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MARCH, 1911

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CONSTRUCTION

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

OFFICE OF PUBLICATION
· TORONTO ·
BRANCH OFFICES
MONTREAL - LONDON · ENG.

A Frank Statement

about

Ideal Concrete Machinery

This is a frank statement to business men who want to make a profitable investment and who appreciate the relation between Price and Quality.

As pioneers in the manufacture of Face Down Concrete Block Machines, we have spent years of continuous effort perfecting a factory organization to build Concrete Machinery as nearly mechanically perfect as materials, skilled mechanics and supervision will permit.

The Ideal Line

Block Machines

Automatic Power Tampers

Sill and Lintel Machines

Proportioning, Continuous and Batch Mixers

Brick Machines

Water Proofing and Colors

Metal Wall Plugs

Our business has been a success from the start. **First**, because we refused to market anything not up to the highest standard or which would not stand the test of practical service. **Second**, because we have always been frank in our advertising and have taken the purchaser into our confidence, openly revealing to him every fact which he should know.

As a result the largest amount of our business comes from those sections where Ideal Machinery has been previously introduced and has been given the opportunity of time and service in which to prove its real merits in competition with all other makes. This shows conclusively that Ideal equipment is not only made right and priced right, but is a profitable investment to the purchaser.

Every good thing has its imitators. Every business has its parasites. Ours is no exception to the rule. Scores of infringers and cheap imitators have placed inferior, unsatisfactory equipment on the market at any old price, claiming that they were "just as good as the Ideal." Some have been misled, but the test of service and the United States Court decisions sustaining our patent rights have opened their eyes. Today the Ideal is the only Block Machine that has an established value. We recognize neither competition nor competitors—there are none—our line is in a class by itself.

The Ideal Block Machine, as originally designed, has proven so efficient, simple, practical, rapid and easy of operation that its adoption has become universal.

The addition of the Ideal Automatic Power Tamper and the Ideal Scraper and Finisher has brought the manufacture of concrete blocks to a high plane, securing thereby the endorsement of architect, contractor and builder.

Our Tycrete process enables the enterprising Block Maker to successfully compete with the highest grades of building material, such as pressed brick, faced brick, cut stone, granite, etc., etc., and to produce a wide variety of artistic effects, giving ample opportunity for architectural expression. We license its use to well-equipped Ideal plants.

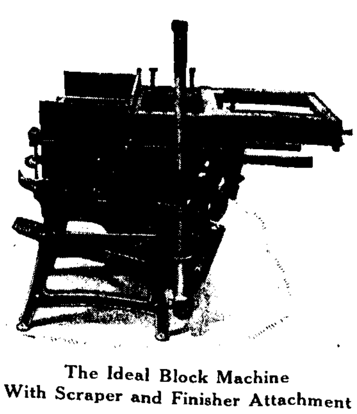
The Ideal stucco block surpasses all other materials as a base to which to apply stucco—being cheaper, stronger, more enduring and absolutely fire and water proof.

Thus Ideal Equipment has taken a tremendous stride in advance, reducing the cost of block manufacture to a minimum, insuring absolute uniformity and perfection.

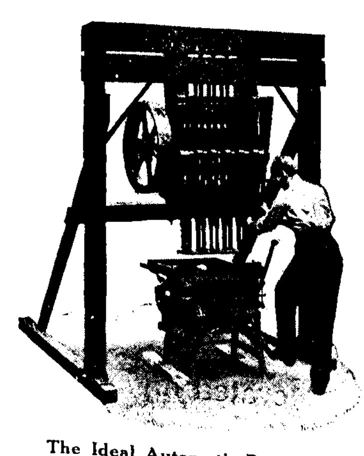
The Ideal Line

Attachments for Chimneys, Water Tables, Course Blocks, Octagons, Circles, Face Designs of All Kinds and Stucco Sets

Special Molds for Columns, Bases, Capitals, Balustrades, Balls, Piers, Porch Columns, Vases, Steps, Sidewalks, Tile and Fence Posts



The Ideal Block Machine With Scraper and Finisher Attachment



The Ideal Automatic Power Tamper

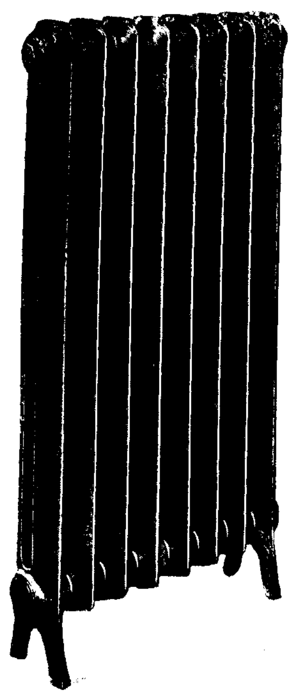
Ideal Concrete Machinery Co., Ltd.

Dept. 221 King St., LONDON, ONT.

Chicago Office—1075 Old Colony Bldg.

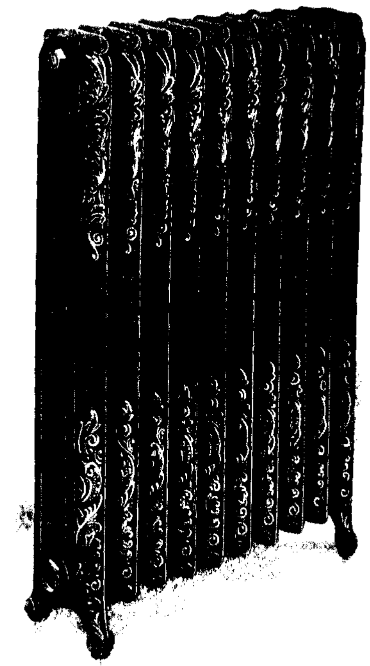
South Bend, Ind.

SAFFORD RADIATORS



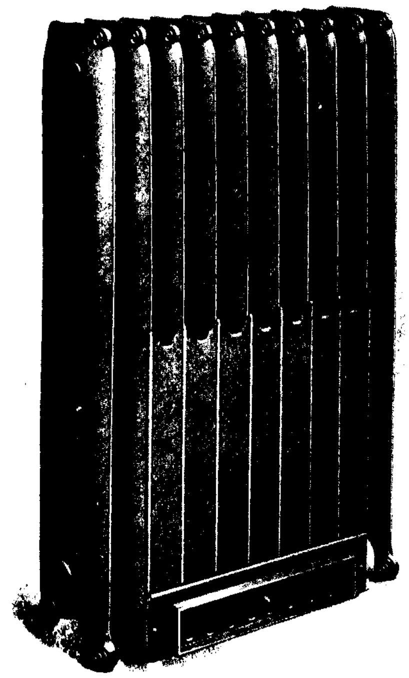
Zenda Plain Single Column.
The Narrowest Radiator Made.

The outstanding feature of the "Safford" line is the magnificent assortment of styles and patterns. There is no requirement in either heating or ventilating apparatus that cannot be fully satisfied by the installation of "Safford Radiators."



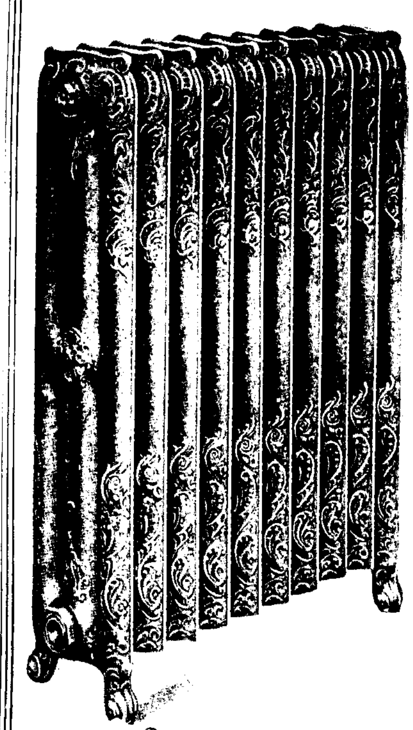
Regina Ornamental.
Two Column.

Not only in the perfect symmetry of outline, but in absolute mechanical accuracy, does the Safford excel.



The New Adjustable Box Base for ventilation work.

Safford Radiators emit a greater number of heat units, per square foot of catalogued radiating surface, than any Radiators manufactured.

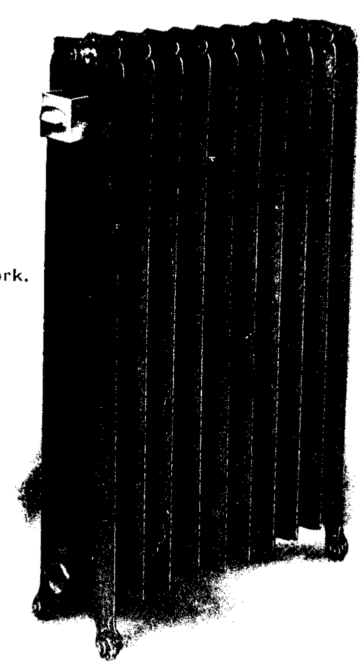


Trident Ornamental.
Three Column.

MANUFACTURED BY

THE DOMINION RADIATOR COMPANY
LIMITED
TORONTO

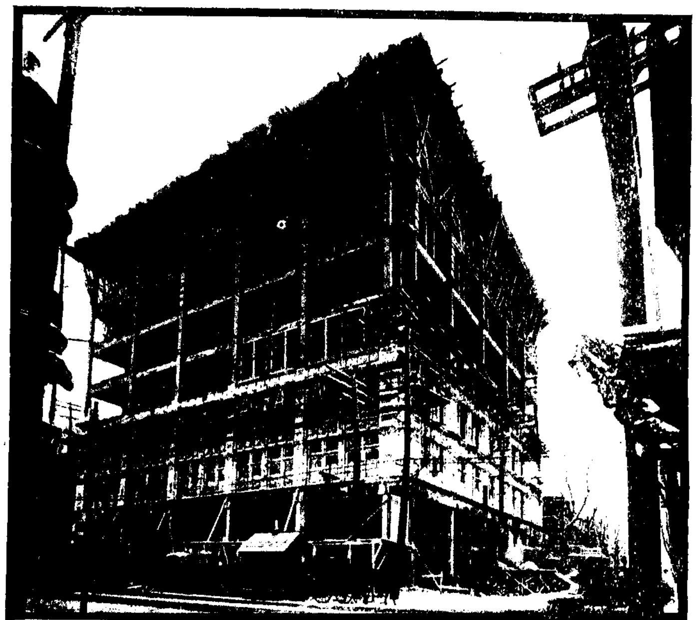
Branch Warehouses and Offices at Montreal, Winnipeg, Vancouver and St. John, N.B.



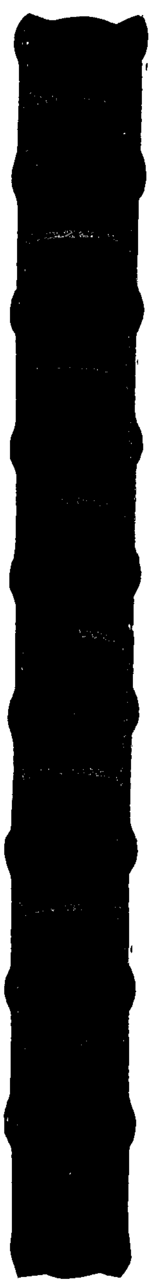
The Empress Humidifying, with Vapor Pan.

KAHN

"The buildings consumed by fire in one year, if placed on lots of 65 ft. frontage, would line both sides of a street extending from New York to Chicago. A person journeying along this street of desolation would pass in every 1,000 ft. a ruin from which an injured person was taken. At every three-quarters of a mile in this journey he would encounter the charred remains of a human being who had been burned to death."—(Bulletin issued by the United States Geological Survey.)



Kellert Bldg., Montreal. Hutcheson, Wood and Miller, Architects, and the George Jay School, Vancouver, B.C.



CUP BARS, from 3/8 in. to 1 1/4 in. area of cross section, same as square bars of like denomination, sold on immediate delivery.

The Reinforcement Spec

A few illustrations recent large Ca Leading Canadi

KAHN SYSTE

Mason & Risch—Architects, Bond & Smith, Toronto.
News Building—Architects, Bond & Smith.
Kent Building—Architects, Dennison & Stephenson, Toronto.
Linseed Oil Buildings (a group of two large buildings and several smaller ones)—Architects, Langley & Howland.
House of Providence, Toronto—Architect, Arthur W. Holmes.
Kimberley Avenue School, Earlscourt School, Harbord Collegiate—Chas. H. Bishop, Board of Education.
Canadian National Carbon Co., Toronto—Architects, Curry & Sparling.
Georgetown Coated Paper Mills—Architects, Bond & Smith, Toronto.
Oliver Chilled Plow Works, Hamilton (several buildings)—Architects, Prack & Perrine.
Canadian Westinghouse, Hamilton—Architects, Owners.
Registry Office, Hamilton—Architect, Stewart McPhie.
Berlin School, Berlin—Architects, Munroe & Meade, Hamilton.

We originate and manufacture mat Reinforced Concrete Construction.
Bars, Rib Metal, Hy-Rib, Trus-

Works and Executive Office, Walkerville

TRUSSED CONCRETE STEEL

Kahn Tru

Branch Offices:
Union Bank Building, Winnipeg.
52 Hutcheson Bldg., Vancouver.

SYSTEM

ified by Most Architects

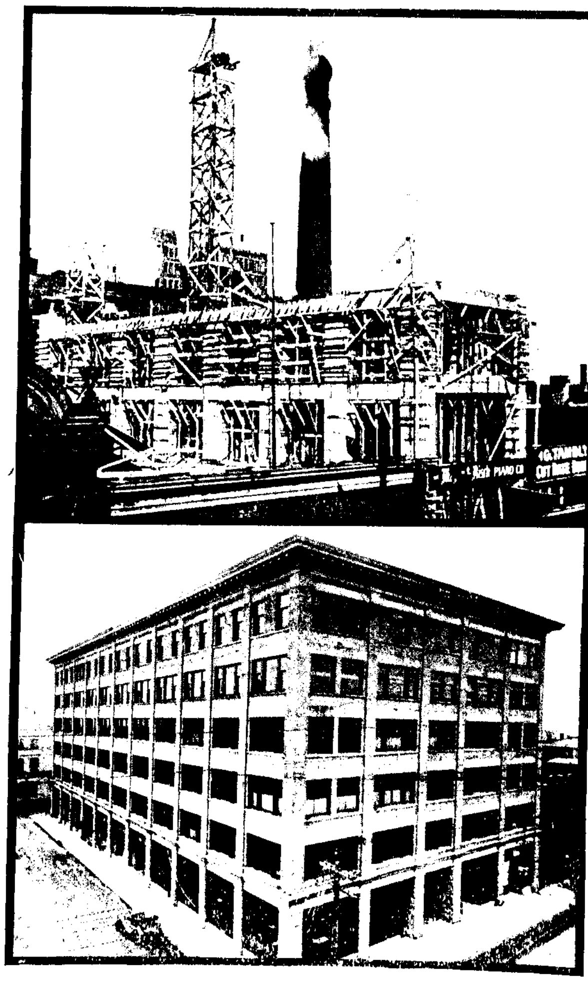
The lessons from all fires point to these conclusions: No structure of the future should be built of wood. No structure of the future should contain any wood. The desirability of concrete construction has become a matter of dollars and cents. Insurance rates dictate fireproof buildings. Your clients' interests demand a fireproof building. Remember—A pleased client means another client.

and a partial list of nadian Buildings by an Architects using

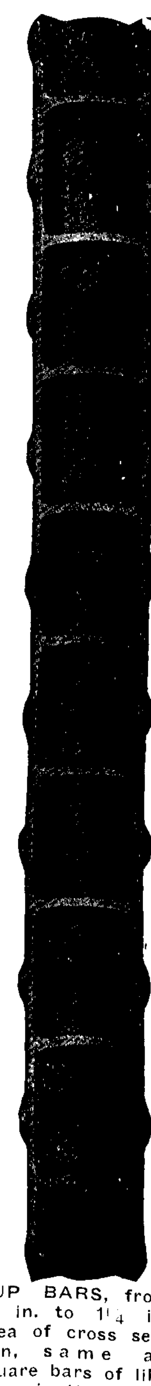
M MATERIALS

Kellert Building, Montreal—Architects, Hutchison, Wood & Miller.
Blumenthal Building, Montreal—Architects, Hutchison, Wood & Miller.
Jacobs Building, Montreal—Architects, Mitchell & Creighton.
Rosenthal Building, Ottawa—Architects, Weeks & Keefer.
Jacobs Building, Cobalt—Architects, Mitchell & Creighton.
Ashbury College—Architects, Weeks & Keefer.
Davis Tannery, Kingston—Architect, O. E. Tench.
Mill and Storage Tanks, Western Canada Flour Mills—Architects and Contractors, Geo. H. Archibald & Co., Winnipeg.
Leeson Dickie and Gross Building, Vancouver.
Pemberton Block, Vancouver—Architects and Builders, Geo. C. Mesher & Co.
Times Building, Vancouver—Architect, W. F. Griffith.
George Jay School, Vancouver—Architect, Thomas Hooper.
Sayward Building, Vancouver—Architect, W. F. Griffith.

erial to meet every requirement of
Specify Kahn Truss Bars, Cup
Con Chemical Products.



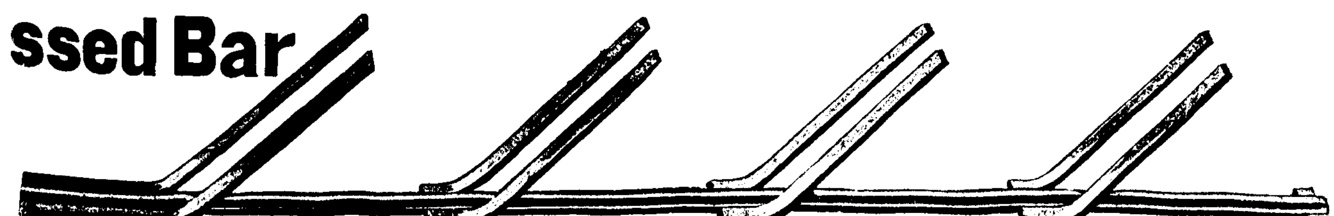
Construction view of Mason & Risch Piano Warehouse, Yonge St., Toronto. Messrs. Bond and Smith, Architects. Lower view shows Pemberton Block, Vancouver. Geo. C. Mesher and Co., Architects.



CUP BARS, from $\frac{3}{8}$ in. to $1\frac{1}{4}$ in. area of cross section, same as square bars of like denomination, sold on immediate delivery.

COMPANY OF CANADA, Limited

ssed Bar



Branch Offices:
23 Jordan St., Toronto.
Merchants Bank Building, Montreal.

leaf in factory construction

THE CONCRETE AGE

Considered from every viewpoint concrete provides the strongest, safest, most durable, and most economical material for factory construction.

