley & Howland, Architects.



Ground Floor Plan.

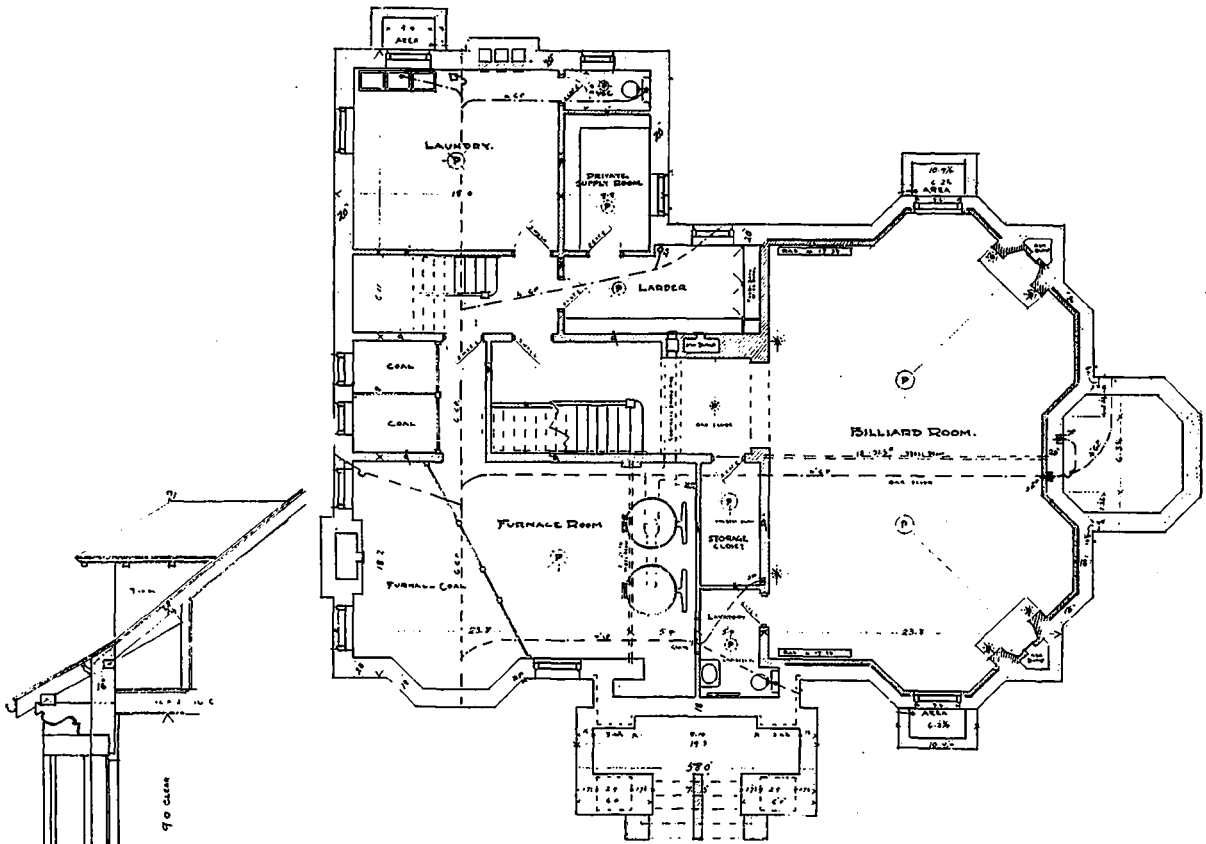
Detail of Entrance.
Residence of W. H. Carrick, Toronto, Ontario. Langley & Howland, Architects.



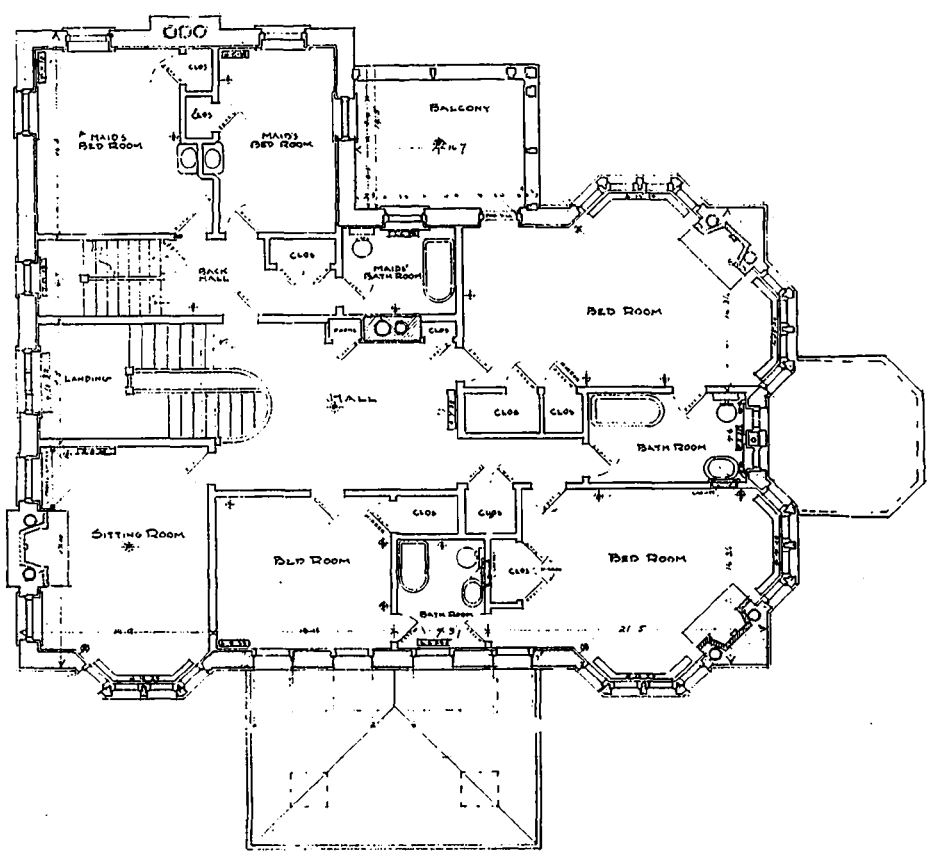
Living Room.

Dining Room.

Residence of W. H. Carrick, Toronto, Ontario. Langley & Howland, Architects.



Basement Plan.



Residence of W. H. Carrick, Toronto, Ontario. Langley & Howland, Architects.

point of view I denounce your charming residences. Prophesying as to the form of dwelling under common-sense Socialism, I say that a large walled enclosure, with a glass roof, will fill the bill. In place of brick boxes will be a large paved playground for all the family, and light screens, readily removable, will give such privacy as decency demands. Sun baths will be the ordinary summer fashion, and daylight ditto for the winter. Gaseous fuel or electricity will give artificial light and heat for cooking in towns; in the country a gipsy fire will be good enough and sweet enough for those who are not rabidly fond of the dirty, wasteful, and unhealthy coal fire.

"And the adoption of this plan would give the present country laborers immediate relief from the house famine. Landowners or the community would provide the cheap and healthy shell dwelling, and the renter of it would rig it up, according to his requirements and ideas, inside. It is a compound of the Crystal Palace, the Spanish inner court, and the Japanese screen wall. Privacy, health, comfort, and ample space for the kiddies to cavort in. And the really simple life; not the, as at present, life of the simpleton—officially ordered and inspected."

A STUDY IN INTERIOR FINISH AND DECORATION

Detailed description of methods and materials by which an attractive interior scheme was evolved.

THE INADEQUACY of ordinary photography in its expression of color makes any illustration of interior decoration, or even of the wood finish, unsatisfactory. At best one sees the bare design in monotone and flat surfaces, and sometimes that which is light in color to the eye shows dark in the photograph, and vice versa, and the imagination has to fill in the deficiency even in proportion, another inaccuracy of the photograph. The photograph showing several views of the interior of Mr. T. P. Phelan's residence in Toronto, J. P. Hynes, architect, are intended to show how a careful study of proportion, color and material produce that artistic repose and balance of color and form that makes for restful harmony. In its bare description again the imagination must be called upon to assist the photograph in giving some adequate idea of the composition that has resulted in the production of some exceptionally attractive interiors.

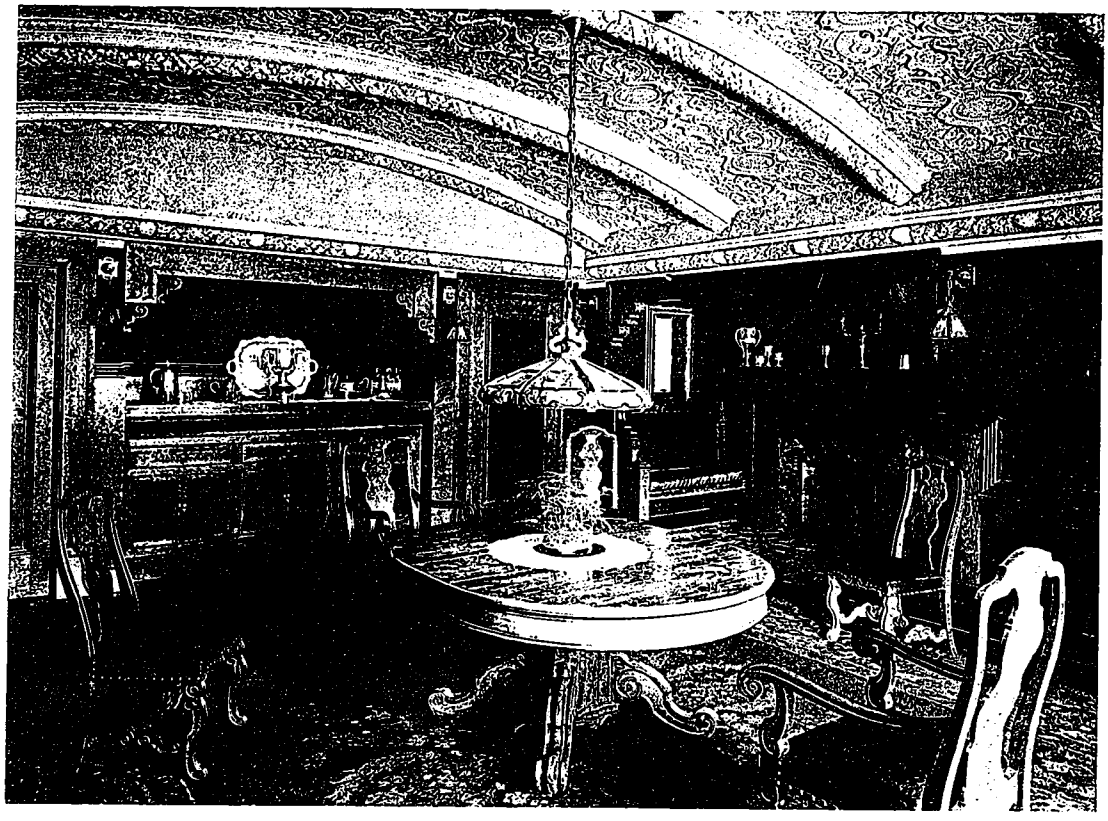
The hallway is finished in mahogany, the wainscoting run, with the top of the door casing, while the pilasters are carried to the ceiling, where they support beams which are also of mahogany as well as is the cornice. The staircase in this hall is of mahogany also, running to a wide landing, with windows its full width having a southern aspect. This staircase connects with the upper hall, which is also finished in mahogany, with wainscoting two feet six inches high.

The dining-room is finished in Circassian walnut, the sideboard and seats of chimney corner being built in as part of the cabinet work of the room. The fireplace is deeply recessed and has a Nomidian marble front, with hearth of the same material, the latter being set in tiles and fills the whole of the floor of the recess. The staff ceiling in this room has been given a vaulted form with ribs enriched with very slightly conventionalized floral ornament, while the surfaces between the ribs are entirely covered with a light conventional ornament .

The billiard-room, which has a platform raised above the floor and an ingle nook fireplace, for those not engaged in the game. It is finished in fumed oak. The fireplace has a Verdi antique marble facing and floor, the seats correspond with the woodwork of the room. The platform is separated from the room proper by columns, and the ceiling of this portion is an elliptic vault with a small rib pattern covering its entire surface. This small rib pattern is carried onto the flat surfaces of the ceiling of the room proper, which has as its central portion in a sunken coffer, the deepest recess of which is also covered with the same light rib decoration.

Owing to the surfaces between the ribs being finished in old gold color, while the rib itself is in olive green, the photograph interprets the gold as being darker than the ribs, which is just the reverse of the effect in reality, which is more pleasing than the photograph would indicate.

ARCHITECTURE is replete with illustrations of the truth that any kind of order may be pleasing even when the forms which are arranged are indifferent or ugly. This is certainly not to argue that the parts so disposed need not be cared for as appeared to be the case in Barocque architecture, but only that order is essential and contributes to beauty. Beyond the field of order as an element of satisfaction, the relation of the appearance to the actual constitution of the structure is another analyzable form of beauty, for which laws may be stated and the appreciation of which may be developed by study. Organic beauty is a source of æsthetic pleasure, not, it is true, immediate in its appreciation as is intrinsic beauty, but depending upon a more or less conscious analysis of the object and upon a perception of the harmony between its parts and their functions, such as occurs, for example, in the relation between the forms and arrangements of walls, piers and arches, their manner of enclosing or supporting, and in their mutual adjustments. So far only do laws of beauty exist that may be stated and their application observed. Intrinsic beauty which lies beyond the kinds already mentioned is unanalyzable and the capacity for its appreciation is only to be cultivated by the development of such faculties as the individual may possess and in a suitable environment. Beauty in architecture is, after all—and it is to be suspected that this is true of the other arts as well—a by-product of expression.



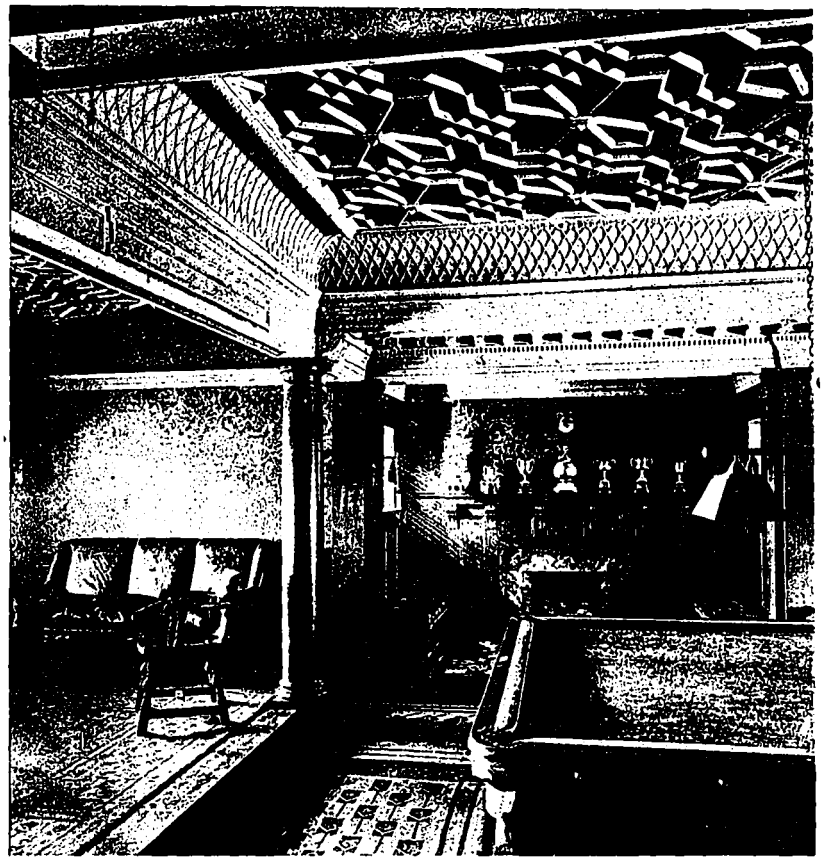
Dining Room.