Reinforced concrete has provided for the Manufacturer an entirely new building material. It has turned over a new leaf in the progress of business architecture. Indestructible, economical and fireproof, it offers features of advantage over: (1) *Wood frame construction,* (2) *Mill construction,* (3) *Steel construction.*

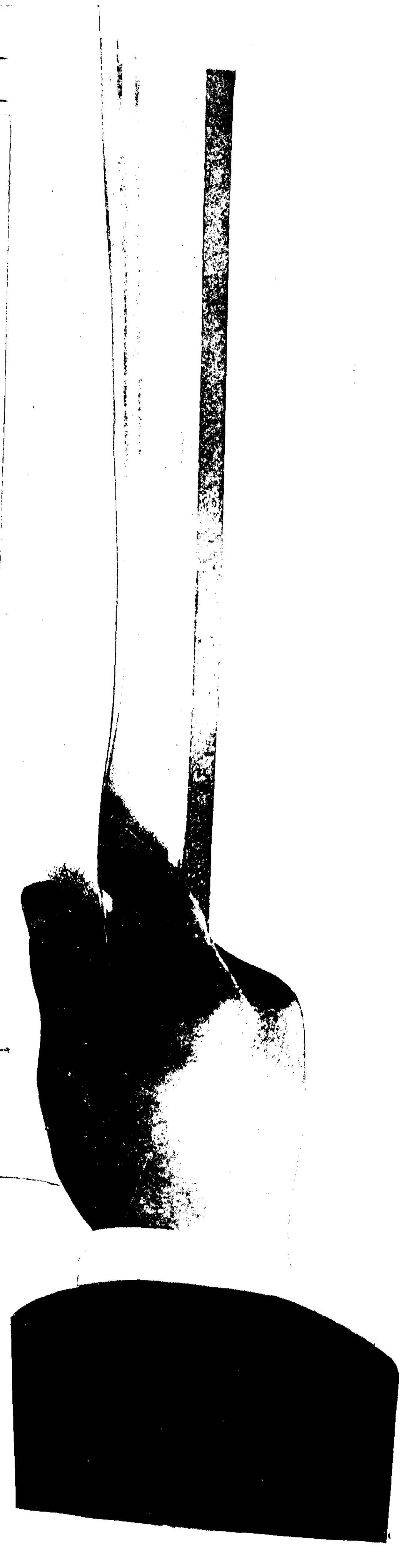
Since the advent of concrete, **wood frame construction** has gone out of date, principally because of its lack of durability and its fire risk. Board walls, narrow floor joists, wood floors and roofs, not only do not protect against fire, but in themselves afford fuel, even when the contents of a factory are not combustible.

Reinforced concrete, besides being as cheap, is superior to mill construction. Reinforced concrete is cheaper than steel construction, and, for factory buildings and warehouses, is superior in every point of comparison. Cheaper because it is lower in cost. It is vibration proof, fire proof, vermin proof, requires no repairs or renewals, and reduces insurance rates.

A special feature of reinforced concrete construction is the possibility of building practically the entire wall of glass, so as to afford a maximum amount of light, at the same time it is so rigid that even with the heaviest high speed machinery, the vibration is absolutely imperceptible.

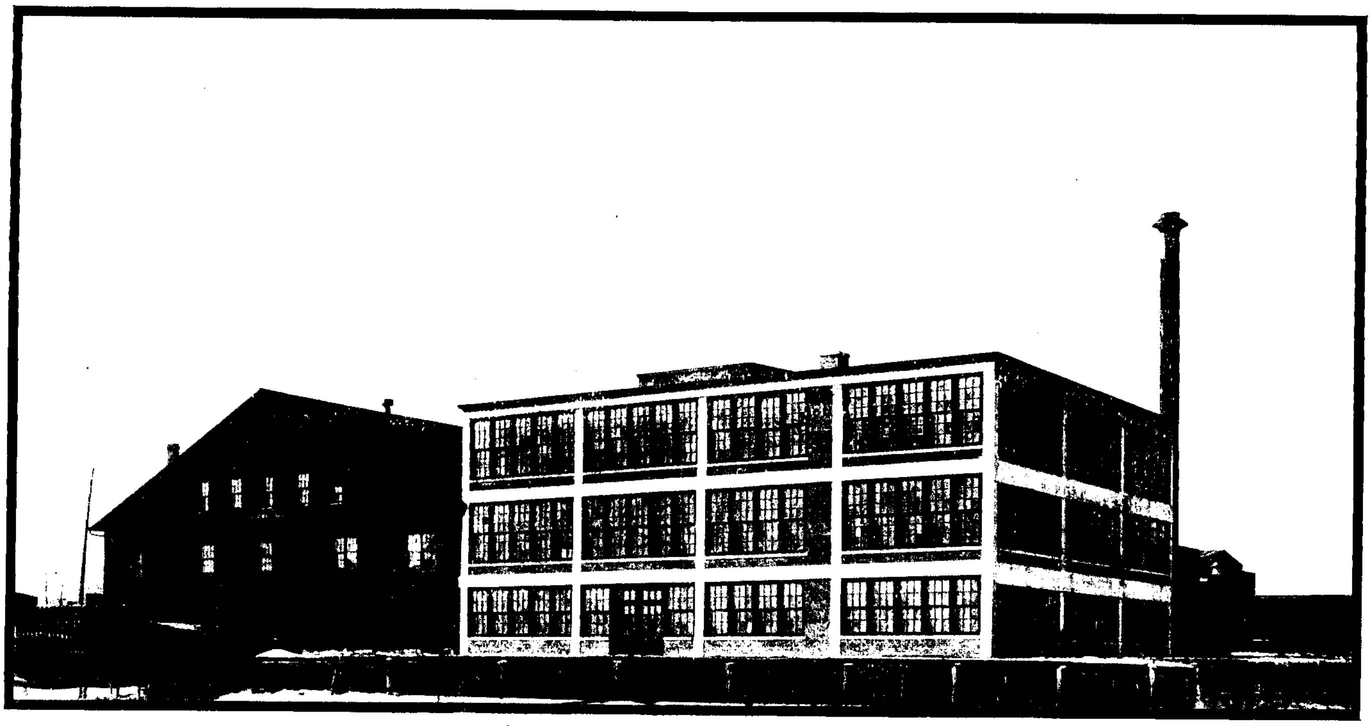
The plastic nature of reinforced concrete permits of provision being made for pulley and shafting brackets and other permanent factory devices.

It is absolutely essential in the construction of reinforced concrete buildings, that the cement used be pure, uniform and of even strength. In every test to which **Canada Cement** has been subjected, it was found to give perfect satisfaction. The "Canadian Standard" associated with **Canada Cement** is not a meaningless phrase intended for effect. It represents a most vital and desirable quality. The standard which Canadian Architects and Engineers exact for building materials is notably high. We realize this, and in adopting this phrase as our trade-mark, we conscientiously accept all the conditions and obligations which its meaning implies. **Canada Cement** is always uniform in color, fineness and strength. Always **full weight,** 350 lbs. (gross). We promise deliveries when and wherever you want them sharply on the specified time. You will find our prices reasonable. May we not quote you on your next undertaking?



COMPANY, Limited

CANADA



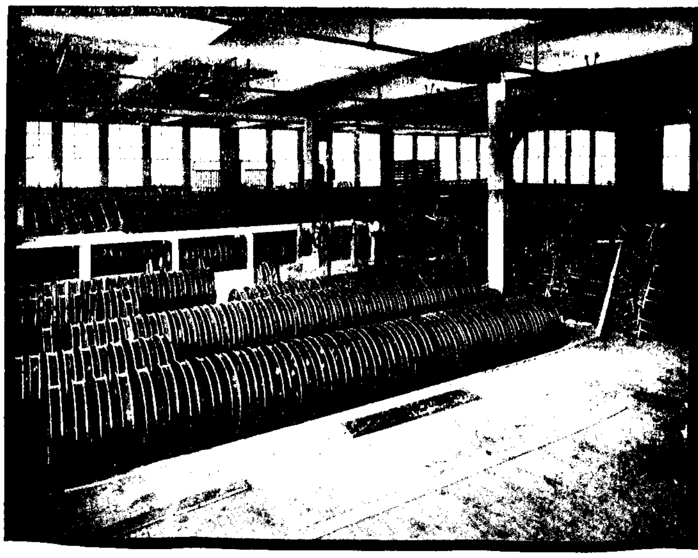
The Reinforced Concrete Factory Erected for the Ford Motor Co. of Canada, 72 feet by 88 feet. Albert Kahn, of Detroit, Architect.

THE accompanying illustrations represent a part of our 1910 work. The large variation of the types of construction employed in these various buildings is a fair example of our ability for executing contracts of every and any type. The contract shown on the first page represents the particular class of work of which we make a specialty. The building was erected for the Ford Motor Co. of Canada, Ltd.; size of building 72 ft. by 88 ft. The architect was Albert Kahn, of Detroit. All floors were designed for a live load of 100 pounds per square foot. It might be said that the foundation soil at this point was very poor, and it was necessary to drive piles under the foundations of the whole building (250-30 foot piles were necessary). From the time that the old buildings were removed and the piles driven, the structure was completed in 10 weeks. In order that the concrete work would become sufficiently dry so that the wood floors could be laid without delay, the wooden sleepers and concrete-fill between them were put on as soon as the concrete took its initial set. This is only one of the features of our engineering contracting organization that warrants us to carry out concrete work in which extraordinary conditions are required in the specifications of the architect.

Our facilities permit us to successfully carry out the construction of buildings in any part of Canada.

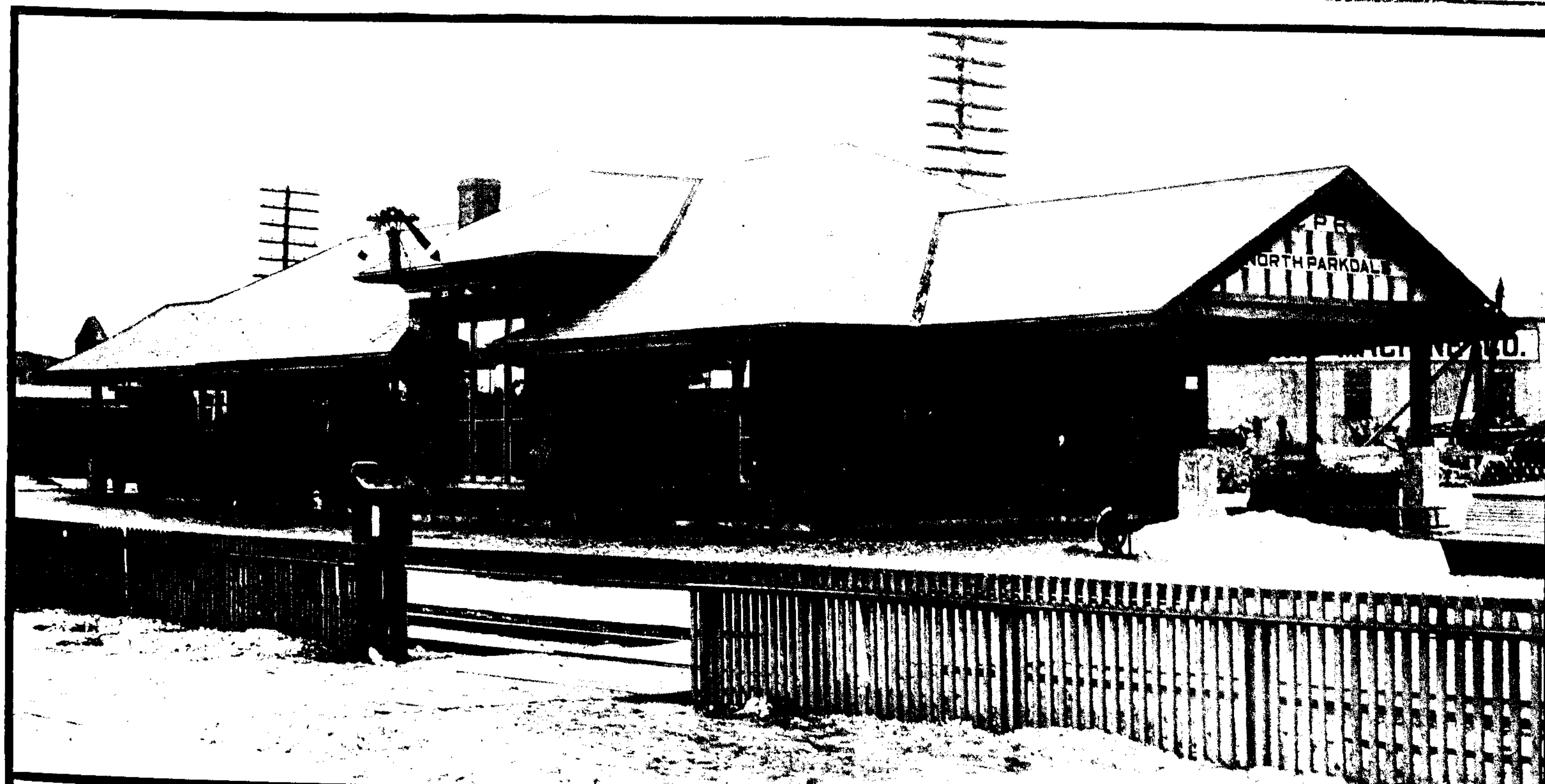
WELLS & GRAY, Limited

316 Confederation Life Building, TORONTO

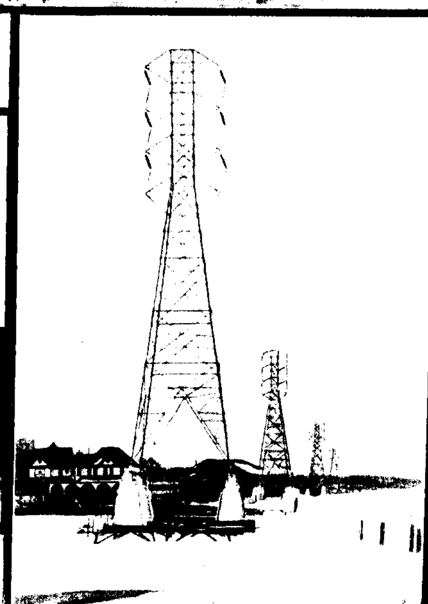


View Showing Paint Shop and Store Room on the Top Floor. This View Further Conveys the Excellent Possibilities in Providing Ample Light in the Structure of this Particular Type.

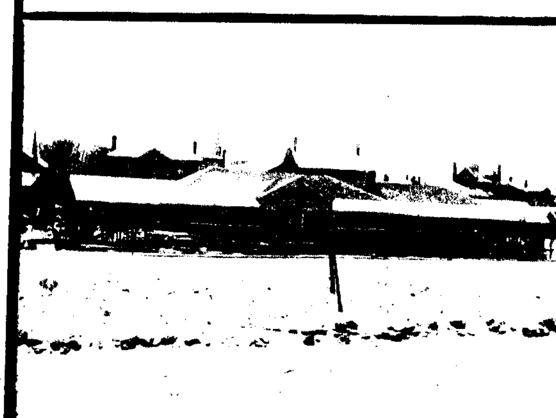
Machine Shop on the Second Floor of the Building Shown on this Page. This View Gives a Fair Idea of the Extraordinary Load on this Floor as Well as Conveying a Fair Conception of the Excellence of the Lighting Arrangement in this Type of Building.



C.P.R. Station, North Parkdale, the General Contract for which was Carried out by us. Lower View Shows Police Station in Hamilton, We Constructed the Concrete Floors and Cells.

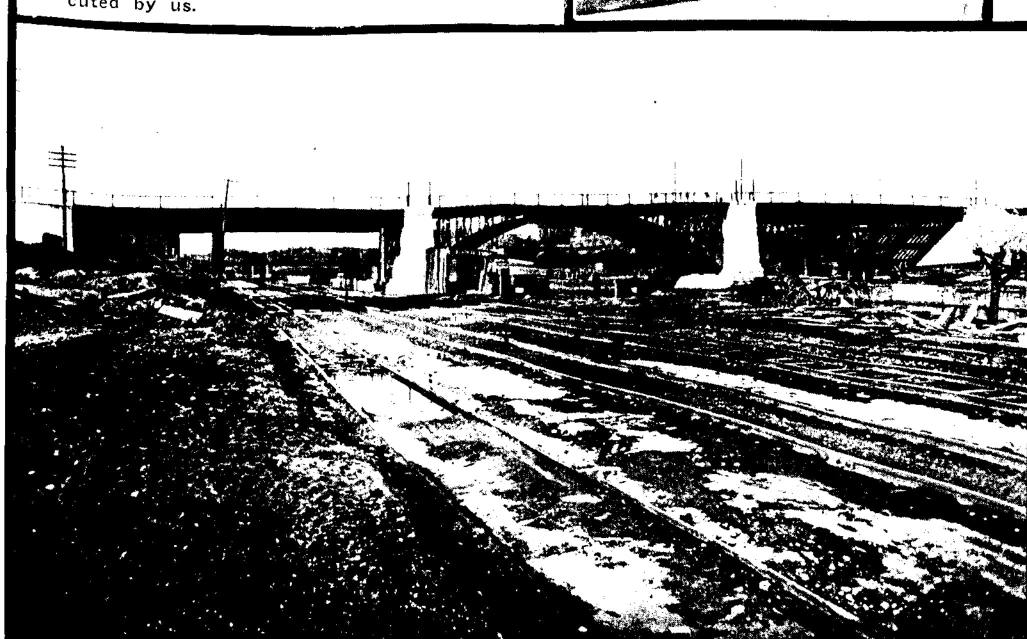


Hydro-Electric Towers on the lake front, Toronto, the Concrete Piers of Which Were Built by Us. (Below) C.P.R. Station at Guelph, Another of our Contracts.



The Illustration Below is a General View of the Wilton Avenue Bridge, the concrete abuttments, piers, and floors for which were executed by us.

The illustration below gives a view of one of the river front concrete piers of the Wilton Avenue Bridge, Toronto.