Hallway and Staircase.

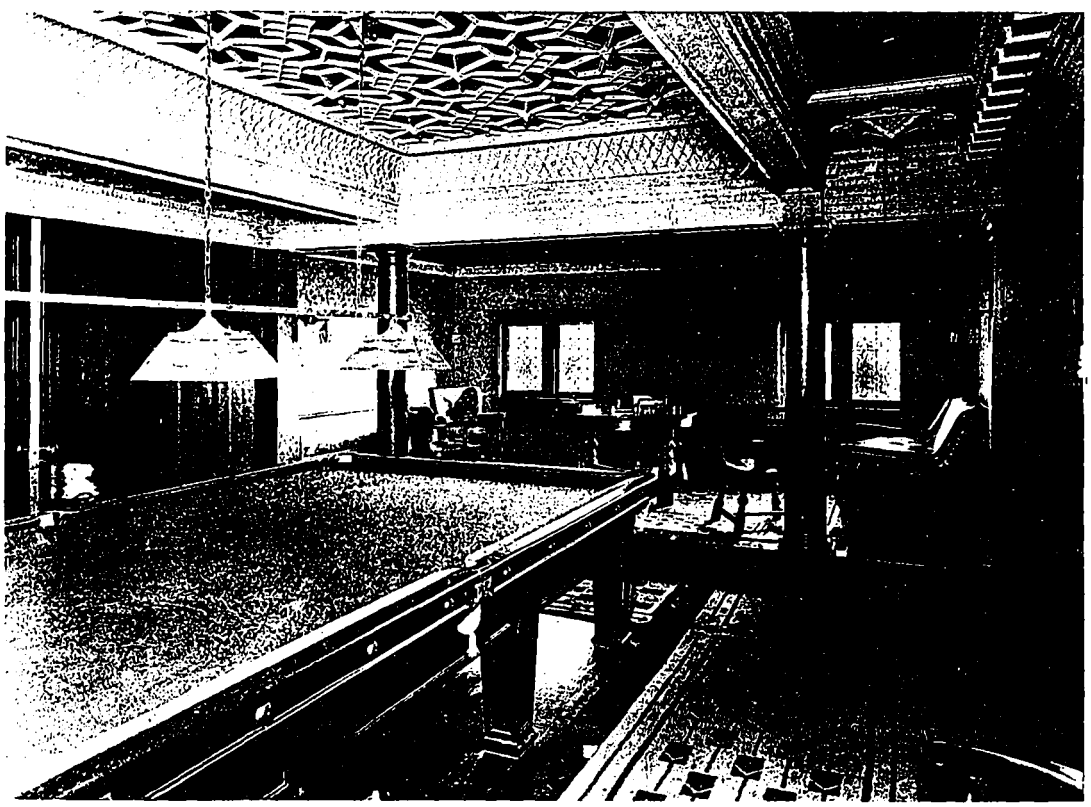
Residence of J. H. Phelan, Toronto, Ontario. J. P. Hynes, Architect.

DETAIL
OF
BILLIARD
ROOM.

J. P. HYNES,
ARCHITECT.



RESIDENCE
OF
J. H. PHELAN,
TORONTO,
ONTARIO.



Billiard Room.

Residence of J. H. Phelan, Toronto, Ontario. J. P. Hynes, Architect.

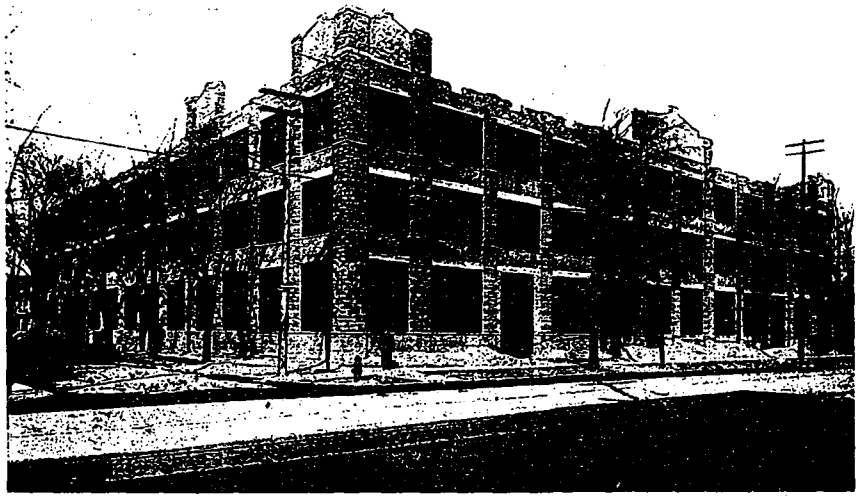
1.—Residence of David Johnston, Oldhall, Paisley, Scotland. David Brown, Jr., Architect.

PRIZE PHOTOS CONCRETE BLOCK COMPETITION

Subjects show recent examples of various types of buildings, and universal extent to which material is being employed.

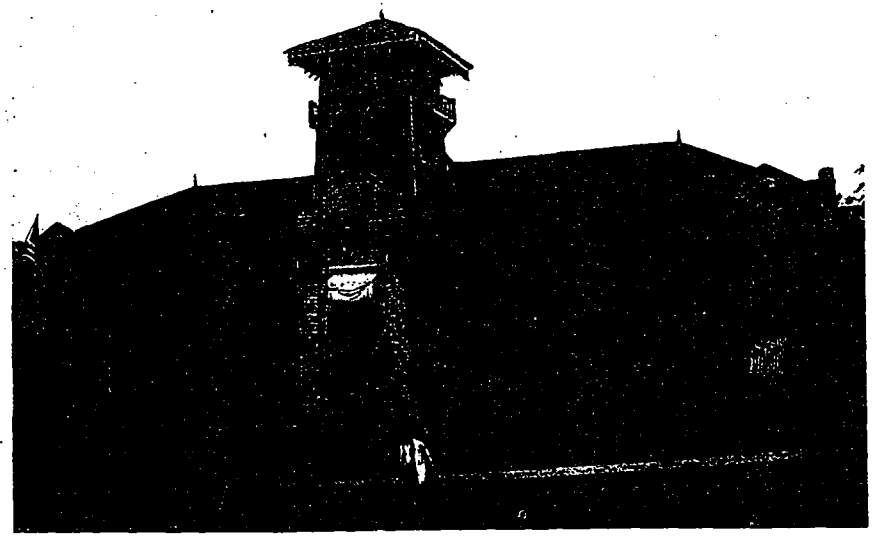
THE GROWTH of concrete block construction, while attributable in a large measure to the fact that the necessary units can usually be manufactured and laid up in the wall at a substantial saving in cost, is due in the main to the merit which the well produced block possesses as structural material. By virtue of its worth in this respect alone, this class of product has not only succeeded in surviving a somewhat precarious beginning, but is being more broadly recognized where permanent materials for building purposes are either demanded or required. It is evident from the progress which has been made within the past few years, that the educational campaign which certain manufacturers have been conducting, has not been without its beneficial and salutary effect. If nothing else, it has resulted in the general production of blocks of a much higher standard, and which are capable of withstanding in every way any of the prescribed structural tests demanded by modern engineering practice. One advance in this respect has been the introduction of the "steam curing process" whereby the porosity of the block is reduced to an extent which gives the material a density and compressive strength equal to, if not greater than that of the best grades of natural stone.

This method of curing blocks will undoubtedly be extensively employed as soon as its advantages are more widely understood, and will result in the better type of construction generally as far as concrete blocks are concerned. There still remains, however, much to be accomplished by way of intelligent application of concrete blocks to the artistic side of building design. Any lack so far manifest in this respect cannot, it must be said, be charged to any inherent defect of the material itself, but to the fact that its logical possibilities have not been sufficiently exploited. With a larger number of architects turning their attention to the use of the material and with the greater care which manufacturers are now giving to precision of architectural detail, it is only reasonable to expect that the near future will witness a vast improvement in this regard. With the object of ascertaining just what was being accomplished in this direction, the Ideal Concrete Machinery Company some little time back offered sixteen cash prizes amounting to $500.00 for photographs showing the best examples of buildings, constructed from blocks

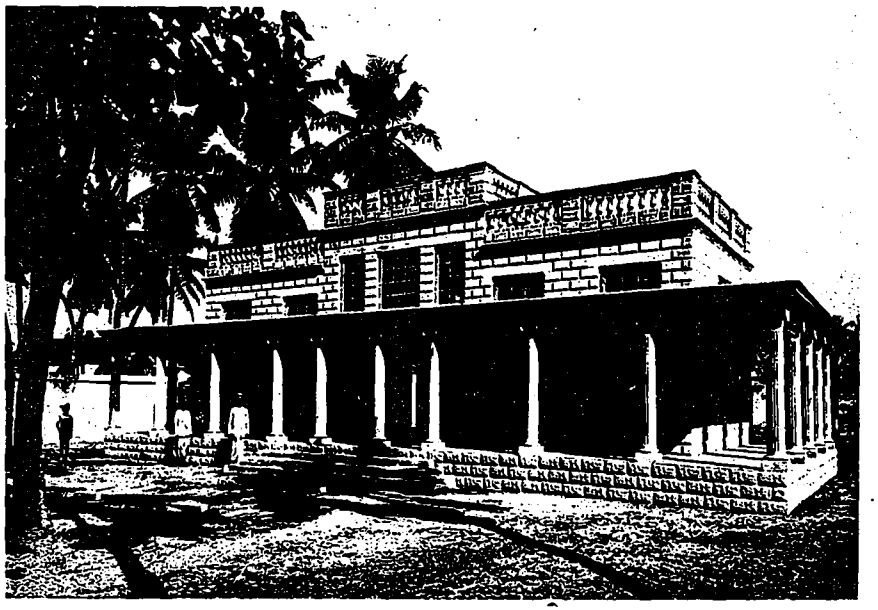


2.—Premises of the City Concrete and Coal Company, Detroit. Lewis Kempen, Architect.

4.—Residence of David Brown, Jr., Architect, Paisley, Scotland.



3.—U.S. Government Building, Zambiango, Philippine Islands. Designed by Provincial Engineer C. F. Vance.



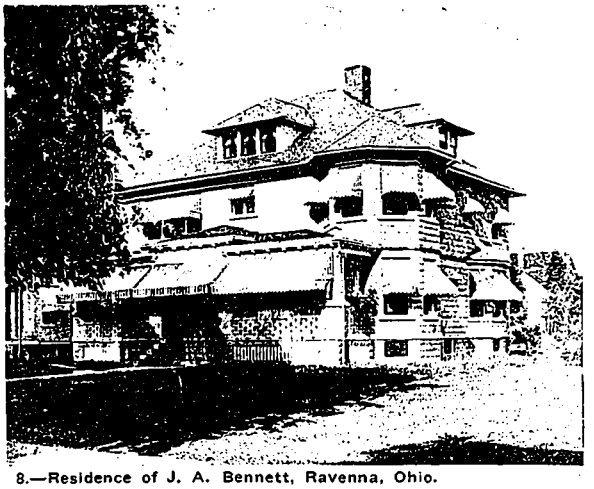
5.—School Building, Madras, India. One of 40 Similar Structures which the Madras Corporation is Erecting.

6.—Garage of W. O. Lambert, Grand Island, Nebraska.

7.—Residence of Prof. E. B. House, Ft. Collins, Colorado.

made on the "Ideal" machine. The prize winners which are illustrated in the accompanying views in the numerical order in which the awards were made, are quite representative of the hundreds of subjects

feature of the competition, if any, was the fact that the subjects submitted in most cases suffered by comparison with other photographs in the company's possession which were not entered. Several excep-

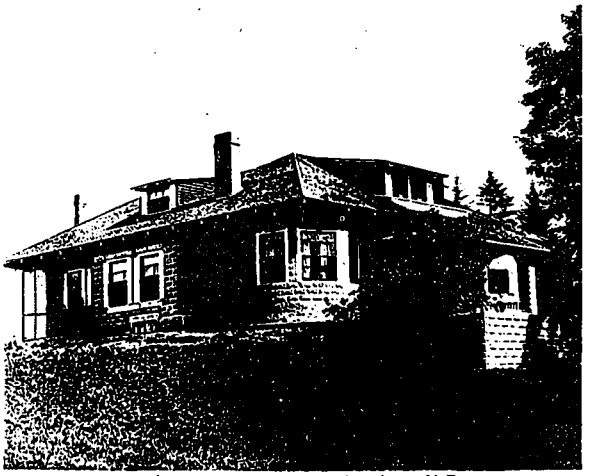


8.—Residence of J. A. Bennett, Ravenna, Ohio.

9.—Sydnaham Club, Owen Sound, Ontario. Forrester and Clark, Architects.

sent in, and are interesting both as showing the various types of building in which concrete blocks are used, and the universal extent to which this product has come to be employed. The only disappointing

tionally well designed buildings are, however, to be this be said of Canadian and Scottish examples. It seems rather singular that the United States, where noted in the accompanying views. Particularly can



10.—Residence of G. W. Daniels, St. Stephen, N.B.

11.—Residence of Rev. Austin Potter, Dundas, Ontario. Martyn H. Hewitt, Architect.

12—Residence of Judge Smith, Britannia Heights, Ottawa, Ont.

the industry first had its inception, and where more concrete blocks are used than in any other place in the world, the general class of work is inferior to that of other countries. The subjects from Scotland are exceptionally commendable. That country received

13.—Molson's Bank, Revelstoke, B.C. A. J. Dunlop, Montreal, Architect.

first and fourth prize; the Philippines, third; and far-off India, fifth, while Canada got six prizes in all.

It is not intended here to go fully into the merits of buildings under consideration, other than to state

14.—Residence of T. L. Dates, Owen Sound, Ont. Awarded Prize for Concrete Porch Design.

that the judges based their award more on the class of work itself, than the design of the building. The photographs can well speak for themselves. Those who judged the photographs were Mr. John M.

15.—Residence of Kenneth K. Bullard, Maywood, Illinois. Awarded Prize for the Construction of Stucco on Concrete Blocks. Robt. B. Seyforth, Architect.

Moore, Architect, London, Ont.; Mr. E. R. Austin, Supervising Government Architect, South Bend, Ind.; Mr. H. G. Christman, South Bend, Ind.; and Mr. B. M. Toutloff, Toronto, Ont.

CANADIAN BUILDING OPERATIONS FOR YEAR 1911

The prosperity attending building operations throughout the Dominion last year, and projected constructions, mark the present as high tide in Canadian commercial advancement.

OFFICIAL RETURNS relating to building operations indicate quite clearly that Canada in the past year enjoyed a degree of prosperity that measures up in every way to the predictions made earlier in the season; for not only do the figures reveal a development equally as great from a standpoint of ratio of increase as that noted in the remarkable period of expansion immediately preceding, but they reflect a condition which for general and consistent progress stands without parallel in the building records of the country.