Sherardized Herringbone Lath

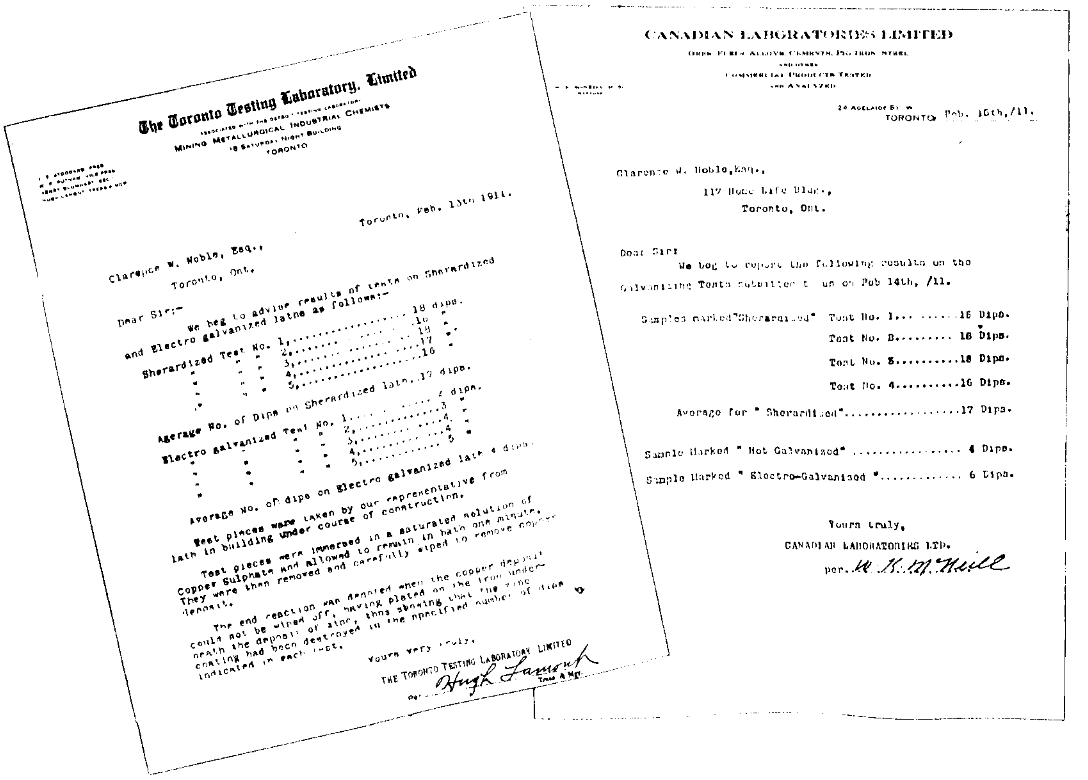
is now on the market. Just look at these galvanizing tests. They are by Prof. C. F. Burgess, of the chair of Metallurgy, University of Wisconsin. He dissolved equal quantities of various coatings in diluted sulphuric acid. Here are the times they took to dissolve :

THE LINES TELL THE STORY

Sherardizing coating - -	**304 minutes**	———————————————
C. P. Zinc - - -	**114 minutes**	———————
Electro galvanized coating -	**50 minutes**	———
Hot process dross, C. C. & G. Mfg. Co.	**79 minutes**	————
Hot process bath, C. C. & G. Mfg. Co.	**20 minutes**	—
Hot process coating from B— hardware	**21 minutes**	—

Our right to the Sherardizing process for metal lath is exclusive. If you want the best protection and the best lath — HERRINGBONE OF COURSE

THE TESTING OF EXPERTS



The Toronto Testing Laboratory, Limited
MINING METALLURGICAL INDUSTRIAL CHEMISTS
18 SATURDAY NIGHT BUILDING
TORONTO

Toronto, Feb. 13th 1911.

Clarence W. Noble, Esq.,
Toronto, Ont.

Dear Sir:—
We beg to advise results of tests on Sherardized and Electro galvanized laths as follows:—

Sherardized Test No. 1.................. 18 dips.
" " " 2.................. 16 "
" " " 3.................. 18 "
" " " 4.................. 17 "
" " " 5.................. 16 "

Average No. of Dips on Sherardized lath..17 dips.

Electro galvanized Test No. 1.............. 4 dips.
" " " " 2.............. 3 "
" " " " 3.............. 4 "
" " " " 4.............. 4 "
" " " " 5.............. 5 "

Average No. of dips on Electro galvanized lath 4 dips.

Test pieces were taken by our representative from lath in building under course of construction.

Test pieces were immersed in a saturated solution of Copper Sulphate and allowed to remain in bath one minute. They were then removed and carefully wiped to remove copper deposit.

The end reaction was denoted when the copper deposit could not be wiped off, having plated on the iron underneath the deposit of zinc, thus showing that the zinc coating had been destroyed in the specified number of dips indicated in each test.

Yours very truly,
THE TORONTO TESTING LABORATORY LIMITED
per Hugh Lamont
Treas. & Mgr.

CANADIAN LABORATORIES LIMITED
ORES FUELS ALLOYS CEMENTS PIG IRON STEEL AND OTHER COMMERCIAL PRODUCTS TESTED AND ANALYZED

24 ADELAIDE ST. W.
TORONTO Feb. 16th,/11.

Clarence W. Noble, Esq.,
117 Home Life Bldg.,
Toronto, Ont.

Dear Sir:
We beg to report the following results on the Galvanizing Tests submitted to us on Feb 14th, /11.

Samples marked "Sherardized" Test No. 1............16 Dips.
Test No. 2.......... 18 Dips.
Test No. 3..........18 Dips.
Test No. 4..........16 Dips.

Average for " Sherardized"...................17 Dips.

Sample Marked " Hot Galvanized" .... 4 Dips.
Sample Marked " Electro-Galvanized "............ 6 Dips.

Yours truly,
CANADIAN LABORATORIES LTD.
per. W. K. McNeill

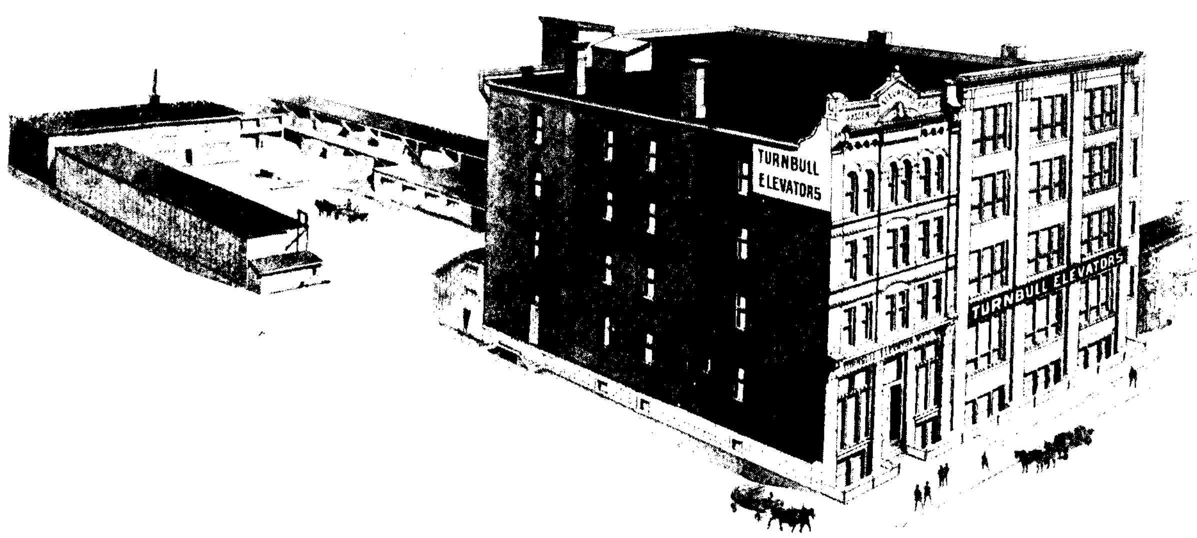
Emphasizes the Overwhelming Superiority of Herringbone Sherardized Lath

Clarence W. Noble, - - General Sales Agent

117 Home Life Building, Toronto

The Metal Shingle and Siding Co., Manufacturers

Where Turnbull Elevators Are Made



Manufacturers of

Electric Passenger Elevators
Electric Freight Elevators
Hydraulic Passenger Elevators
Hydraulic Freight Elevators
Hand Power Elevators
Contractor's Hoists

The Turnbull Elevator Mfg. Co.

TORONTO

MONTREAL

WINNIPEG

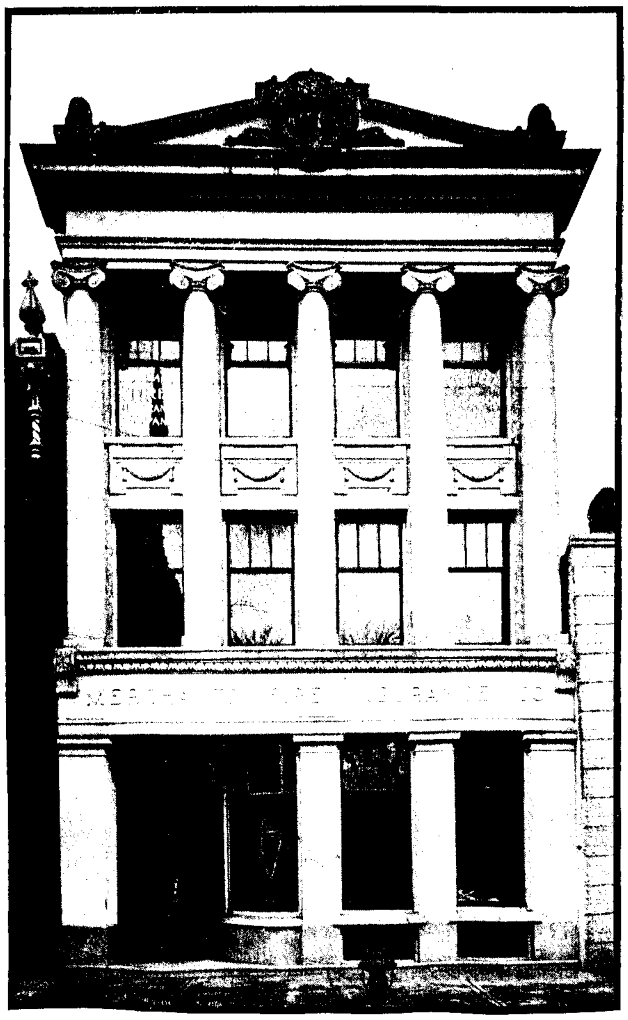
ROMAN

Trade Mark

The Stone of Quality

Proposed Compartment Mausoleum for Toronto. Green and Wicks, Architects.

These Mausoleums are to be of reinforced concrete construction, finished on the exterior with **ROMAN STONE.** **ROMAN STONE** has been selected because of its superiority by withstanding the effects of the elements for years. It also adds tone and dignity combined with structural character, which were the necessary requirements.



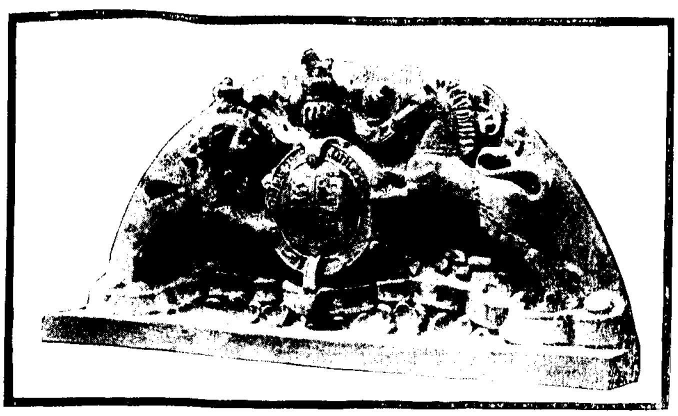
Merchants Fire Insurance Co. Beaumont Jarvis, Architect, Toronto.

ROMAN STONE CO.

LIMITED

HEAD OFFICE 504-5, TEMPLE BUILDING

TORONTO **WESTON, ONT.**



MOORE'S CEMENT PAINTS were used in the Pennsylvania Terminal Depot, New York, the Largest Railway Terminus in the World. Messrs. Carrere & Hastings, Architects.

A "POINTER"

It is important to every arch
products here illustrated
cluded in the new c
of manufactur
a determ
best

Fenestra Sash

Recognized as the only complete answer to the question: How best to obtain maximum light for an industrial structure. Looked upon, moreover, as almost a necessity in cases where fireproof construction is desired. Most architects and engineers take Fenestra Sash into consideration when planning their buildings. Do you?

"Steelcrete" Lath

The merits of this new steel mesh lath are such as to appeal strongly to all interested in building trades. To specify this lath is to insure freedom from any possibility of cracks, stains or corrosion. An allied product of this, and one equally worthy of consideration, is our "Steelcrete" Plasterers' Corner Bead.

"Steelcrete" Metal Reinforcement

To obtain the proper area of steel in the proper place and to insure a slab reinforced throughout, is the aim of the architect in handling important concrete work where reinforcement is needed. "Steelcrete" exactly fills this requirement, producing a mechanical bond, unsurpassed by any other system, whether it be mesh fabric or rods.

Klutch Bars

Both tension stresses and sheer stresses are fully taken care of by the use of Klutch Bars. Any architect who may not be familiar with the peculiar advantages of this bar, should write us for our literature that explains the ingenious cup formation of its surface. Not to know Klutch Bars is to neglect an important aid toward satisfactory construction.

Toronto Show Rooms
80 Adelaide St. E.
96 King St. W.

Montreal Show Rooms
and Sales Office
138 Craig St. W.

STEEL AND RADIATION, LIMITED

FOR THE ARCHITECT—

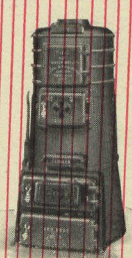
itect and engineer in Canada to know and appreciate the fact, that the and described are now manufactured by the united interests in- oncern, known as Steel and Radiation, Limited. Modern methods e; reduction in expenses, both in making and selling---combined with ination to make the name, Steel and Radiation, stand for all that is in the various lines upon which our business touches. These are features that should make a strong appeal for every one of these products, to every architect and every engineer throughout this broad Dominion.

King Boilers

Our new line "King Boilers" is now on the market. Designed by experts and manufactured under ideal conditions in our own fine plant, the King Boiler possesses that high degree of quality that the profession and trade have come to expect from the manufacturers of the King Radiator. There are several exclusive features in connection with this new boiler—but the principal feature is the care which we exercise in its manufacture to remove all possibility of cause for complaint.

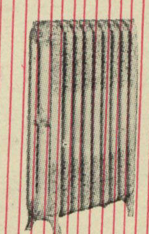
King Radiators

The esteem in which the King Radiator is held in the architectural and engineering profession is evidenced by the proportion in which the King is specified on large and important jobs, as compared with other radiator lines. The success of the King is too deep-seated and too marked to have resulted from chance or from any cause other than sheer merit of the highest order.



Steamfitters' Specialties

We handle a full range of Steamfitters' Supplies. Special attention is directed to our line of valves, which we absolutely guarantee.

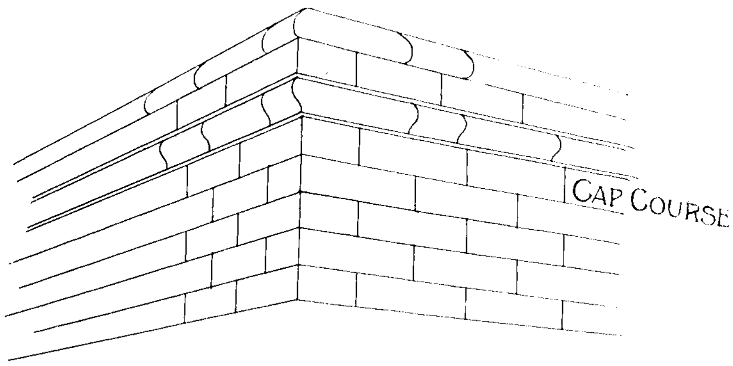


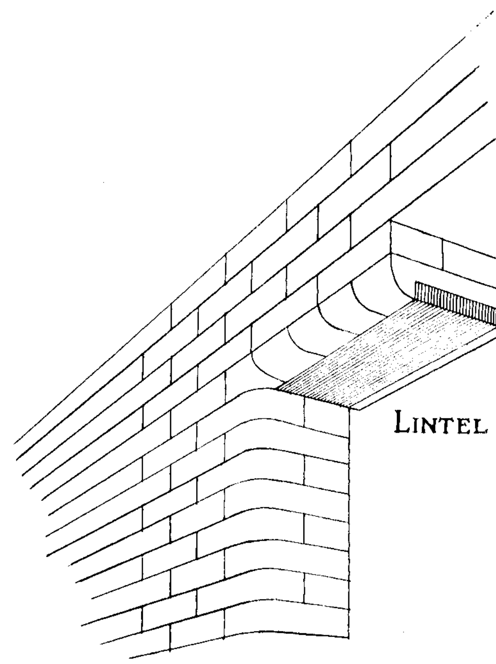
Agencies in all leading cities in Canada

HEAD OFFICE, FRASER AVE., TORONTO

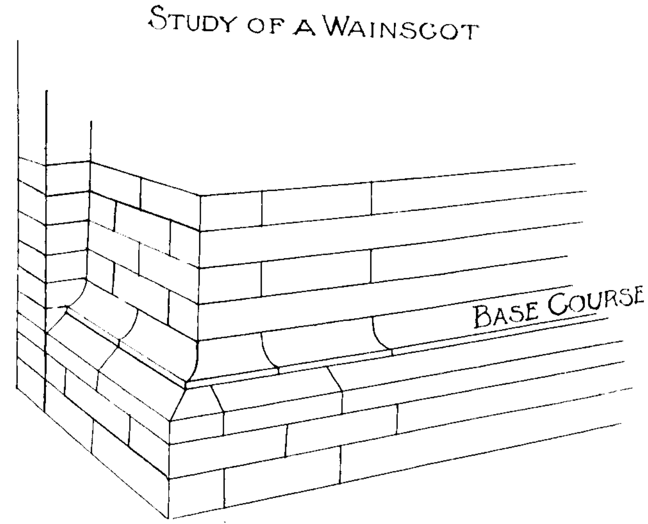
THE USES OF ENAMELLED BRICKS in modern buildings of importance have become manifold, and even in smaller and less pretentious structures, where the architect is particular about specifying the most suitable materials, they have found many uses.—The many outstanding superior features of DON VALLEY ENAMELLED BRICKS have

made them highly popular with the Architect and the Building Public.—In them is combined Beauty, Utility and the advantage of being absolutely Sanitary.—With our large variety of shades and colors (as illustrated in the accompanying plates) the architect may successfully carry out any desired color effect or decorative scheme.—The smooth, impervious, glazed surface of ENAMELLED BRICKS not only renders them perfectly sanitary but permits of their being washed and kept free from discoloration, from dust or smoke.—ENAMELLED BRICKS will save their first cost many times in the small labor of cleaning and the elimination of the necessity of resurfacing or painting.