Permits issued in the thirty-one cities submitting comparative figures to CONSTRUCTION give a grand total of $128,765,991, as against $96,701,149 in the previous year. This is equivalent to an average gain of 32 per cent., and is practically double the investment made in 1909. But seven decreases were noted in all, and in two of these instances, viz., Ottawa and St. Thomas, the loss recorded was so trivial as to amount to less than one per cent.

The general results as indicating the great era of progress, through which the Dominion is passing, is perhaps all the more noteworthy when consideration is given to the fact that the political aspect attending the reciprocity issue in the recent Federal election, when a large number of important industrial projects were laid over until 1912, robbed the year's

total of a still further advance over the gratifying mark already reached. As it is, the amounts in the list are sufficiently large to impressively point out the strength and greatness to which the nation is attaining; for it is safe to assume that the figures, though representing a limited number of centres, quite accurately reflect the situation in general, in that no growth such as these industrial and commercial points indicate, is either probable or logically possible unless accompanied by a more or less universal development affecting secondary cities and towns.

Toronto's investment of $24,374,539, representing a gain of 15 per cent. over the previous year, indeed reflects a state of tremendous activity, and is surpassed in the United States only by the totals of New York, Chicago and Cleveland. And yet the comparative amounts in this particular case fail to denote a proportionate increase as great as noted in the number of other instances. Calgary, for example, registers an actual gain of over $7,000,000, the exact extent of operations amounting to $12,907,638, as compared with $5,589,594 in 1910. Few cities of like size possibly ever achieved such a splendid record. Operations were also undertaken on an extensive scale at Vancouver and Winnipeg, both of which issued permits valued at over $17,000,000; the amounts noted giving these centres relative positions of seventh and eighth in the list of cities on the American Continent for operations in the past year. With one exception, viz., Lethbridge, which registers a decrease of 14 per cent., all principal points in the West are substantially ahead. Regina has an increase of 116 per cent.; Moose Jaw 131 per cent., and Saskatoon and Prince Albert relative gains of 90 and 87 per cent. In Regina and Saskatoon the investment in each case was in excess of $5,000,000, while in Moose Jaw it amounted in exact figures to $2,475,736. Edmonton undertook operations involving an expenditure of $3,672,260, which is 69 per cent. better than her previous total; and Medicine Hat, in the same province, forged ahead to the extent of 261 per cent., and has the highest individual advance recorded for the year among the cities reporting. Other gains noted are: Brandon, 6; Nelson, 2; and Victoria 77 per cent., the expenditure in the last named place amounting to $4,026,315. North Vancouver, while not submitting figures for the corresponding period, also indicates by a total of $772,468 a state of development that was highly satisfactory.

Ontario made most excellent progress in all parts, although a decline was registered at both Peterboro and Port Arthur, in addition to the two losses previously mentioned. These decreases, however, detract but little from the sum total otherwise recorded. Hamilton's amount of $4,255,250 shows a growth practically two-thirds again as great as that experienced in the preceding year. In Fort William the value of work undertaken reached $3,078,010, net-

	Permits for Dec., 1911.	Permits for Dec., 1910	Increase Per Cent.	Decrease Per Cent.	Permits for 1911.	Permits for 1910.	Increase Per Cent.	Decrease Per Cent.
Berlin, Ont.	$	$	.....	.....	$ 358,095	$ 347,550	3.03	.....
Brandon, Man.	1,925	18,068	.....	89.35	1,043,929	982,385	6.26	.....
Calgary, Alta.	698,160	354,300	97.05	.....	12,907,638	5,589,594	130.92	.....
Edmonton, Alta.	74,735	141,321	.....	47.12	3,672,260	2,161,356	69.90	.....
Fort William, Ont.	589,400	424,135	38.96	.....	3,078,010	2,381,125	29.26	.....
Halifax, N.S.	98,000	14,345	583.16	.....	508,796	630,380	.....	19.29
Hamilton, Ont.	92,300	49,550	86.27	.....	4,255,730	2,604,605	63.39	.....
Kingston, Ont.	3,311	495	568.88	.....	314,569	220,092	42.92	.....
Lethbridge, Alta.	112,750	35,450	218.05	.....	1,033,380	1,211,310	.....	14.69
London, Ont.	187,563	63,085	197.30	.....	1,036,880	805,074	28.79	.....
Medicine Hat, Alta.	17,935	11,805	51.93	.....	743,352	205,639	261.48	.....
Montreal, Que.	623,422	756,800	.....	17.63	15,715,859	14,580,632	.....	7.23
Moose Jaw, Sask.	50,000	25,000	100.00	.....	2,475,736	1,071,000	131.16	.....
Nelson, B.C.	6,650	46,850	.....	85.81	166,700	163,430	2.00	.....
Ottawa, Ont.	195,060	174,350	11.87	.....	2,997,610	3,022,650	.....	.83
Peterboro, Ont.	4,115	9,240	.....	55.47	345,372	517,958	.....	33.33
Port Arthur, Ont.	9,495	76,800	.....	87.64	597,705	892,681	.....	33.05
Prince Albert, Sask.	450	3,000	.....	85.00	921,595	492,475	87.13	.....
Quebec, Que.	31,100	.....	.....	.....	.....	.....	.....	.....
Regina, Sask.	71,230	20,625	245.35	.....	5,099,340	2,351,238	116.87	.....
Saskatoon, Sask.	214,125	6,600	3144.31	.....	5,028,366	2,646,496	90.00	.....
St. John, N.B.	14,000	12,800	9.37	.....	572,700	536,425	8.79	.....
St. Thomas, Ont.	2,100	10,150	.....	79.32	285,515	286,400	.....	.31
Sydney, N.S.	9,000	12,800	.....	29.69	495,642	347,554	42.03	.....
Toronto, Ont.	1,791,032	1,353,265	32.34	.....	24,374,539	21,127,783	15.36	.....
Vancouver, B.C.	1,592,485	958,775	66.09	.....	17,652,642	13,150,365	34.23	.....
North Vancouver, B.C.	55,425	.....	.....	.....	772,468	.....	.....	.....
Victoria, B.C.	242,350	131,750	83.94	.....	4,026,315	2,273,045	77.13	.....
Windsor, Ont.	81,150	22,700	257.48	.....	392,040	739,515	88.62	.....
Winnipeg, Man.	206,550	970,250	.....	78.72	17,550,400	15,116,450	16.10	.....
Welland, Ont.	.....	.....	.....	.....	342,808	245,942	39.39	.....
	$7,075,818	$5,704,309	22.53	.....	$128,765,991	$96,701,149	32.36	.....

ting an increase of 29 per cent. Windsor surpassed its former work by 81 per cent.; Kingston shot forward 42 per cent., while Welland and Berlin annexed gains of 39 and 3 per cent. in order named.

Montreal's total is $14,580,463, which is 7 per cent. less than the investment in 1910; though it might be said that these figures fail materially to represent the actual extent of operations. Twenty millions would, in all likelihood, be closer to the mark. Montreal has a large number of big buildings in immediate prospect, and every indication points to a tremendously active season.

In the Maritime district, Sydney and St. John are ahead by a margin of 42 and 8 per cent. in order named. Halifax, however, is behind, the loss noted being 19 per cent. It is regrettable that so few Eastern cities are represented in the list, as it is definitely known that Campbellton and a large number of other places witness the heaviest operations in their career.

As to the outlook for 1912, possibly the best indication is the large number of industrial plants and commercial buildings projected. A growth of this character must naturally be accompanied by a propor-

tionate growth in other lines. The architectural offices, in lact, at the present time are well laden with work. Contractors and material firms can prepare for a season that will come up to their most optimistic expectation.

BOOK REVIEWS

CANADIAN GOVERNMENT REPORT ON THE GYPSUM DEPOSITS OF THE MARITIME PROVINCES. Issued by the Deparment of Mines. By William E. Jennison, M.E.

The thoroughness with which the Federal Government presents the different classes of natural products of the Dominion in the shape of exhaustive reports calls for special commendation. No better survey map illustration is produced by any Government, and the detail into which the experts employed in the work makes each volume an exhaustive treatise. The report under consideration is that completed by William E. Jennison for the Department of Mines on the Gypsum deposits of the Maritime Provinces. The report not only locates by map and description the various deposits of gypsum and its associated deposits, but describes its manufacture, and even presents plans of machinery and converting plants, shows by photograph the manner of loading onto boats and describes transportation. Its many uses from building plaster to fertilizer is minutely described, and on the whole the report number 84 is an exhaustive treatise upon the subject of gypsum, the compilation of which is an invaluable addition to the literature that the Government is continually issuing upon the natural products

FACORIES AND WAR,HOUSES OF CONCRETE. Published by Association of American Portland Cement Manufacturers, Philadelphia, Pa. Price, 50 cents, which is only intended to cover cost of production and postage.

In its preface this compilation of facts regarding concrete construction, says:—"The purpose of this book is to present to those intending to build industrial buildings, a few examples, of the many hundreds in this country, of factories and warehouses of reinforced concrete construction and to give important facts concerning these buildings, together with an expression as to their merit by their owners. In so doing, it is frankly hoped to increase the number of these buildings which are built of reinforced concrete, and thus improve the building construction throughout the country."

It fills its preface in a most complete, and at the same time, presentable manner. In the compilation covering 223 pages, there are 255 concrete buildings shown in half-tone, gathered from thirty States, and representing the work of 132 architects, 193 engineers, and 97 contractors. The volume is admirably arranged for ready reference and comprehensive study. It is arranged in units of four pages. On the first of each four pages is a typical example of a building of a certain class of occupancy, and on the second page follows a description of this example, giving facts of interest to a prospective builder. On the third page appears an interior view together with a letter from the owner of the building. On the fourth page is a group of photographs of buildings used for similar purposes. As far as possible these four page units are arranged in alphabetical order by the industries they represent, and the last four pages are devoted to showing the effect of fire on this class of construction. It is also comprehensively indexed.

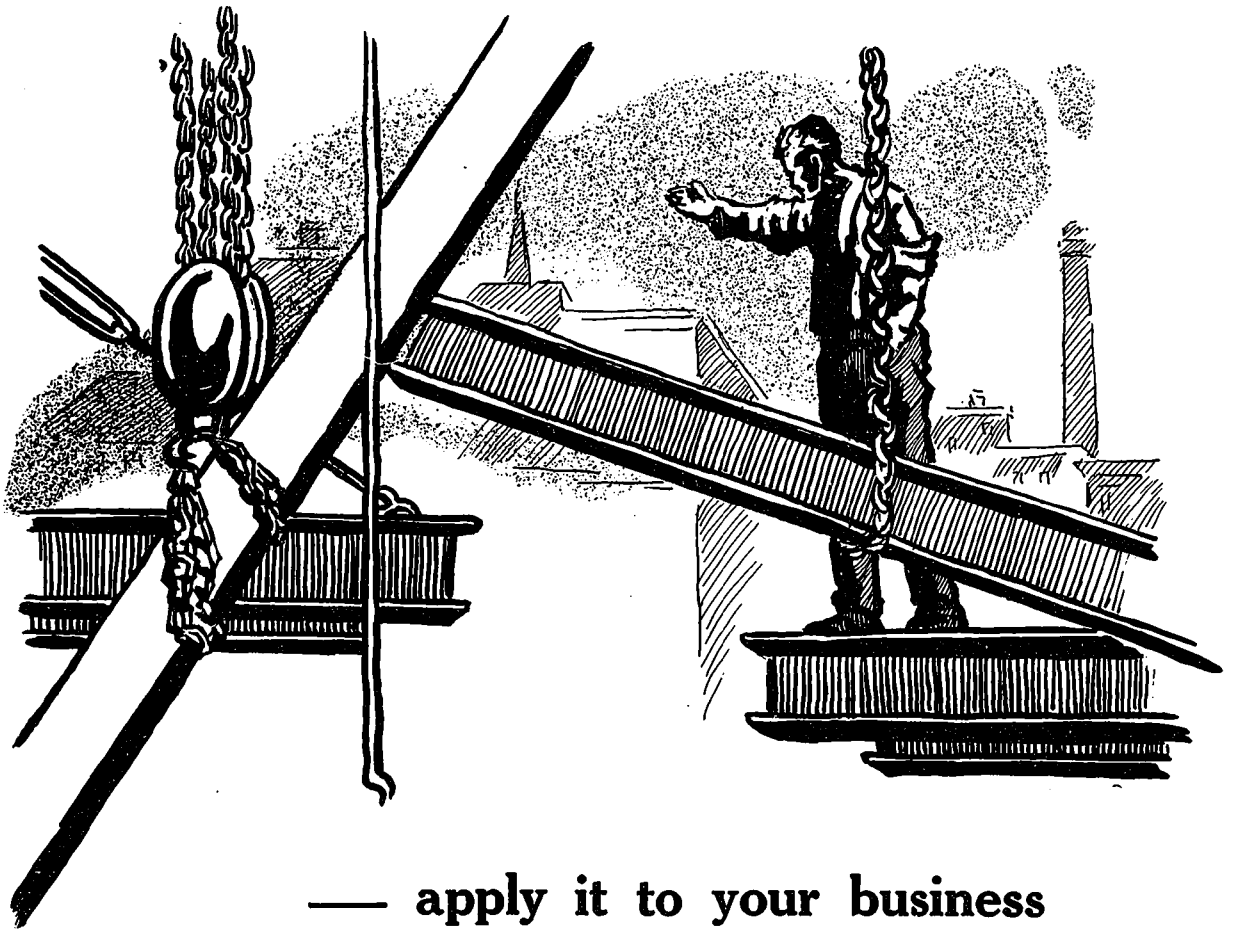
Thus the publication presents to the prospective builder, his architect and engineer, information of great value. There is also a short description of the removal of a concrete building, which is interesting and valuable, when a lot is required for another building and purpose.

WATER-POWERS OF CANADA. Report by Leo G. Denis, B.Sc., E.E., and Arthur V. White, C.E. Published by Commission of Conservation of Canada. Hon. Clifford Sifton, Chairman; James White, Secretary. 1911.

In an exhaustive treatise of some four hundred pages, accompanied with maps covering the entire territory, the report of the Commission of Conservation lays before the Canadian people an index, and a description as well, of the water power riches of the Dominion. From the Horseshoe falls of Niagara and from Nova Scotia to the Yukon in description, photograph and map the report describes, and in technical tables states the water heads and estimated horsepower of every water fall and rapid that can in the future contribute light, heat, and power to the immediate neighborhood. The work of the Commission not only comprises the collection of such data but one of its chief objects was to ascertain to what extent waters may be stored in natural and created reservoirs and all other data that pertains to the conservation and use of the Dominion's water power. An appendix contains the text of the treaty between the United Kingdom and the United States relating to boundary waters and questions arising along the boundary between the United States and Canada, with biographical data relating to books, reports and pamphlets containing data relating to the water powers of the Dominion of Canada. The maps which accompany the report are: Water-powers in Nova Scotia, New Brunswick, and Prince Edward Island; Water-powers in Quebec; Water-powers in Ontario; Water-powers in Manitoba, Saskatchewan and Alberta; Water-powers in British Columbia; Irrigation Canals in Southern Alberta.

APPLIED SCIENCE FOR JANUARY, 1912, contains papers upon: The Evolution of Vertical Lift Bridges; Patents and the Engineer two exhaustive illustrated papers upon tests on steel columns; Garden Suburbs, Engineering in Wisconsin University.