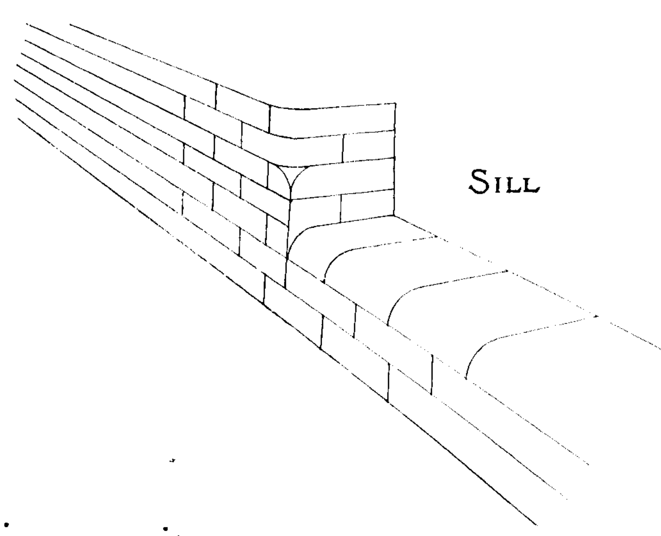




STUDY OF A WAINSCOT



STUDY OF WINDOW OPENINGS



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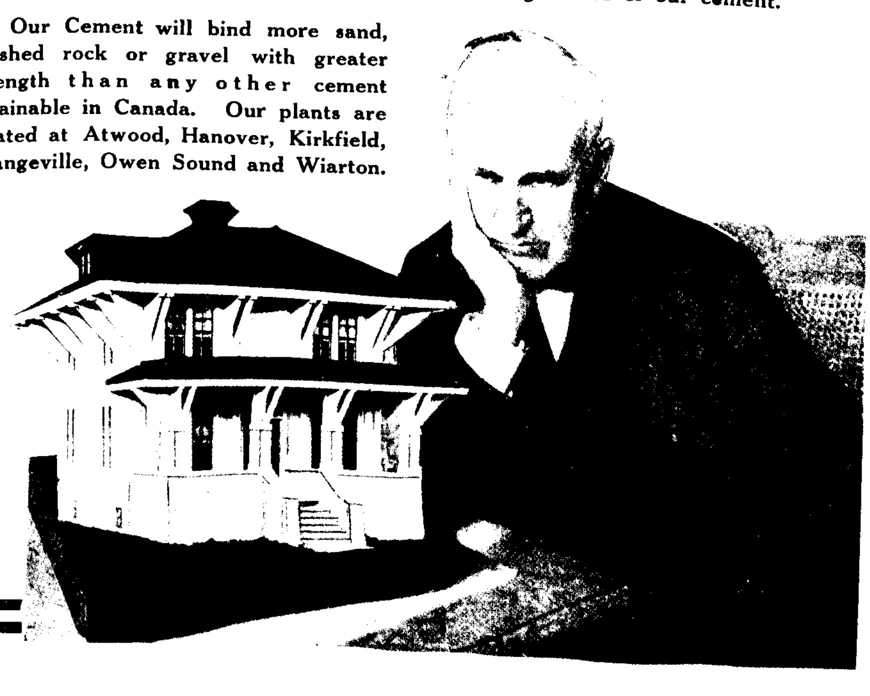
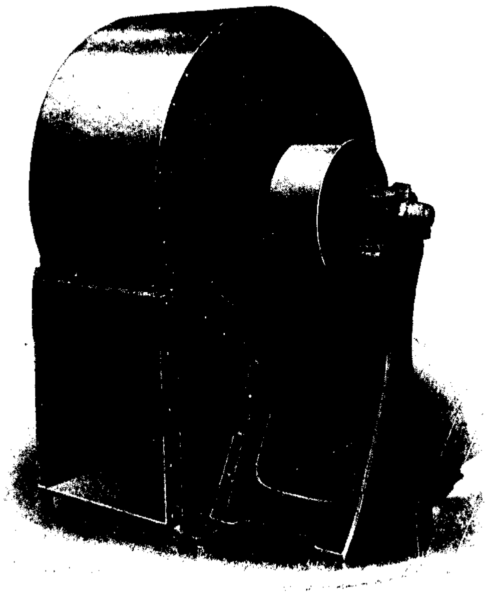


THE

ÆOLOS FAN

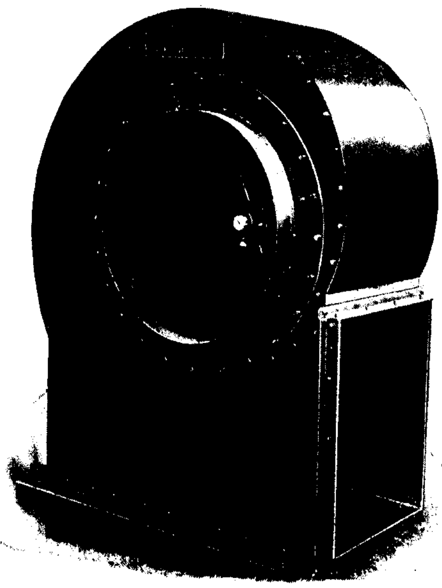
(Pronounced E-O-LOS)



ÆOLOS FAN, pulley side, bottom discharge.

The King of The Winds

Canadian Patent No. 122822



ÆOLOS FAN, inlet side, bottom discharge.

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THERE IS NO TYPE OR CHARACTER of building construction to-day that is attracting the attention of the Architectural and Engineering Professions, as well as the lay public, more than Concrete. Business Buildings, Factories and Warehouses are constructed of this material, which has been selected because of its fireproof and time-proof properties. For residences, both expensive and low priced, the usual method of concrete construction has very often been found impracticable because of the high cost of forms, when the Architect undertakes to give his structure any degree of architectural expression. The material is admirable, its possibilities are great, but the usual method of construction does not allow for elasticity and individuality of architectural expression.

The realization of these facts has prompted the invention of a System of Molds that serve to overcome the one and only—yet important—objection to the use of Concrete in dwelling-house construction.

We have secured from the American Building Corporation the exclusive rights for Canada for this

Design by Architects Ross and MacFarlane, of Montreal, for a Row of Monolithic Concrete Houses to be Built in Montreal During t Gives a Fair Conception of the Architectural Possibilities in Concrete Dwelling House Construction as Carried out by Our System of Mold

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perfected System of Concrete Molds with which houses of varied designs can be constructed of solid Concrete at a lower cost than possible with any other material.

With the use of these Molds a house can be completed in the time ordinarily taken to erect the form work usually used in the construction of a monolithic concrete dwelling. The use of these Molds eliminates the present heavy cost of the erection of concrete form work, which represents a very large percentage of the cost of the building and which, because of their necessarily rough and unfinished condition, do not give the desired finish and texture to the completed structure. The Molds, it may be noted, are inexpensive, easily operated and exceedingly durable. A remarkable feature of this system of portable concrete form work is that it is sufficiently elastic to admit of individuality in Architectural Design. The same set of Molds will serve to carry out any and every design in dwelling-house construction.

Coming Season. This Design

In the two illustrations shown herewith one shows a Concrete Residence constructed through the use of our System of Molds. The house is one solid Concrete Monolith—walls, partitions, stairs, balustrades, mantels, floors and roof are all of Concrete. It is absolutely fireproof, indestructible and highly sanitary. The other illustrates in a carefully worked out design the broad architectural possibilities of our System in residence construction. This design is for a row of houses in Montreal which will be erected after our System during the coming season.

The possibilities of this System of Concrete Construction for residences is unlimited. We have the rights for Canada. We are subletting the right to use this System of Molds in different districts on a royalty basis.

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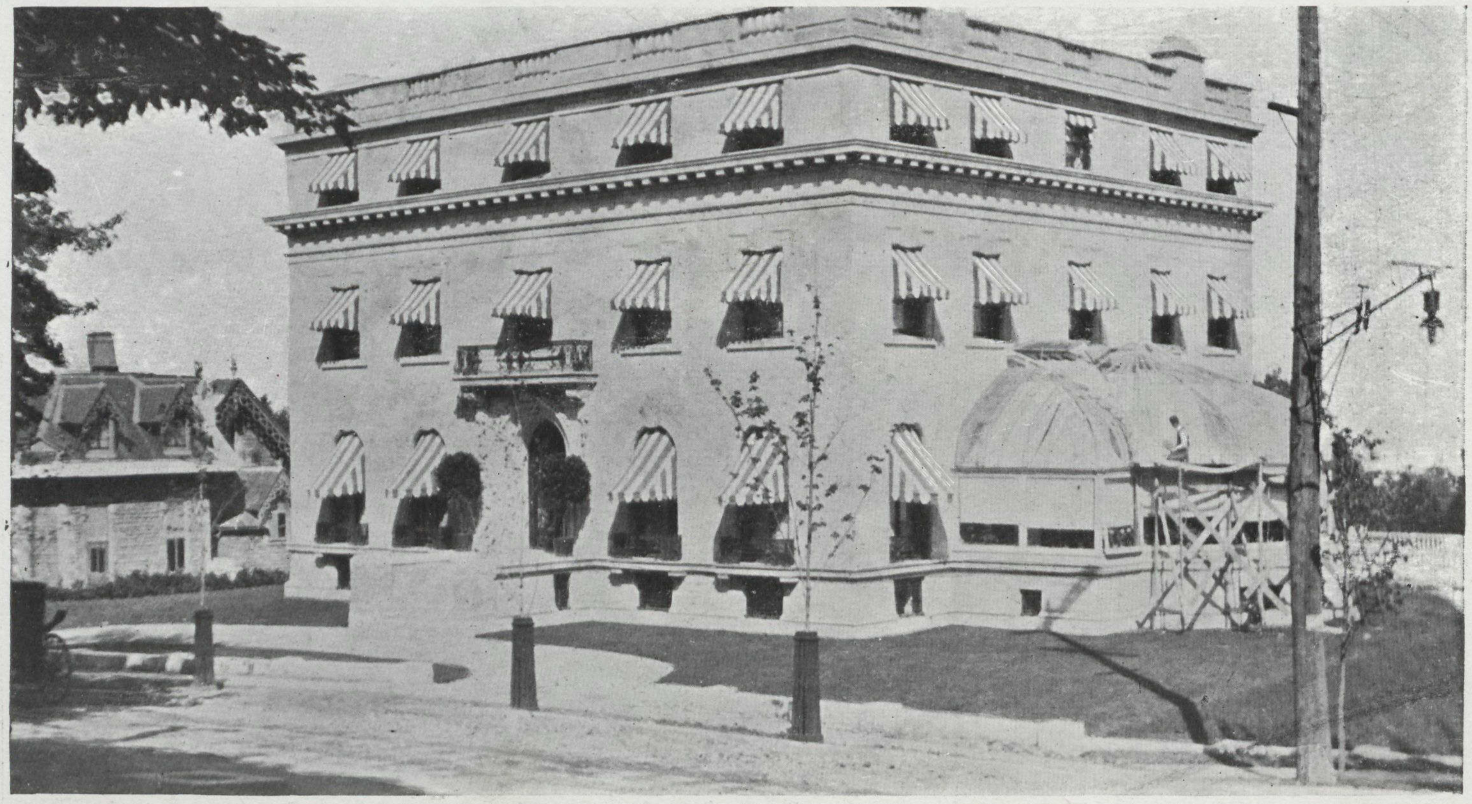

Residence of M. B. Davis, Montreal. Equipped with "Standard Ideal Ware." Robert Findlay, Architect. W. J. McGuire & Co., Plumbers.

Jacobs Building, Montreal. Equipped with "Standard Ideal Ware." Mitchell & Creighton, Architect. W. J. McGuire, Plumber.

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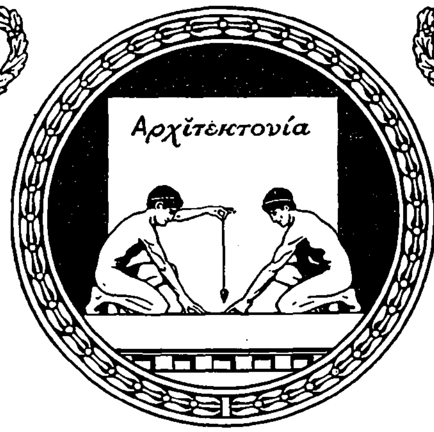

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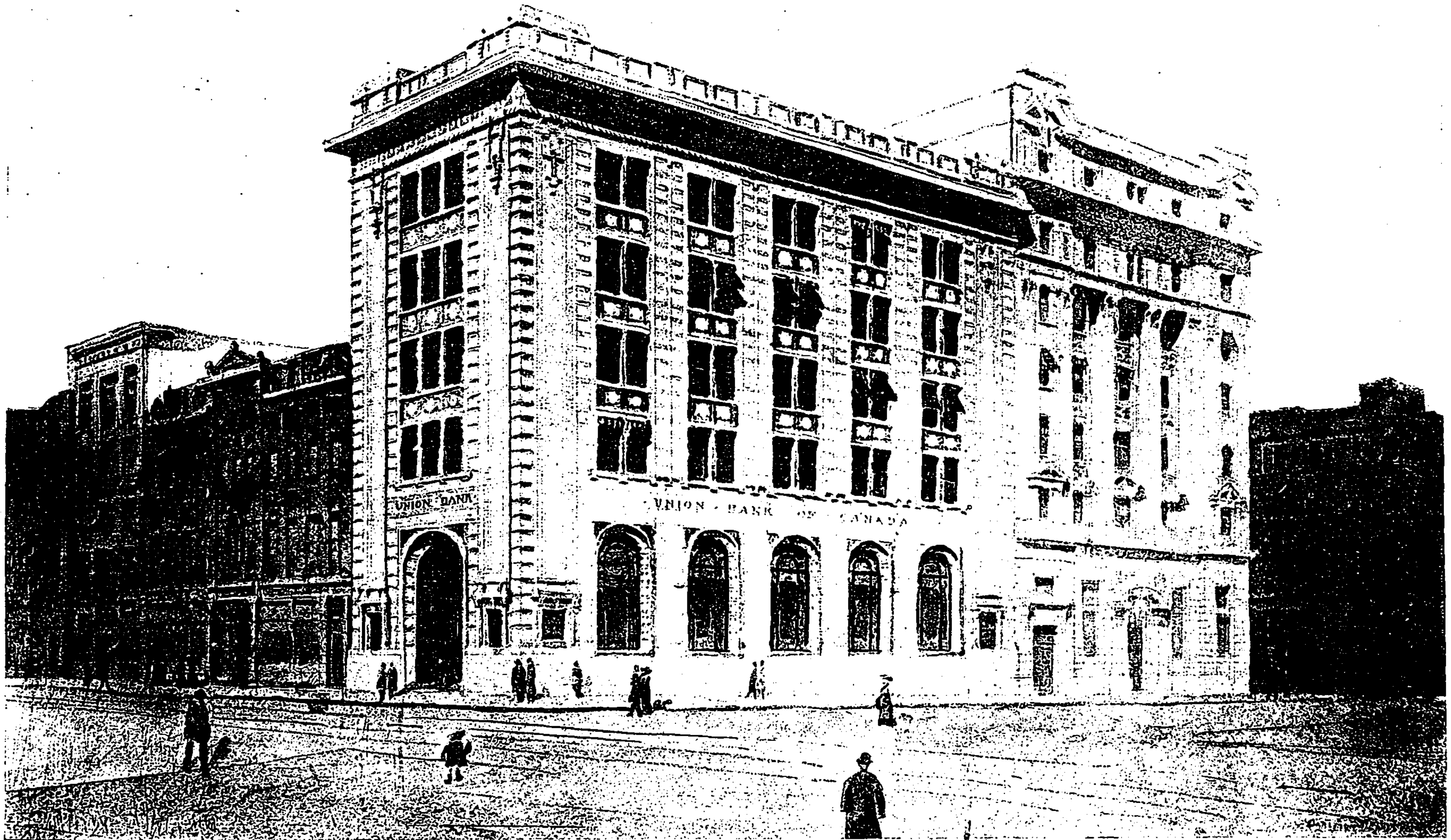


Perspective of Union Bank Building under Course of Erection on King St., Toronto.—Darling & Pearson, Architects.

¶ *Building Returns for January—Twenty-two cities show average gain of 37 per cent.—Vancouver's phenomenal increase the feature of the month.*

ALTHOUGH THE MONTH of January was sixes as far as individual gains and losses were concerned, the aggregate total ($3,100,842) for building operations carried out in the twenty-two cities submitting comparative figures to CONSTRUCTION was 37 per cent. in excess of that noted in the corresponding period of the previous year. The losses, while greater in number than any recorded in the past twenty-four months, indicate but little when the comparative amounts in most cases are taken into consideration, other than the usual period of mid-winter inactivity. Taking everything into account, the situation in general remains but little changed. The gains noted are not only of substantial proportions, but in a number of instances are the largest by far ever made in their respective localities.

Especially is this true as regards Vancouver, whose total investment of $1,412,442, representing a gain of 123 per cent., is not only the highest amount recorded for the month, but is approximately one million dollars in excess of the total of any other city included in the list. The West in fact outstepped the central and eastern portions of the Dominion in the matter of gains. While less assertive than her sister city, Victoria, nevertheless in an expenditure of $151,445, tacked on an increase of 17 per cent.; Calgary undertook new buildings aggregating in value $296,040, as against $106,500 for the same month in the previous year; and Winnipeg, where operations amounted to $199,700, made an advance of 6 per cent. Other gains noted are: Brandon (363 per cent.) and Moose Jaw (14 per cent.), although the corresponding amounts in either case are extremely small. Edmonton and Lethbridge, however, have respective decreases of 12 and 49 per cent, while Regina and Saskatoon are in the arrear to the extent of 62 and 21 per cent. in order named.

Percentage decreases, as previously stated, except in one or two individual cases, amount to little as far as this particular month is concerned. This is quite evident in reviewing the figures of Ontario, where most of the losses were sustained. Toronto's decline of 32 per cent. is by far the most serious set-back experienced throughout the Dominion; yet, despite this reversal, permits were issued amounting to $458,580, which is a very splendid showing, especially in view of the fact that several important projects have been a trifle slow in materializing. Outside of this, it is hardly necessary to summarize the situation in this Province, other than to add that both Hamilton and Windsor are relatively 106 and 192 per cent. ahead of their former figures.

Further east, Montreal, which has the third largest amount noted, records a total of $365,840, or a gain of 129 per cent. Evidently the metropolis intends to duplicate its remarkable growth of the past year. Sydney also has a slight increase, although Halifax is considerable in the arrear of her corresponding amount.

According to reports to hand, every section of the country has a large amount of important work in prospect, much of which will materialize at a very early date. Another month should see operations in full swing and it would be well for contractors and supply firms to make preparation for what will most likely prove the most busy and profitable season that has yet come their way.

	Permits for January, 1911.	Permits for January, 1910.	Inc. Per Cent.	Dec. Per Cent.
Berlin, Ont.	$ 3,850	....	.....	.....
Brandon, Man.	5,450	$ 1,165	363.83	.....
Calgary, Alta.	296,040	106,500	177.97	.....
Edmonton, Alta.	38,405	44,090	.....	12.90
Fort William, Ont.	9,550	36,890	.....	74.12
Halifax, N.S.	8,600	30,650	.....	71.94
Hamilton, Ont.	39,250	19,000	106.58	.....
Lethbridge, Alta.	25,800	51,015	.....	49.43
London, Ont.	7,030	61,810	.....	88.63
Montreal, Que.	365,840	159,510	129.35	.....
Moose Jaw, Sask.	3,500	3 050	14.75	.....
Ottawa, Ont.	29,100	57,650	.....	49.53
Port Arthur, Ont.	1,350	....	.....	.....
Regina, Sask.	9 225	24,585	.....	62.48
Saskatoon, Sask.	12,500	15,900	.....	21.39
St. Thomas, Ont.	1,200	2,800	.....	57.14
Sydney, N.S.	5,750	1.200	379.16	.....
Toronto, Ont.	458,580	682.088	.....	32.77
Vancouver, B.C.	1,412,442	631,311	123.73	.....
Victoria, B.C.	151,455	128,985	17.42	.....
Windsor, Ont.	16.225	5,550	192.34	.....
Winnipeg, Man.	199,700	188,000	6.22	.....
	$3,100,842	$2,251,759	37.48	.....

Proposed Architectural Copyright Act in England—Its possible Influence upon the Canadian-British Copyright Arrangement—Need for similar Act in Canada.

WITH THE PROSPECT of a tacit understanding being arranged between the Canadian and British Governments at an early date providing for the formulation of a common Copyright Act that will apply to both Canada and the British isles, the following comments by THE BUILDER (London) on the new Copyright Act introduced into the British Parliament last session by Mr. Sidney Buxton, the object of which is to give architecture protection comparable to that enjoyed by the sister arts or to be enjoyed by them, should be of considerable interest to the profession in Canada.

It has not as yet been made public just what amendments to our Copyright Act the Hon. Mr. Fisher will introduce, but his published statements made upon his return from his recent visit to England would lead us to believe some radical changes will be proposed by the Government.

As it is, architecture in Canada is practically without protection. Speculative builders, real estate dealers and owners, show absolutely no regard for the rights of the architect as the sole owner of the designs and the plans of which he is the author. Whole rows of houses are built after stolen plans and the author of the plans does not seem to have any recourse. As to whether the proposed Act will become law in England is not as yet, of course, known, nor is it clear, at present, if such a law were enacted in England, just to what extent its provisions might be adopted in the proposed joint copyright agreement between England and Canada.

Our English contemporary outlines the provisions of the Bill, together with the probable effect of its adoption, in the following:

At the present time, as is generally admitted, architecture is most inadequately protected by the copyright laws. Indeed, it may be said to be, for all practical purposes, entirely without protection, for copyright extends merely to the plans and drawings of a building, and not to the edifice itself. Consequently, any original and artistic piece of architecture may now be imitated with impunity by anyone whose fancy it takes or whose purpose it suits.

Unless the context of the new Act otherwise requires, whatever applies therein to an "artistic work" will also apply to an "architectural work of art." The latter is defined as meaning "any building or structure having an artistic character or design, in respect of such character or design, but not in respect of the processes or methods of its construction." This, it will be seen, is at once, and rightly so, extending protection beyond the mere plans and drawings. But it is extremely doubtful whether the word "*structure*" would be held by a court of law to include a small *model* of a building. It is, however, imperative that architectural models shall enjoy protection; yet the Act does not appear to afford protection to models of any kind—unless "model" may be held to be covered by the term "Work of artistic handicraft," upon which it would not be safe to rely.

"*Publication,*" says the Act, "*means the issue of copies to the public, and does not include . . . . the construction of a work of architecture.*" So that, unless the plans or other drawings of a building be issued to the public, a work of architecture will remain for ever an unpublished work—a somewhat curious position in the case of a work of art permanently on view in a public thoroughfare. The Bill vides that "*copyright in an architectural work of art shall not be infringed by making drawings, engravings, or photographs thereof.*" Although it is not so stated—as it ought to be—we may presume that the said photographs, drawings, and engravings may be sold to the public. Were it otherwise, we might have at some future date a situation in which the sale of pictures of Fleet street was prohibited, because of the erection there of a new copyright building! Since, then, elevations and perspective views of a building may be photographed and published by anybody, it will be seen that there is very little left of the original graphic parts of the architectural work of art in which the architect has the sole pictorial copyright—merely the plans of each floor, and such-like. However, until a building be erected in accordance with the plans and drawings made for it, the latter will enjoy complete protection.

The Act states that the first owner of the copyright in any work of art is to be the author thereof, and it is provided that "*Where the work was ordered by some other person and was made for valuable consideration in pursuance of that order, then, in the absence of any agreement in writing to the contrary, the person by whom the work was ordered shall be the first owner of the copyright,* UNLESS THE WORK IS AN ARCHITECTURAL WORK OF ART, *or is an artistic work intended for a public place or building, in which case the author shall be the first owner of the copyright, but shall not be entitled to make, or authorize the making of, reproductions of the work except with the consent of that other person, and that other person shall be entitled to the same remedies in respect of the infringement of the copyright in the work as if he were the owner of the copyright.*"

Architects are here given an advantage over workers in other arts, but in order to prevent friction, which, it is to be feared, is sure to arise occasionally, it will be advisable for them to get, before they commence designing, the written consent of "*that other person*" to authorize the making of reproductions of their work. Where consent is refused, a higher figure should in fairness be paid for designs. Regarding the phrase "*An artistic work intended for a public place or building,*" which occurs in the above question, it is not clear whether the provision as to the ownership of copyright be intended to apply to ANY building or only to a PUBLIC building. Probably the latter is meant—all doubt should be removed—and in that case it is difficult to see why the copyright in a fresco, say, or in a stained glass window, should belong to the author thereof when ordered for a town hall and not when ordered for a private residence.

Careful consideration is required of what remedies are to be provided in the case of an infringement of an architectural work of art. Section 7 says:

"(1) *Where the copyright in any work is infringed by the construction of a building or other structure, the owner of the copyright shall not be entitled to obtain an injunction or interdict to restrain the construction of such other building or structure, or to order its demolition when constructed.* (2) *Such of the other provisions of this Act as confer on the owner of the copyright in any work the same remedies against a person having in his possession for sale or dealing with a pirated copy of the work as if it were his property, or as impose summary penalties, shall not apply in any case to which this section applies.*"

Against these parts quoted is placed the marginal reference "Remedies in the case of architecture." But these are the DENIAL to architects of the remedies to be enjoyed by practitioners of the other arts. Then, what ARE the remedies in the event of an infringement of architectural copyright? It would not do, of course, to stop the erection of an uncompleted building, or to pull down a completed one. As an alternative, however, a penalty might very well be provided to meet the peculiar requirements of architectural work. It might take the form of AD VALOREM damages, calculated on the cost of erecting the building found to be an infringement, or on the value of the copyright building—say, ten per cent. in the case of a deliberate infringement, and five per cent. for an innocent one, in either case an injunction to be granted to restrain the defendant from erecting similar buildings without the consent of the plaintiff.

As the Bill now stands, although architectural copyright is to be extended so as to include the actual buildings when they are of an artistic nature, the remedy architects will have against infringements arising from the erection of similar buildings is buried in obscurity. Apparently they will have none at all!

New Building Code as Proposed by Secretary Fitzpatrick of the International Association of Building Inspectors and Commissioners.

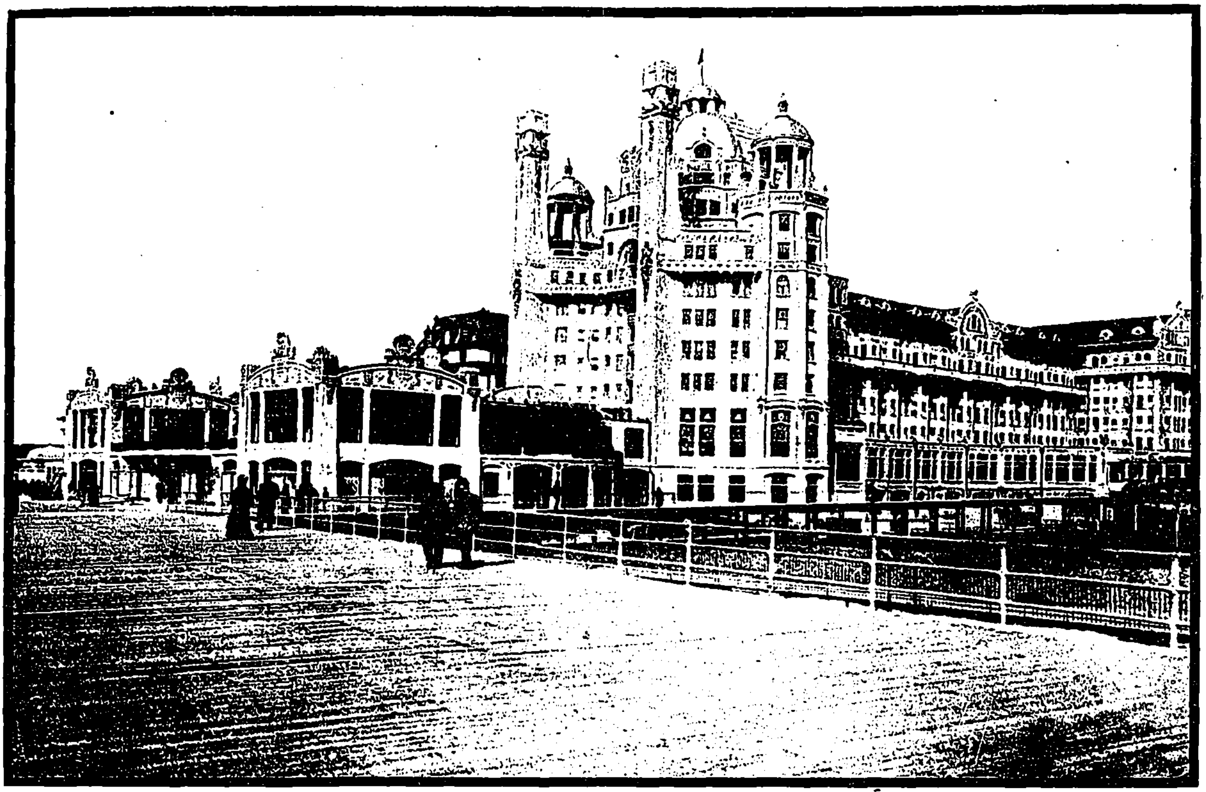
A NEW BOOK dealing with the history of fire, the fire waste, the theory and practice of fire-prevention and fire-proof construction, has just been issued by the American School of Correspondence. It is in cyclopedic form and is written by Architect Fitzpatrick, of Washington, D.C. It is illustrated with hundreds of splendid views of fires and fire's effects and seems to have been gotten up regardless of cost. Though intended primarily as an instruction book for students of building construction, it will be of very great value to every fire department, building department, architect, engineer and builder in the country.

Not the least important feature of the book is the first appearance of the model building code upon which Mr. Fitzpatrick has so long been at work. It is the official code of the Association of Building Commissioners and it is expected that before long it will be the one adopted by most if not all of the larger cities on the American Continent.

Probably no one man has had as much to do with the inception and revision of building codes as has Mr. Fitzpatrick, and this one is the summing up, the putting into one all that experience and skill have devised in the codes that have been written ere this. It defines clearly the functions of a building department and gives it an advisory board. It calls for careful plans for every building by an experienced architect, and makes that architect sign a statement, in securing a permit, that the plans are in accordance with the code and that he is responsible for the building. If an attempt is made to evade the provisions of the code then the department declines to issue permits for other works by that architect. It licenses builders and holds them under bond to build according to the code. It provides for the remission of fees to those who build better than the code exacts for the nature of building planned—an encouragement to build well. It divides the city into "inner fire limits," "outer fire limits" and "boundary limits." Within the inner limits all buildings must be fireproof; all public buildings anywhere have also to be fireproof as also all buildings over 4 stories. In the outer limits all buildings must be fire-retarding in that the outer walls and roofs must be non-combustible. In the suburbs frame buildings may be erected but even there nothing of frame over three stories is allowed, and in those buildings adequate cut-offs and barriers have to be provided. All public and semi-public buildings, hotels, apartments, etc., have to be conspicuously labelled as to the class of construction they are, "fire-proof," "ordinary," or "dangerous," and it is made a misdemeanor to advertise one's building as of a superior class to that it is labelled. The floor loads allowed are also to be conspicuously labelled at each story. The height of buildings is limited to twice the width of the fronting street, with a maximum height of 200 feet. But the maximum height may be taken advantage of anywhere, provided that at a height twice the width of the street the building be recessed back to a line 50 feet from the centre of the street. Towers and domes may, under proper restrictions, be carried up above the 200 feet limit.

AS THIS ISSUE goes to press everything is practically in readiness for the third annual convention and cement show of the Canadian Cement and Concrete Association, to be held at Toronto from March 6th to 11th, inclusive, and which promises to be a huge event in every way. The programme which has just been announced includes addresses and papers by prominent engineers and authorities identified with various branches of the industry both in Canada and the United States. A large number of the papers will be illustrated with lantern slide. The Exhibition, which, as previously stated, is to be held at the St. Lawrence Arena, will be formally opened by the Hon. Geo. P. Graham, Minister of Railways and Canals; and the daily meeting of the convention will take place in the lecture room of the Engineers' Club at 96 King street west.

The Lumsden Building, Corner of Yonge and Adelaide Streets, Toronto. A Ten-Story Office Structure which Strikingly Illustrates the Architectural Use of Concrete Stone in Exterior Wall Construction. It is the Largest Building in the World Entirely Faced with Manufactured Stone. J. A. Mackenzie, Architect.



The Marlborough-Blenheim Hotel, Atlantic City, N.J. The Largest Reinforced Concrete Building in the World. It is 680 Feet Long, 125 Feet Wide, and Nine Stories High to the Main Roof Line. The Tower Seen in the Foreground Rises to a Height of Approximately Fifteen Stories.

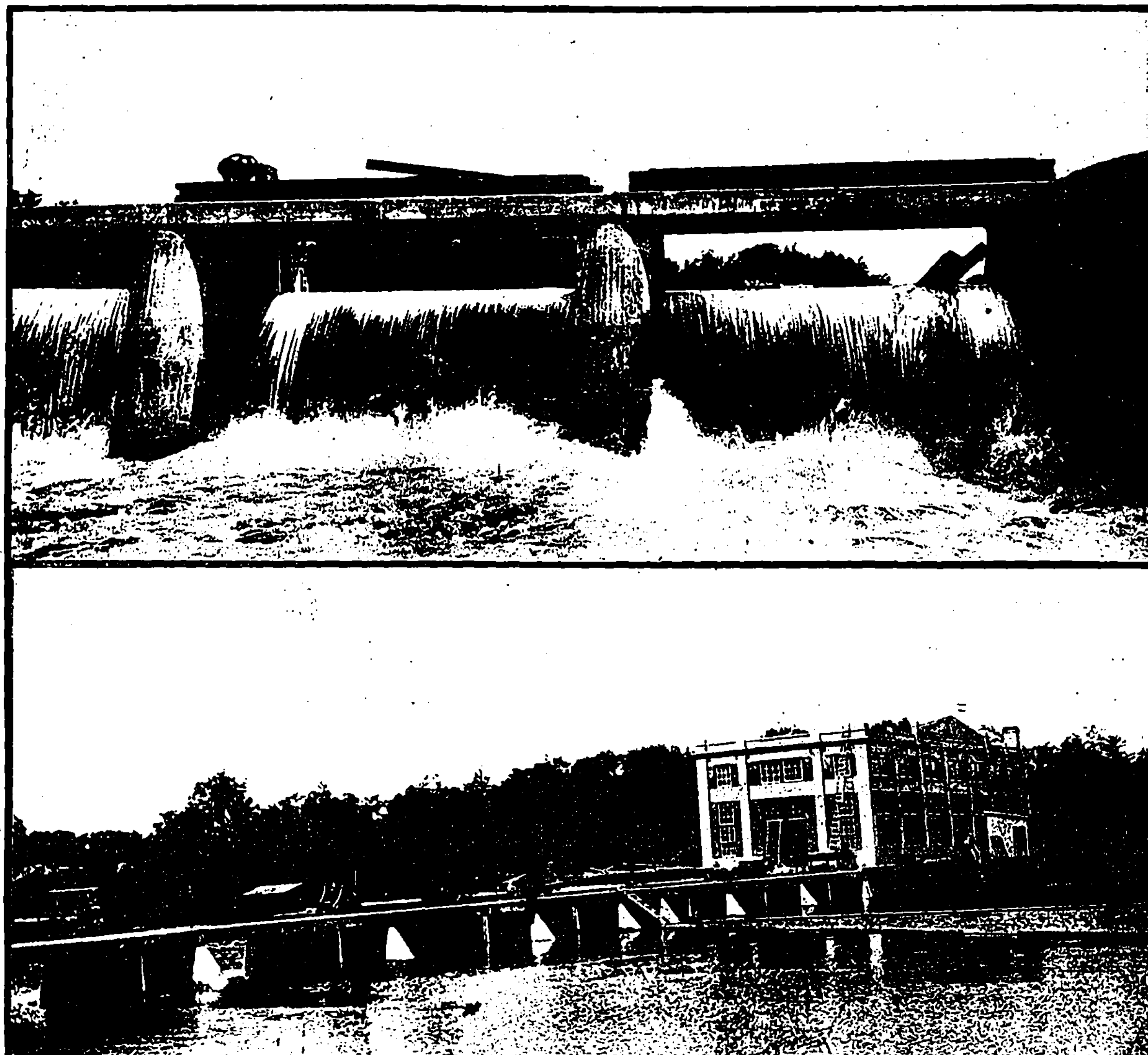
REINFORCED CONCRETE ITS ADVANTAGES AND LIMITATIONS

Specially contributed by Prof. Peter Gillespie, Lecturer on Theory of Construction at Toronto University and President of the Canadian Cement and Concrete Association.

IT IS VERY DOUBTFUL if any industry of modern times has shown a growth comparable with that of Portland cement. Twenty years ago, the aggregate annual production of this material in the United States was half a million barrels; to-day, the estimated yearly output is seventy-five million barrels. In Canada, twenty years ago, the production of Portland cement began in a small mill owned by the Rathbun interests at Marlbank, Ont. To-day, the output in this country is between four and five million barrels, and the industry is just beginning.

Reinforced concrete, by which is meant a combination of concrete and steel in suitable proportions, dates from 1855, when it is said M. Lambot of Paris constructed a small rowboat of cement mortar in which wire netting was imbedded. This is the beginning of what has proved to be the most important engineering development of the present generation. The structures built of it aggregate millions of dollars in value, and include buildings for every possible purpose. The building entirely of reinforced concrete and the reinforced concrete skeleton with walls, partitions and floors of brick or terra cotta, or with a veneer of tile or stone masonry, are types which are now found in almost every American city.