While "Applied Science" is the circulatory medium devoted to the interests of engineering, architecture, and applied chemistry at the University of Toronto, and is incorporated with transactions of the University Engineering Society, it is because of these transactions and other data, a valuable magazine for the engineering and architectural student, and as such is perhaps the best recorder of such theories and practical experiments along engineering lines in Canada. It is well edited and should have a general circulation among those who wish to keep posted along the lines of study which it features.



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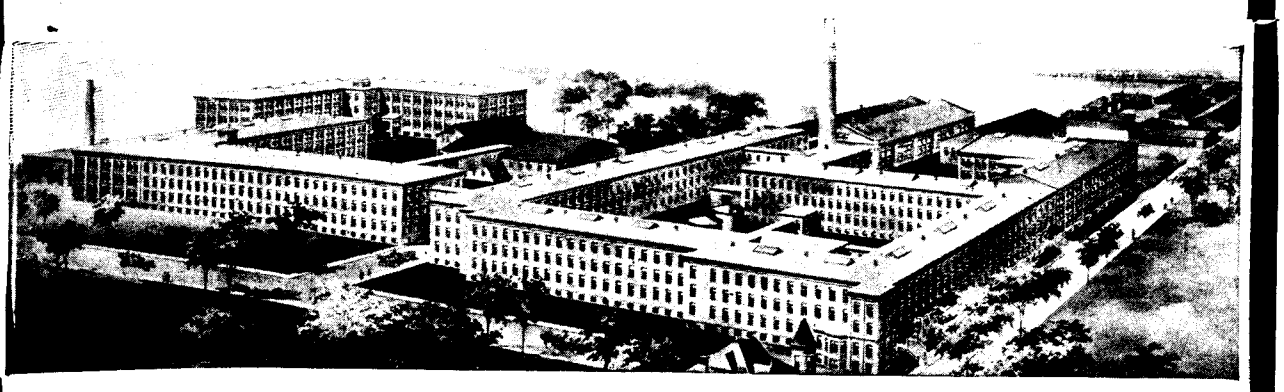

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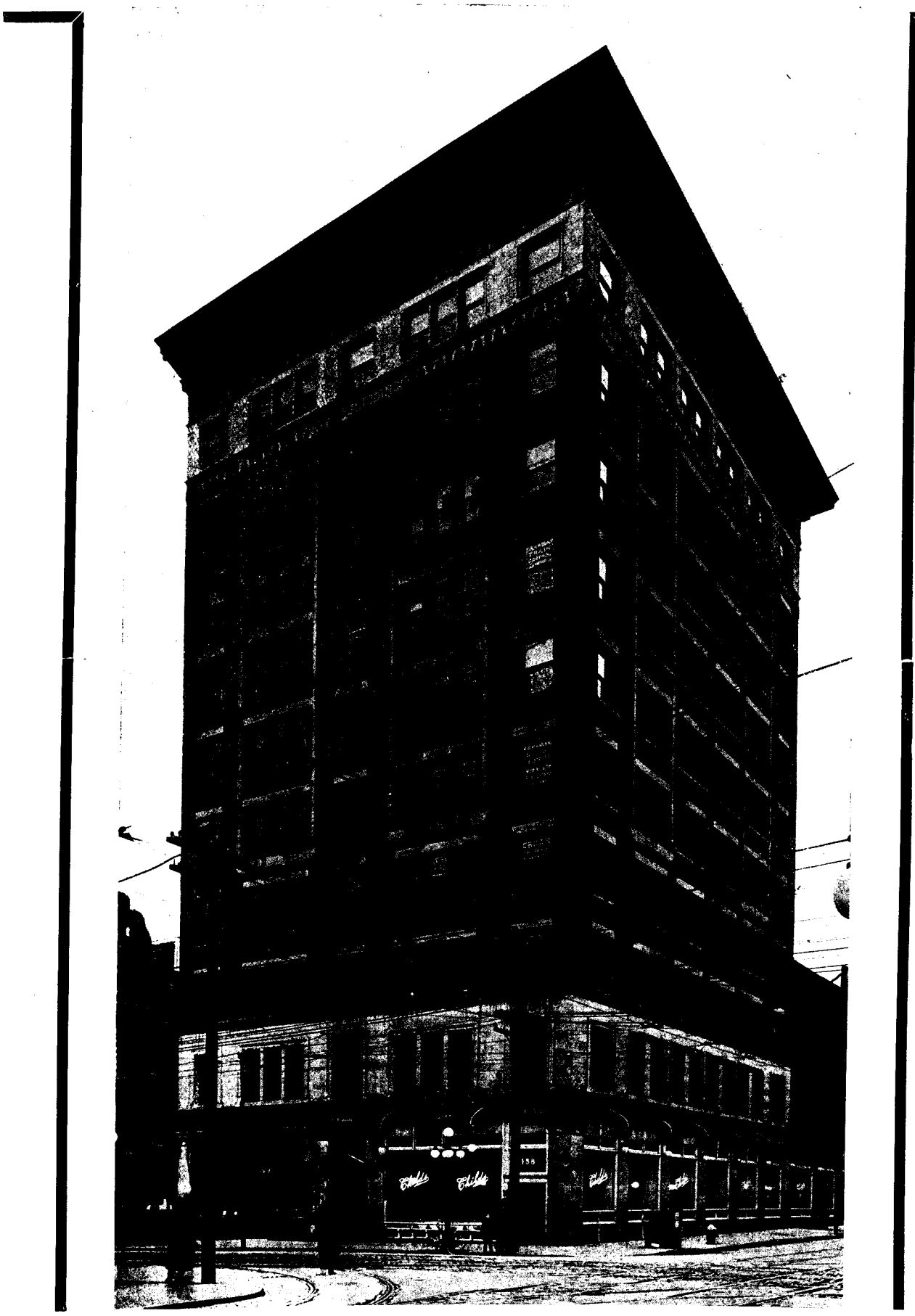

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Exhaust Fans.
Sheldons, Limited.

Engineers and Contractors.
Consumers' Gas Co.
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.
E. F. Dartnell.
Stinson-Reeb Builders' Supply Co.

Fire Sprinklers.
General Fire Equipment Co.
Vogel Co., of Canada, Ltd.
McGuire, W. J.

Fire Extinguishers.
A. B. Ormsby, Ltd.
Vogel Co., of Canada, Ltd.
General Fire Equipment Co.,
Johns-Manville Co., H. W.

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

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

Fireproofing.
Waite-Fullerton Co., Ltd.,
Clarence W. Noble.
Don Valley Brick Works.
E. F. Dartnell.
Eadie-Douglas Co.
Johns-Manville Co., H. W.
Steel & Radiation, Ltd.
Port Credit Brick Co.
The Pedlar People.
Trussed Concrete Steel Co.

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

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

Flooring.
Bird, F. W. & Son, Hamilton.
Eadie-Douglas Co.
Seaman, Kent Co., Ltd.

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.
Sheldons, Limited.
The Pedlar People.

Galvanized Iron.
A. C. Leslie & Co., Ltd.

Glass.
Consolidated Plate Glass Co.
Hobbs Mfg. Co.
Toronto Plate Glass Importing Co., Ltd.

General Contractors.
Bowes & Francis.

Grille Work.
Dennis Wire & Iron Co., Ltd.
Steel & Radiation, Ltd.
J. & J. Taylor.
Meadows, Geo. B. Co.

Hangers.
A. B. Ormsby, Limited.
Allith Mfg. Co.

Hardware.
Allith Mfg. Co.
Taylor-Forbes Co., Ltd.

Hardwood Flooring.
Canadian Fairbanks Co., Ltd.
Siemon Bros.

Heating Apparatus.
Consumers' Gas Co.
Kerr Engine Company.
Clare Bros.
Dominion Radiator Co., Ltd.,
C. A. Dunham Co.
Steel & Radiation, Ltd.
Goldie & McCulloch Co., Ltd.
Pease Foundry Co., Ltd.
Sheldons, Limited.
Taylor-Forbes Co., Ltd.