Engineers have not failed to recognize that reinforced concrete has its limitations as well as its advantages. In buildings where ordinarily steel framing might be used, reinforced concrete proves itself an economical material. For residential buildings and structures of one story, its use is generally of doubtful economy. For isolated roof trusses or girders, high above the ground, the cost of erection is generally prohibitive in competition with steel. Frequently, the brick curtain wall, in structures of the factory or warehouse type, where columns, roof and floor system are of concrete, is preferred. There has been a marked tendency of late years toward this



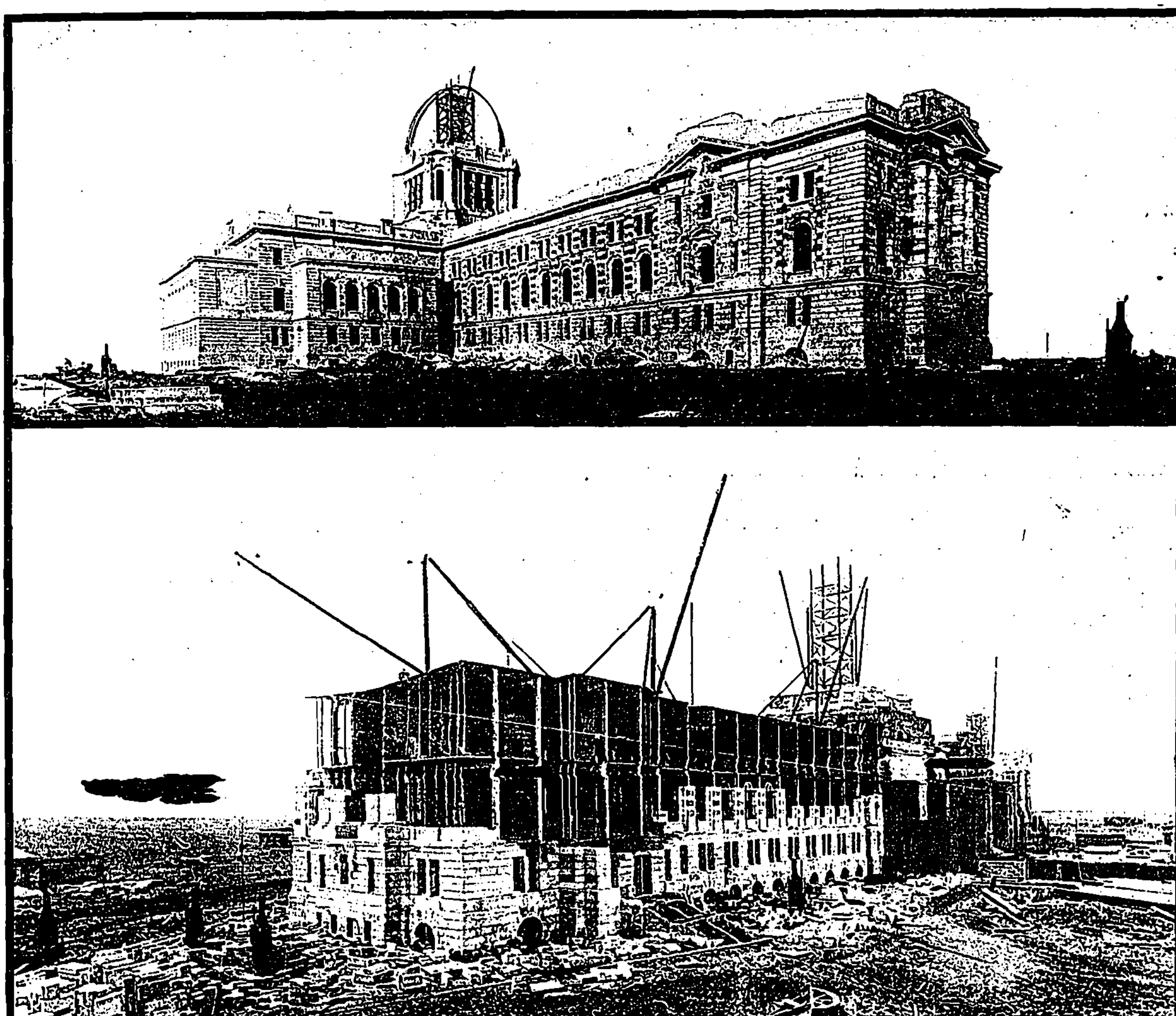
Reinforced Concrete Waterworks Dam and Power House Built for the Municipality at Peterboro', Ont. William Kennedy, Jr., Engineer. A Character of Work for Which Concrete is Particularly Adapted. Bishop Construction Company, Contractors.

type, and this is due, partly, to the desire for a less monotonous appearance, partly to economy, especially where building regulations are exacting in their requirements as to reinforced concrete (in addition

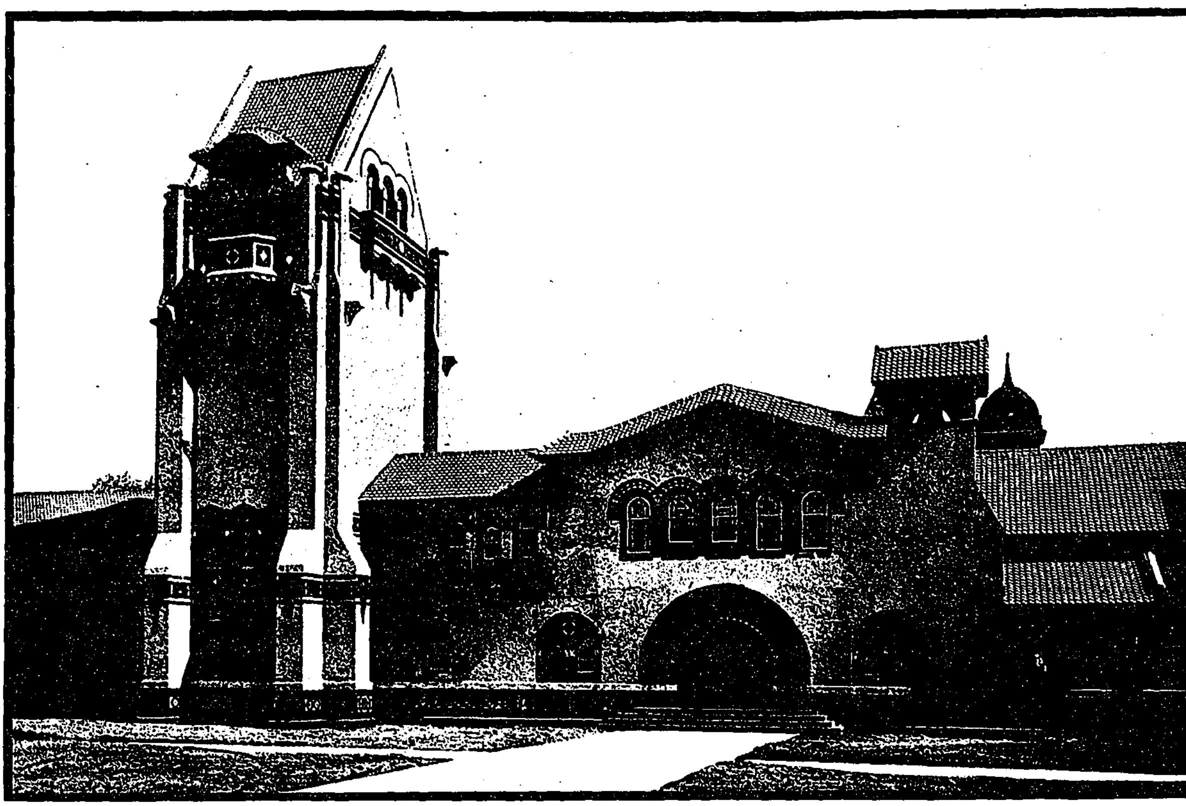
Reinforced Concrete Factory of the Peabody Manufacturing Company, Walkerville, Ont. Showing the Completed Structure and the Form Work when the Building was in Process of Erection. Bishop Construction Company, Contractors.

to which the form work will always be an expensive item) ; and partly to the comparative ease with which the brick wall may be removed in case lateral extensions at some future time are required. The dead weight in other types of construction will make reinforced concrete an impossibility. A few years ago, the engineering profession and press were much concerned over the boldness of a proposal to construct a 700-ft. Hudson Memorial Arch in New York city. No one as yet has had the temerity to suggest reinforced concrete for the new Transcontinental bridge over the St. Lawrence River at Quebec. The question of upkeep should not be lost sight of. It is generally conceded that reinforced concrete improves with age and does not, like steel or wood, deteriorate through exposure to the elements. It does not require painting and its fire-resisting properties, like those of its rival, terra cotta, are pretty generally conceded. For certain factory buildings, where heavy machinery has to be placed on upper floors, the rigidity and freedom from vibration possessed by a properly constructed reinforced concrete building are very desirable.

If some inventive investigator were to evolve, at moderate cost, a constructive material possessing the lightness of timber, the strength and rigidity of steel, the color variety of brick and the weathering properties of bronze, it would not require a prophet to predict that radical changes in constructive design would sooner or later follow its appearance. Such a substance would possess qualities so different from those of any single material at present known to constructive art, that its applications, and its methods of architectural treatment would be radical departures from the traditional paths. It would find uses never dreamed of as suitable for its predecessors; the elements of structures made of it would be dimensioned according to entirely new rules and the canons of decoration and embellishment would be very radically revised. It would at first be put by enthusiasts to uses for which it was not adapted, for, although possessing a capacity for service without precedent, it would not follow that it must lend itself satisfactorily to the construction, say, of mirrors or floor coverings. It would also be put to legitimate uses, but in ways out of keeping with its resisting



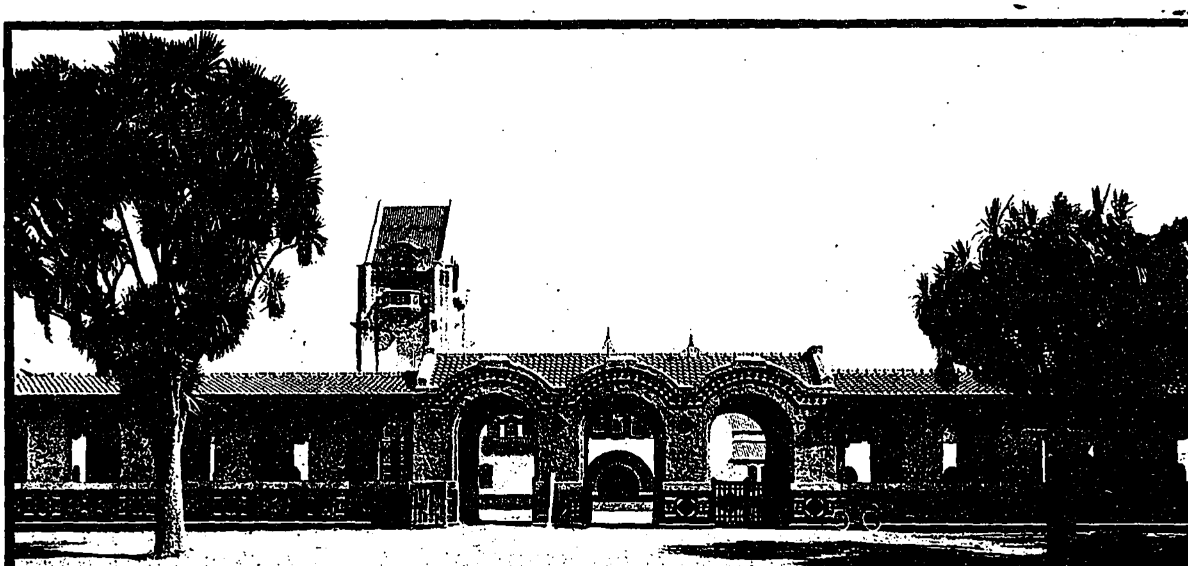
The Saskatchewan Parliament Building, Now in Course of Erection at Regina. The Largest Reinforced Concrete Building in the Canadian West, and the Only Legislative Building of this Type of Construction in the Dominion. The Upper View Shows the Exterior Walls of Stone Practically Completed, and the Lower View the Internal Construction when the Outside Masonry was Only Partially Carried Up. E. & W. S. Maxwell, Architects.



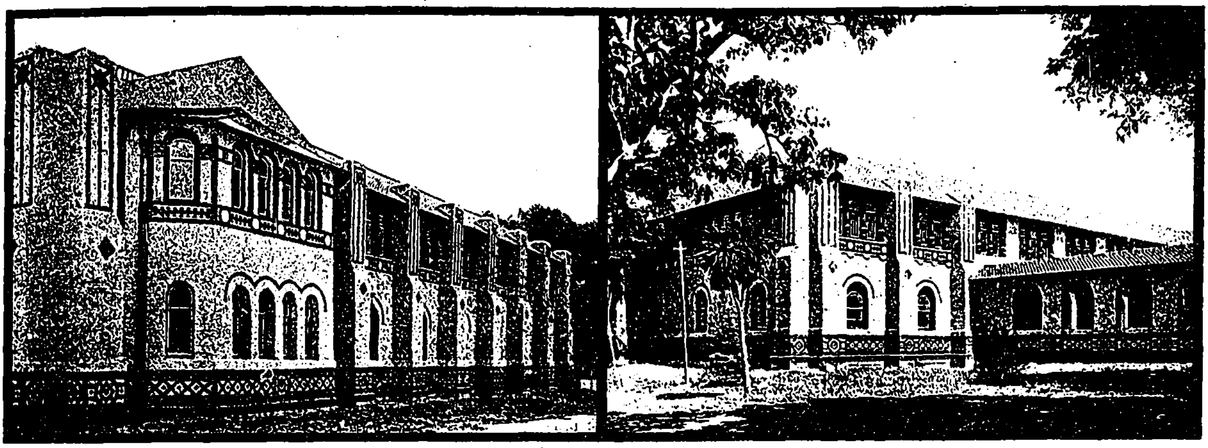
Administration Section and Tower, State Normal School, San Jose, California. A Recently Completed Monolithic Structure which is Noteworthy both as an Example Showing a Frank and Consistent Use of Concrete in Exterior Wall Treatment, and as an Instance which Forcibly Demonstrates the Opportunities Concrete Affords for Architectural design in the Hands of an Architect Who Fully Appreciates the Possibilities of His Material. W. D. Coates, Jr., Architect.

powers, and failure would sometimes follow; and with some, it would be considered a discredited material. Its method of architectural treatment would probably follow at first that of the old materials which it was destined to replace and illogical designs and offensive imitations would result. But time and experience would eventually eliminate defects, and a logical style would ensue. Such changes, however, are always of slow accomplishment.

The Revolutionists of France, in their desire to free themselves from the thraldom of despotic kingship, drafted in a day a constitution which they expected would last a century. Tom Paine, in one of his boastful moments, once said that he could write in a month a better Bible than that which had con-

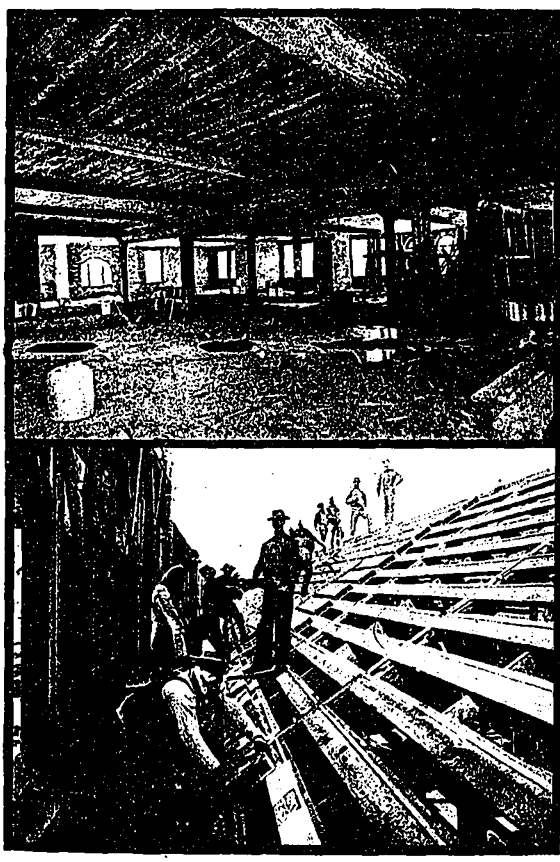


Detail of Entrance, State Normal School, San Jose, California. Showing the Red Brick and Green Tile Inlay on Grey Background, which Harmonizes Effectively with the Red Tile Roof. W. D. Coates, Jr., Architect.



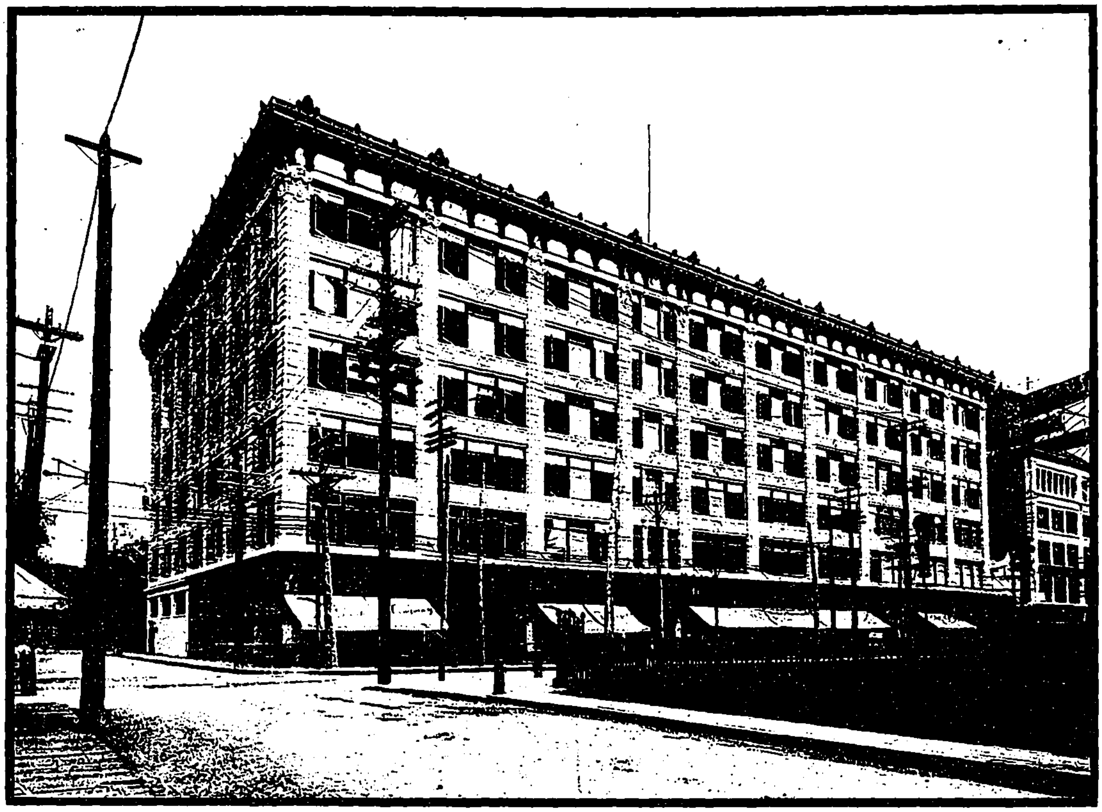
Detail of Library Exterior, State Normal School, San Jose, California. This Building was Erected at a total Cost to the State of $272,000, or a Little Less than 16½ Cents per Cubic Foot. W. D. Coates, Jr., Architect.

sumed sixteen centuries in the making. The signal failure of both endeavors affords an exemplification of the truth that those institutions and traditions which are most esteemed, and which are most stable, are the result of slow growth and gradual evolution. So it is with an architectural style. For centuries, architects and craftsmen have designed for and built in traditional materials, stone and brick and timber, and for a shorter time, in steel; systems of construction architecturally and structurally in keeping with these materials, have been evolved, and these have the sanction of age and the approval of custom. Within the present generation, as stated above, reinforced concrete has entered the field. This is a material which, because of its many undisputed advantages and the increasing cost of the materials which it is gradually replacing, is destined to find a place of growing importance in the architecture of future generations. But the place will not be quickly won. In some respects, too, its position to-day is analogous to that of our hypothetical material. The methods by which it is made, and its mechanical properties when made, render it in many ways a new material. Its internal cohesion and its ability to resist water percolation, make it desirable for foundations, dams, retaining walls, canal construction and the sub-structures of hydro-electric developments. Its ability to resist bending

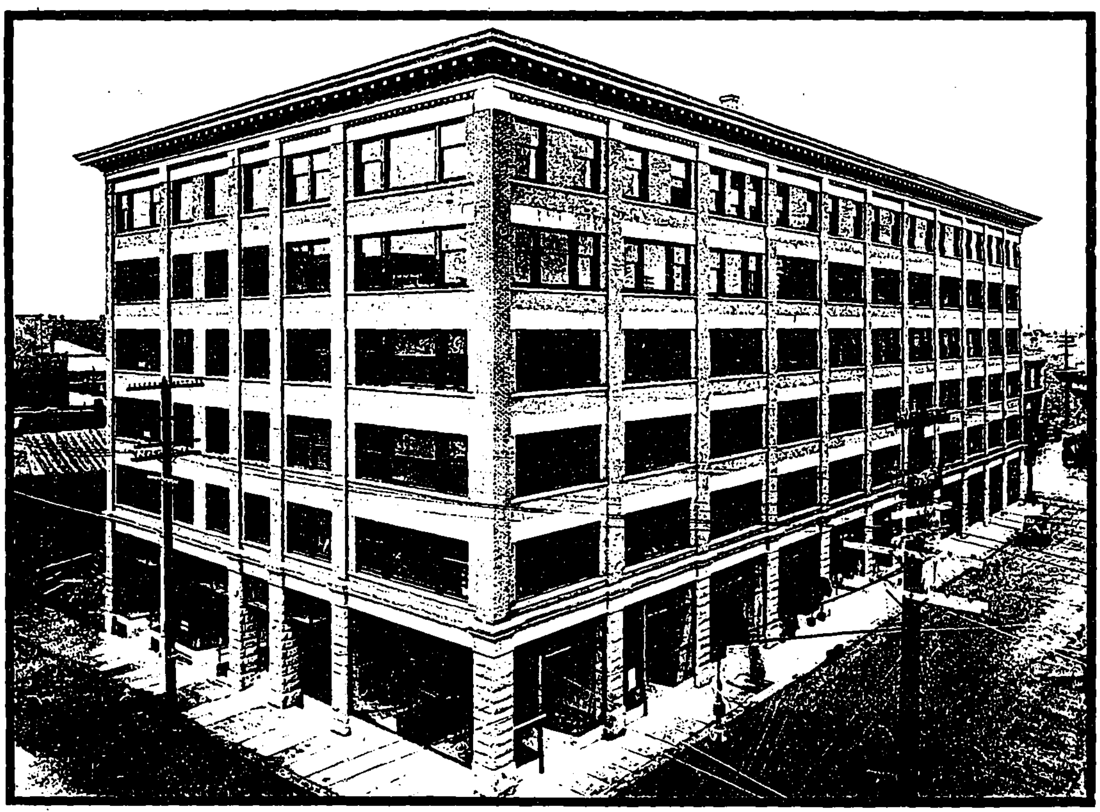


Concrete and Hollow Tile Construction. Upper View: Interior, Showing Complete Floor. Lower View: Method of Laying Tile on Concrete Roof Supports. This Type of Work Bids Fair to Attain Considerable Popularity, both Owing to Economy in Cost and the Light Yet Strong Form of Construction of Which it Aamits.

Under Side of Stadium, Harvard University, Cambridge, Mass. Showing Completed Floor. Lower View: Method of Laying Tile struction.

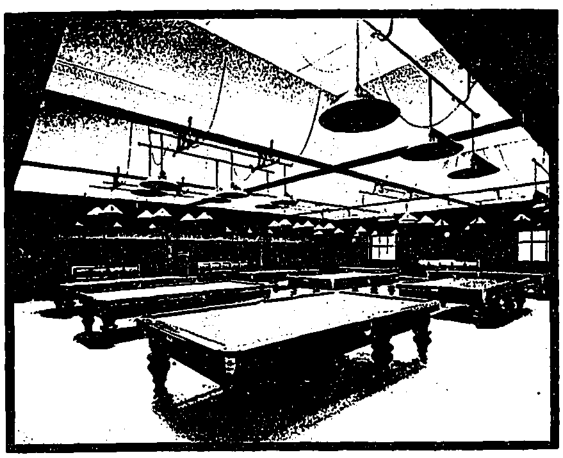


The Jacobs Building, St. Catherine and St. Alexander Streets, Montreal. Built of Reinforced Concrete with Terra Cotta Exterior Facing, and Notable as Largest Building of this Type of Construction in Canada. Mitchell and Creighton, Architects.



Pemberton Block, Vancouver, B.C. A Large Reinforced Building Which is Interesting as an Example in which the Floor System Extends to Form the Outer Wall Beams, and in this Manner is Incidentally Made to Serve as a Simple Decorative Feature for the Brickwork. G. C. Mesher & Company, Architects.

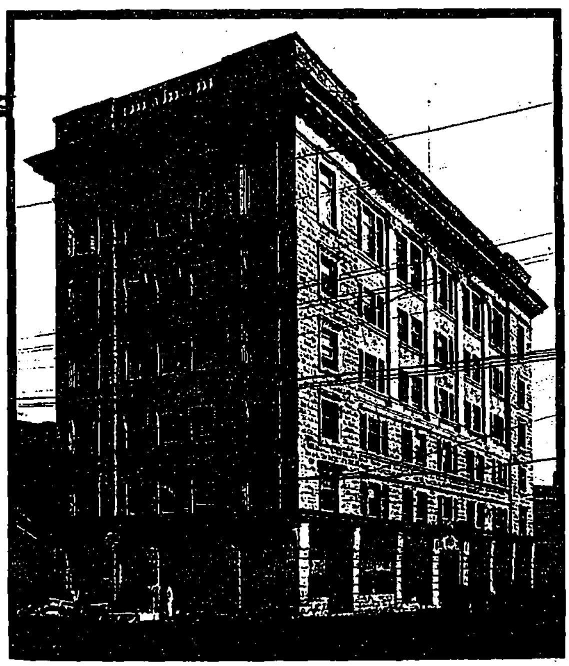
stresses, when adequately reinforced, renders it particularly useful for horizontal spanning. These advantages were soon recognized, and the success attending its use in a purely commercial or utilitarian way, has been undoubted. Needless to say, some disturbance of our cherished notions regarding the proportion of parts has ensued, and some of us have been led to suspect that perhaps in the past, the arbitrary rule has been accorded too much reverence,



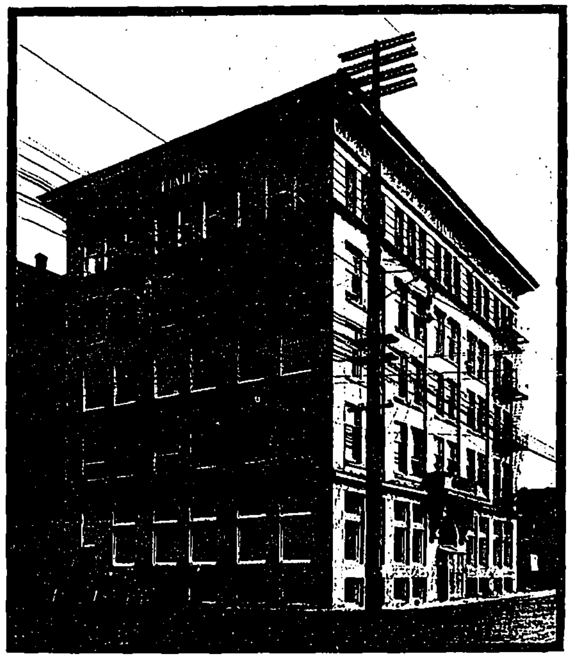
Interior View, Pemberton Block, Vancouver, B.C. Showing the 68-Foot Concrete Span Which Extends the Full Length of the Skylight Over Billiard Room.

and that there may not be any one set of proportions that, apart from association and training, is inherently more pleasing or beautiful than another. The goddess of Beauty, as conceived by the native African, would be, as Sir Joshua Reynolds asserts, a negress with the tribal features augmented and emphasized.

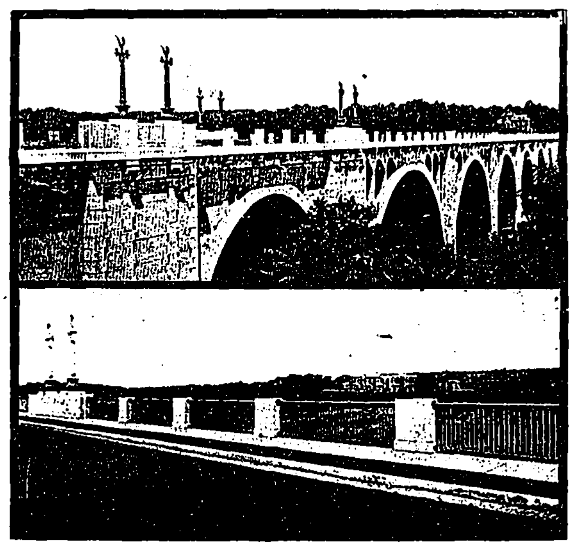
But it is where attempts to treat the form and surface of this material in order to attain a pleasing and enriched exterior, that the results have been particularly disappointing. What are the outstanding qualities of reinforced concrete? What are those things which must guide us in the co-ordination of quality of material and architectural treatment? They are two in number. In the first place, it is a moulded material, and in the second, its masonry is monolithic and continuous, not jointed.



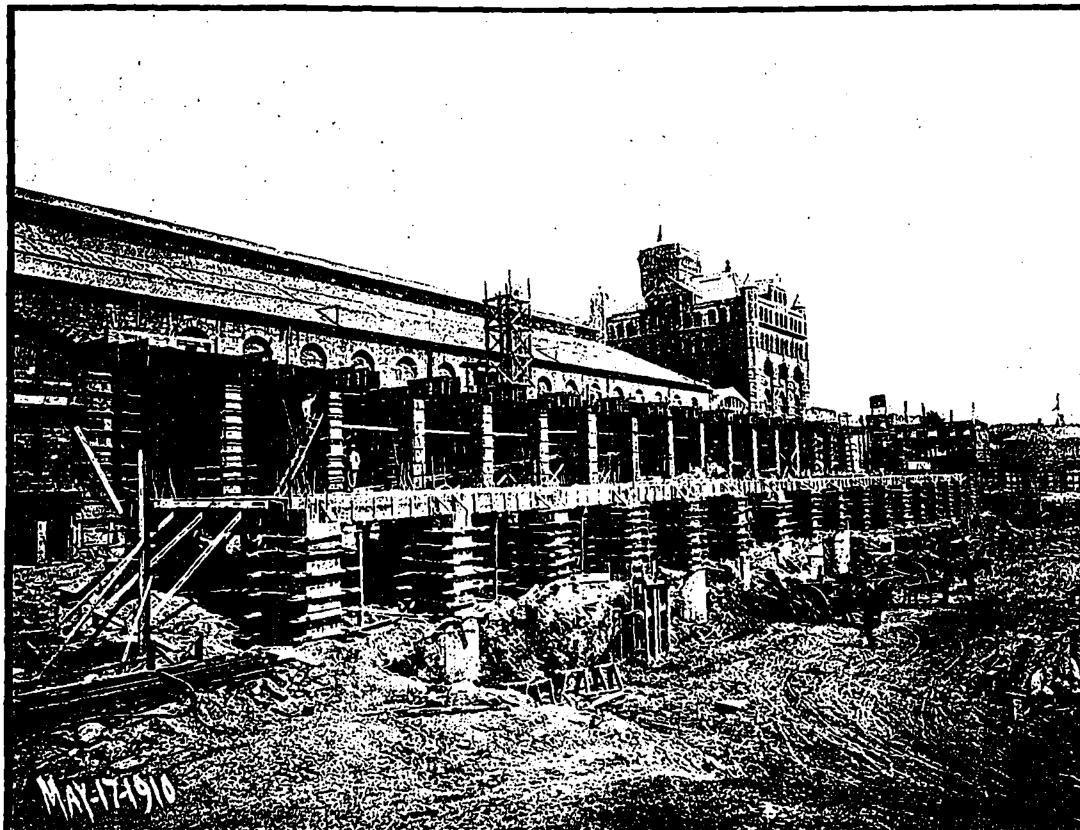
Grain Exchange, Calgary. Faced with Calgary Stone, and Possibly the Largest Reinforced Concrete Commercial Building Between Winnipeg and Vancouver. Hodgson & Bates, Architects.



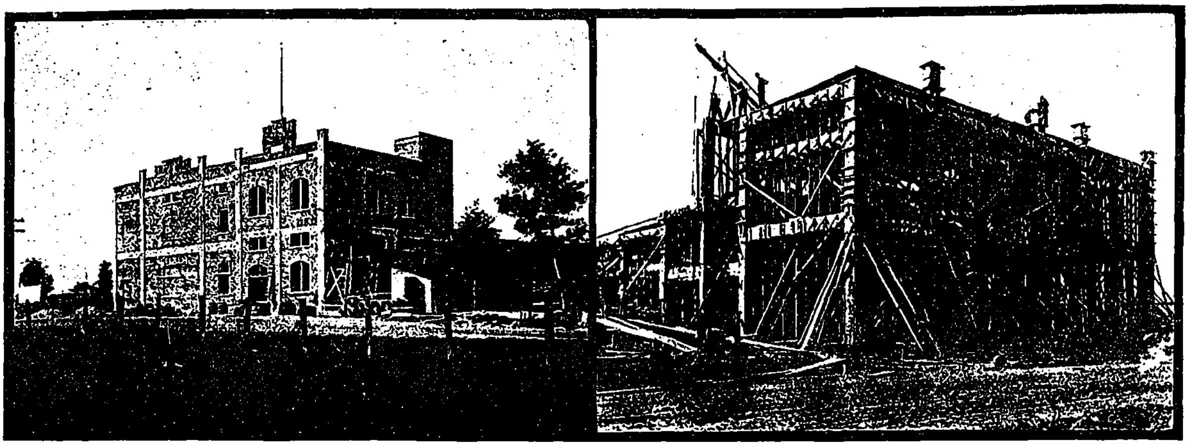
Times Building, Vancouver. Another Recently Erected Reinforced Concrete Building in the Canadian West. W. S. Griffiths, Architect.



Connecticut Avenue Bridge, Washington, D.C. A Celebrated Example of the Utility of Concrete Which Is Not Only Remarkable as the Largest Concrete Bridge in the World, But as a Structure Which Strikingly Illustrates the Use of Moulded Concrete Blocks for Decorative Purposes in Conjunction with Monolithic Masonry Construction. This Bridge was Erected at a Cost of $850,000. It has a Total Height, Including Approaches, of 1,400 Feet, and is 150 Feet Above the Bed of the Gorge at its Highest Point. The Lower View Shows the Railing with its Series of Interspersing Concrete Posts Along the Approach and Deck of the Bridge.

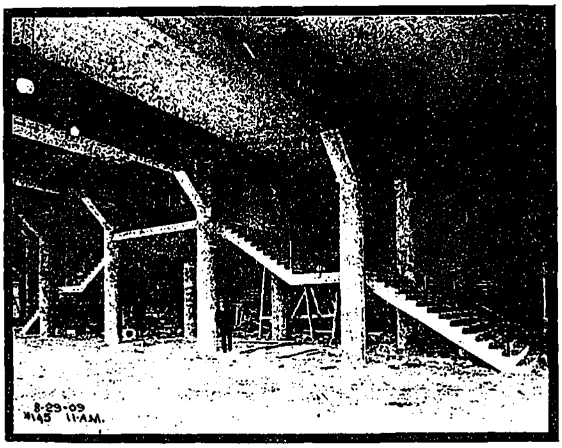


Concrete Viaduct, Windsor Street (C.P.R.) Station, Montreal. Showing Form Work, and Section of Finished Structure, Which is Designed to Carry the Heaviest Type of Locomotives and Passenger Cars. W. S. Painter, Chief Architect. Bishop Construction Company, Engineers.



Sudbury Brewery, Sudbury, Ont. A Reinforced Concrete Building in which the Floors are Designed to Carry the Outside Brick Walls. The Views Show the Erection of Form Work and the Structure Practically Completed. Bishop Construction Company, Designing and Erecting Engineers.

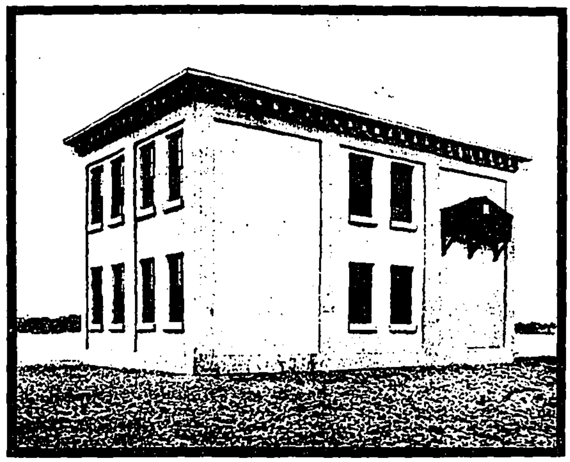
Ornament, if of the mass, will be an integral part of it and must grow out of it. It should not, as in the case of brick or stone masonry, consist of added units of the same material. Hence, mouldings and cornices not suggestive of masonry, are quite permissible; but brackets for the support of such cantilevered projections are inconsistent with its mechanical properties. The reinforced concrete arch is as truly an arch as its historic masonry namesake, inasmuch as it exerts upon its supports a horizontal thrust. The fact that it is capable of sustaining bending stresses—is in fact identical with a curved beam—does not invalidate the statement. But, it knows no *voussoirs* with separating radial joints, and these should not be employed as a means to a decep-



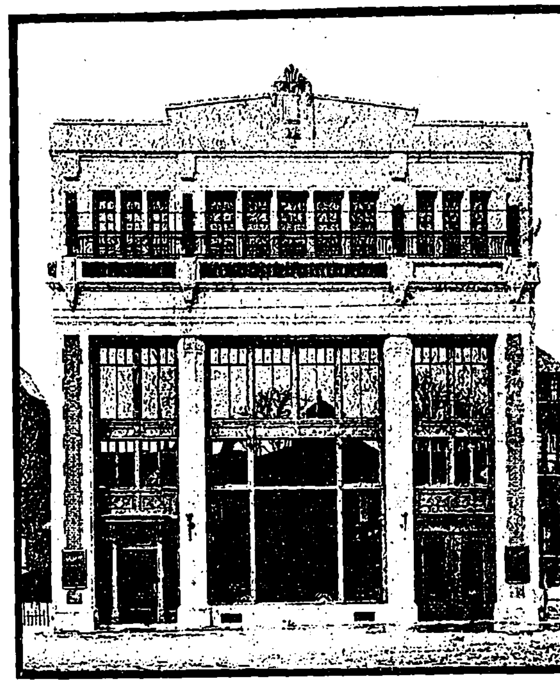
Concrete Stairs Under Grand Stand at State Fair Grounds, Minneapolis, Minn.

Typical Example of a Concrete Interior.

Smith Biscuit Company's Building, Vancouver, B.C. A Recent Example of the Application of Monolithic Construction to Factory Building Design. W. S. Griffiths, Architect.



Transformer House at Port Colborne, Ont. An Example of Stucco Work on Monolithic Concrete Construction. J. A. Jamieson, Engineer.