Heating Engineers and Contractors.
Sheldons, Ltd.

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

Hinges.
Taylor-Forbes Co., Ltd.

Hydrants.
Kerr Engine Company.

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

Iron Stairs.
Canada Foundry Co.
Dennis Wire and Iron Works
Meadows, Geo. B. Co.

Iron Supplies.
Kerr Engine Company.

Illuminating Engineers.
Consumers' Gas Co.
Northern Electric & Mfg. Co.

Insulation.
Bird, F. W. & Son, Hamilton.
Kent Company, Limited.
The Can. H. W. Johns-Manville Co., Ltd.

Interior Woodwork.
Burton & Baldwin.
Seaman Kent Co., Ltd.

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

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

Lamp Standards.
Canada Foundry Co.
Dennis Wire and Iron Works
Canadian Tungsten Lamp Co.
Seaman, Kent Co.

Lath (Metal).
B. Greening Wire Co., Ltd.
Clarence W. Noble.
Steel & Radiation, Ltd.
Galt Art Metal Co
Stinson-Reeb Builders' Supply Co.
The Pedlar People.
Trussed Concrete Steel Co.

Laundry Tubs.
Toronto Laundry Machinery Co.

Leaded Glass.
Hobbs Mfg. Co.

Marble.
James Robertson Co., Ltd.
E. F. Dartnell.
Missisquoi Marble Company.
The Hoidge Marble Co., Ltd.
Dominion Marble Co.
Lammers & Carleson.

Metallic Sash.
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.
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.
Canadian Fairbanks Co., Ltd.

Paints—(Steel and Iron).
Glidden Varnish Co.
R. I. W. Damp Resisting Paint Co.
E. F. Dartnell.
Machan and Hebron.
Brandram & Henderson.
International Varnish Co.

Paints and Stains
E. F. Dartneli.
James Robertson Co., Ltd.
Brandram & Henderson.
International Varnish Co.
Berry Bros. Ltd.

Perforated Steel.
B. Greening Wire Co.

Pipe Covering.
Canadian Johns-Manville Co.
Kent Company, Limited.

Plasters.
W. J. Hynes.
Brandram & Henderson.
Johns-Manville Co., H. W.

Plaster Corner Beads.
The Pedlar People.

Plate and Window Glass.
Consolidated Glass Co.
Hobbs Mfg. Co.
Toronto Plate Glass Importing Co., Ltd.

Plumbers' Brass Goods.
Steel & Radiation, Ltd.
James Robertson Co., Ltd.
Standard Ideal Co., Limited.
Canadian Fairbanks Co., Ltd.

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.
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.

Radiator Valves.
Steel & Radiation, Ltd.
Kerr Engine Company.

Reinforced Concrete.
Steel & Radiation, Ltd.
Noble, Clarence W.
The Pedlar People.
The Canadian Siegwart Beam Co., Ltd.
Trussed Concrete Steel Co.,

Relief Decoration.
W. J. Hynes.

Roofing Paper.
Alex. McArthur & Co., Ltd.
The Pedlar People.
F. W. Bird & Son.
Johns-Manville Co., H. W.

Roofing.
Asbestos Mfg. Co.
Bird, F. W. & Son, Hamilton.
H. W. Johns-Manville Co.
Paterson Mfg. Co.

Roofing (Slate).
Waite-Fullerton Co., Ltd., Winnipeg.
A. B. Ormsby, Limited.

Roofing (Tile).
Waite-Fullerton Co., Ltd., Winnipeg.
E. F. Dartnell.
The Pedlar People.

Rubber Tiling.
Gutta Percha & Rubber Mfg. Co., Limited.

Safes. Fireproof and Bankers.
Goldie & McCulloch, Limited.
J. & J. Taylor.
Canadian Fairbanks Co., Ltd.

Sanitary Plumbing Appliances.
James Robertson Co., Ltd.
Standard Ideal Co., Limited.

Sand and Gravel.
Sand and Supplies, Ltd.

Sand Screens.
Steel & Radiation, Ltd.
B. Greening Wire Co. Limited

Screens.
Watson-Smith Co., Ltd.

Shafting Pulleys and Hangers.
Goldie & McCulloch Co., Limited.
Canadian Fairbanks Co., Ltd.

Sheet Metal.
A. C. Leslie & Co.

Sheet Metal Workers.
Sheldons, Ltd.
A. B. Ormsby, Limited.
Galt Art Metal Co.
The Pedlar People.

Shingle Stains.
James Robertson Co.
International Varnish Co.

Sidewalks. Doors and Grates.
Dennis Wire & Iron Works Co.

Sidewalk Lifts.
Otis-Fensom Elevator Co.,

Sidewalk Prisms.
Hobbs Mfg. Co.
International Supply Co.

Slate.
James Robertson Co., Ltd.

Stable Fittings.
Dennis Wire & Iron Works Co., Ltd.

Staff and Stucco Work.
Johns-Manville Co., H. W.
W. J. Hynes.

Steam Appliances.
Steel & Radiation, Ltd.
Kerr Engine Co.
Sheldons, Ltd.
Taylor-Forbes Co., limited.
Canadian Fairbanks Co., Ltd.

Steam and Hot Water Heating.
Steel & Radiation, Ltd.
Sheldon, Ltd.
Dominion Radiator Co., Ltd.,
C. A. Dunham Co.
Taylor-Forbes Co., limited.

Steel Casements.
Steel & Radiation, Ltd.

Steel Concrete Construction.
Steel & Radiation, Ltd.
Noble, Clarence W.
The Pedlar People.
Trussed Concrete Steel Co.

Steel Doors.
Dennis Wire & Iron Co., Ltd
Mussens, Ltd.
A. B. Ormsby, Limited.
The Pedlar People.

Structural Iron Contractors.
Canada Foundry Company.
Dennis Wire & Iron Co., Ltd.
Dominion Bridge Co., Ltd.
Hamilton Bridge Co.
Reid & Brown.
Structural Steel Co., Ltd.

Store Fixtures.
Burton & Baldwin Mfg. Co

Telephone Systems.
Northern Electric & Mfg. Co.

Structural Steel.
Canada Foundry Company.
Sheldons, Ltd.
Mussens, Ltd.
Dennis Wire and Iron Works
Dominion Bridge Co., Ltd.
Hamilton Bridge Co.
Reid & Brown.
Structural Steel Co., Ltd.

Terra Cotta Fireproofing.
Carter & Co., Ltd.
Waite-Fullerton Co., Ltd., Winnipeg.
Don Valley Brick Works.
Eadie-Douglas Co.
E. F. Dartnell.
Missisquoi Marble Company

Tile (Floor and Wall).
Carter & Co., Ltd.
Waite-Fullerton Co., Ltd.,
E. F. Dartnell.
Smith Marble & Construction Co.
Asphalt & Supply Co.

Vacuum Heating Systems.
C. A. Dunham Co.

Varnishes.
Ault & Wiborg Co.
Berry Bros., Ltd.
Brandram & Henderson.
International Varnish Co.

Vaults and Vault Doors, Fireproof and Bankers.
Goldie & McCulloch Co., Ltd
J. & J. Taylor.

Valves.
C. A. Dunham Co.
Steel & Radiation, Ltd.
James Robertson Co.
Kerr Engine Co.
Taylor-Forbes Co.
Canadian Fairbanks Co., Ltd.

Ventilators.
Sheldons, Limited.

Wall Finishes.
E. F. Dartnell.
Berry Bros.
International Varnish Co.
Brandram & Henderson.

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.
Johns-Manville Co., H. W.

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.
Brandram & Henderson.
Glidden Varnish Co.

Window Guards.
Dennis Wire & Iron Co., Ltd
Steel & Radiation, Ltd.
B. Greening Wire Co. Limited

Wire Rope and Fittings.
B. Greening Wire Co. Limited
Mussens, Ltd.
Otis-Fensom Elevator Co

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