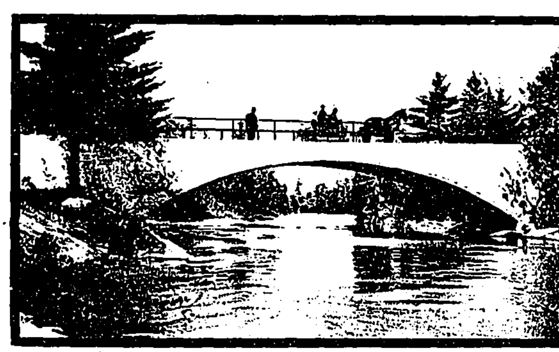


Garage of the Ontario Motor Car Company, Toronto. Showing a Richly Detailed Exterior of Cement Stone Inset with Red Brick Panels. Smith, Henchman & Grill, Architects.

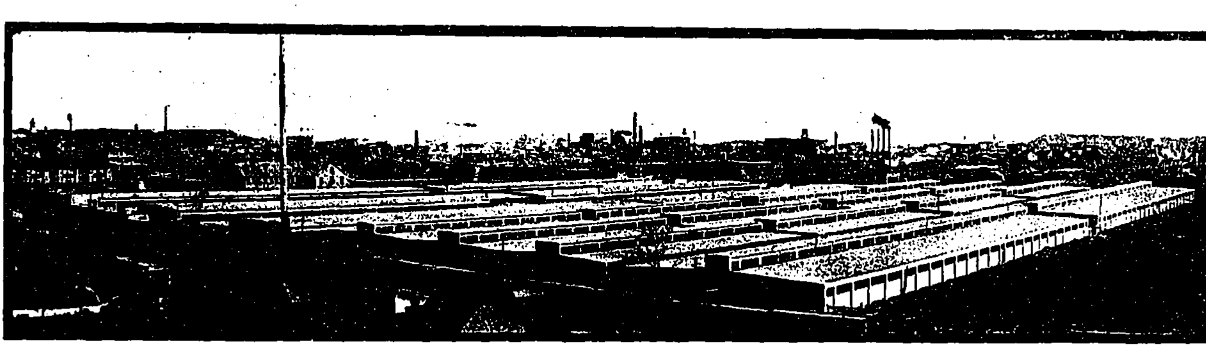
tion. If monolithic and jointed masonry be thought of as having changed places in history, it might be conceived that masons, following their introduction to the new material, would be as diligent in concealing mortar joints in their ashlar and range work as some of us of recent years have been in announcing

Rosenthal Building, Ottawa. Showing the Designers' Perspective and the Concrete Frame Work Before the Façade Was Carried Up. Weeks & Keefer, Architects.

them. "The day is coming when everyone will know that that single limitation, adaptation of material, is the philosopher's stone for architecture." The imitator usually fails to recognize that the thing imitated has been successful because it follows that this most important law, one indeed which he transgresses in the copying. The column is primarily for sustaining vertical loads. As such, the widened base and cap suggest, respectively, stability and the capacity for receiving weight; but the individual elements, base and shaft, do not exist in the monolithic column. Similarly, the arch and its abutments are one, and it

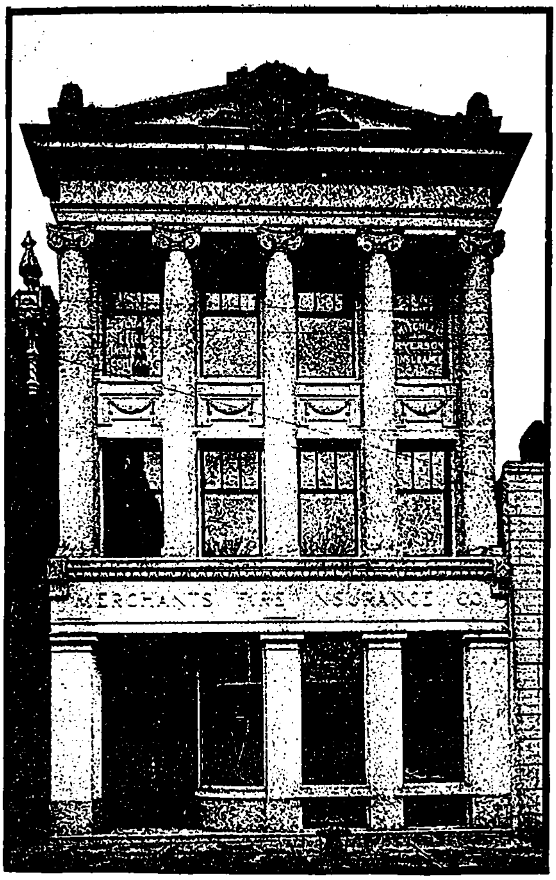


Roman Arch Bridge Over the Severn River. One of the Many Reinforced Concrete Bridges Built at Various Points Throughout Ontario by the Provincial Government.



Group of Concrete Cattle Sheds, Union Stock Yards, West Toronto. Bishop Construction Company, Erecting Engineers.

is inadvisable that the design would suggest the individuality of these elements (except in so far as is required by considerations of stability) when individuality does not exist.

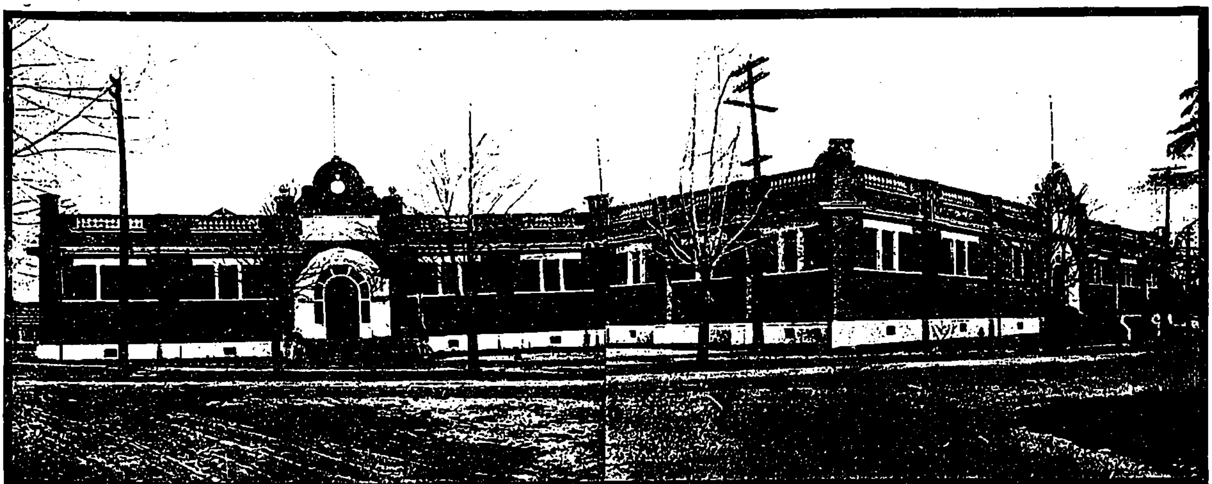


Merchants Fire Insurance Company's Building, Toronto. A Further Example Showing the Use of Manufactured Stone in Exterior Wall Treatment. Beaumont Jarvis, Architect.

A modern steel office building of twenty storeys, clad with its shell of protective masonry and without external embellishment of any kind, would be a public outrage. But the architect with his pilasters and his arches and his cornices, gives to his unpromising parallelopiped a certain attractiveness of form, suggestive possibly of something else, which satisfies the eye although it does not mislead the understanding. The effect is suggestive of what might be attained if the walls were what they pretend to be, and no one essays to condemn a fiction that modern conditions have rendered a necessary means to an end. Similarly, the stucco finish, applied to cement

Entrance to Pinchin & Johnson Varnish Factory, Carlaw Ave., Toronto. An Example of Cement Stone Work which Admirably Demonstrates the Adaptability of this Material for Decorative Detail. J. L. Havill, Architect.

blocks or metal lath is suggestive of what concrete would look like if the wall were in reality what it

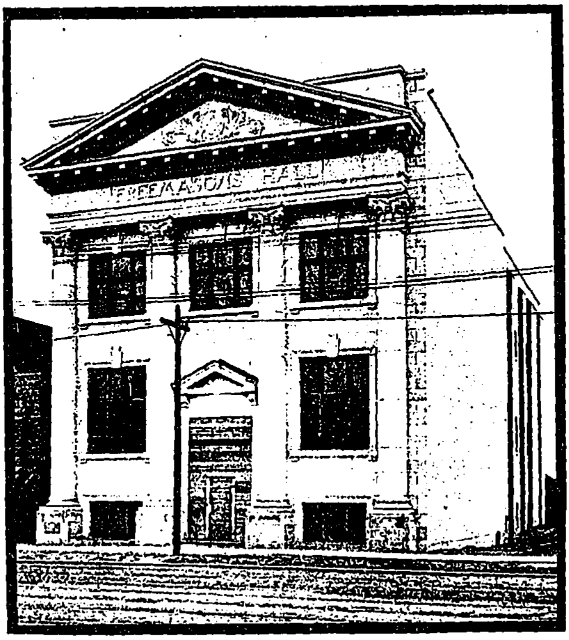


Poultry Building, Exhibition Grounds, Toronto. A Red Brick Structure which Shows an Interesting Use of Concrete Stone in the Doorways, Windows and Foundation Facing. Geo. W. Goulnlock, Architect.

1. Detail of Entrance to Poultry Building, Exhibition Grounds, Toronto. Geo. W. Gouinlock, Architect. 2. Carling Brewing Company's Offices, Simcoe Street, Toronto, the Entire Lower Portion of Which is Executed in Cement Stone.

appears to be, one of monolithic concrete. In Europe, the almost universal method of securing architectural decorative effect in concrete work, is by this means, and European builders have attained a skill in its use, scarcely known on this side of the Atlantic. Where stucco is used, the lintel and the keystone and whatever else is essentially of other materials, should be suppressed. If wood be employed for eaves or cornices, or tiles for roofing of ornamentation of broad expanses of wall, or bricks for pillars, these materials should be acknowledged, not disguised. The stucco method is a treatment of "concrete as concrete."

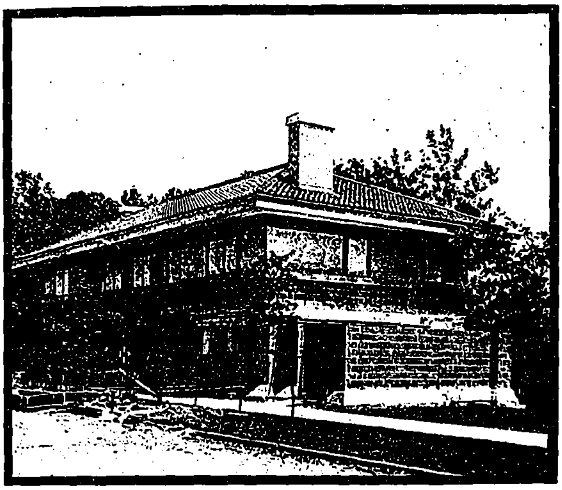
As stated previously, the architectural features of reinforced concrete, if of that material, should be of the moulded type. For this purpose, hollow forms are required, and as anything in the way of elaborate design in such necessitates great labor and expense in the form making, it follows that for commercial reasons, such enrichment will generally be quite simple. Other methods must be sought. The monotony of the blank wall must be relieved and the use of brick and tile, in geometrical or conventionalized design, for this purpose has been attended with



Free Masons' Hall, College Street, Toronto. A Recently Completed Structure in Which the Entire Façade is Executed in Cement Stone. Edward & Saunders, Architects.

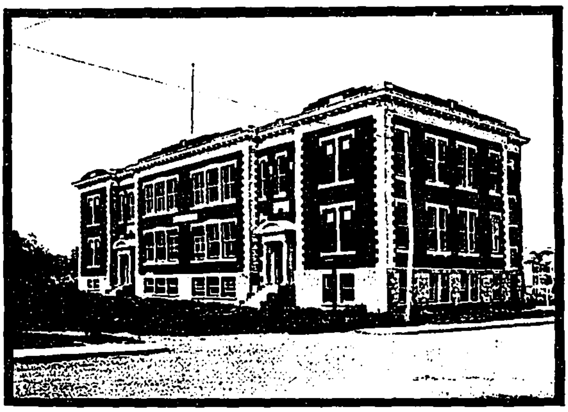
Detail of Cement Stone Work.—1. Branch of Merchants Bank of Canada, Roncesvalles Avenue and Dundas Street, Toronto. C. J. Gibson, Architect. 2. Branch of the Molsons Bank, Meaford, Ont. Langley & Howland, Toronto, Architects.

much success, and offers an attractive field for the enthusiast to exploit. If stucco be applied to the monolithic concrete wall, it is advisable that the wall be cast in the rough so that the stucco may adhere



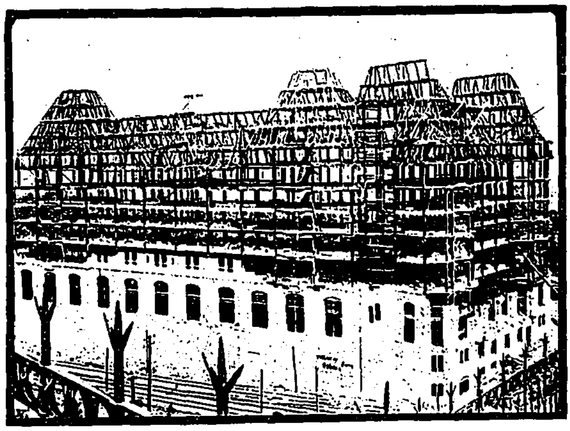
A Concrete Block and Cement Stucco Residence. Showing the Lower Portion Before the Plaster is Applied and the Upper Story Finished.

the better. To give a touch of "life" to the surface, the use of the bush hammer is quite effective. This was adopted with gratifying success in the case of the Connecticut avenue bridge at Washington, D.C., and on the Walnut lane bridge at Philadelphia, Pa. The texture of the moulded wall can be improved in various other ways. If the work is of such a character that forms may be removed in 24 hours, that is, before the final hardening has progressed very far, a surface of uniform texture and color may



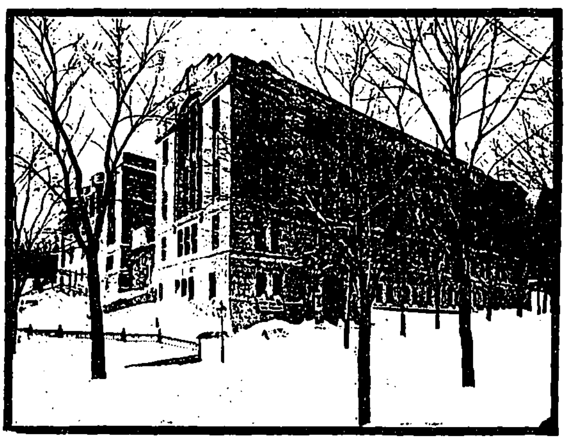
Querbes School, Outremont, District of Montreal, in Which Concrete Plaster on Metal Lath has been Extensively Adopted, Owing to the Fire-Resisting Properties of this Form of Construction, and the Sanitary Advantages Which it Affords. Joseph Perrault, Architect.

be obtained by rubbing with wooden floats and water only, no cement being used. This can be done by unskilled labor. Another method of treating the surface is by scrubbing it, preferably when still green, with wire brushes. This will remove the outer skin of sand and cement and will expose the underlying aggregates, the effect being to give a lifelike texture to the otherwise sombre gray surface. This process may be rendered somewhat more expeditious by the use of dilute acid, provided the concrete be green. For vertical surfaces, well hardened, the difficulties attending its application are so serious that some process of mechanical chipping or bush hammering is more economical and much quicker. The use of a carborundum block or emery stone with water is an effective though somewhat expensive method of exposing the aggregates in cross section. Needless to say, the finished surface is much smoother than



Chateau Laurier, Ottawa's Splendid New Hotel, Now Nearing Completion, and in Which the Structural Parts Throughout are Protected by a Patent Welded Fabric and Concrete Plaster Applied to Metal Lath. Ross and McFarlane, Architects.

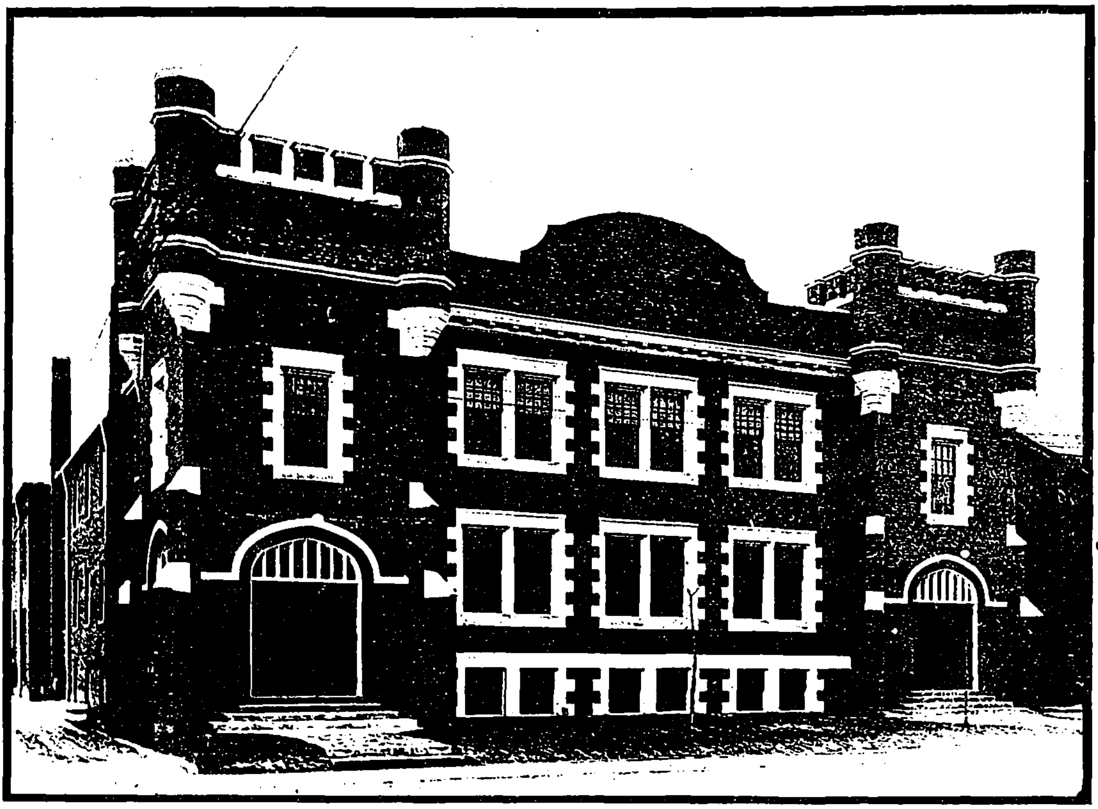
by the other process described. Best results from this method are obtained when the aggregates are of the softer kinds, and are selected with a view to securing pleasing variety in color. Still another method of improving surface texture, is by means of the sand blast. This consists in impinging, by means of compressed air, a sharp siliceous sand against the surface to be treated. The outer skin and adhering sand and cement are removed, and the underlying aggregates exposed in a manner similar to that in



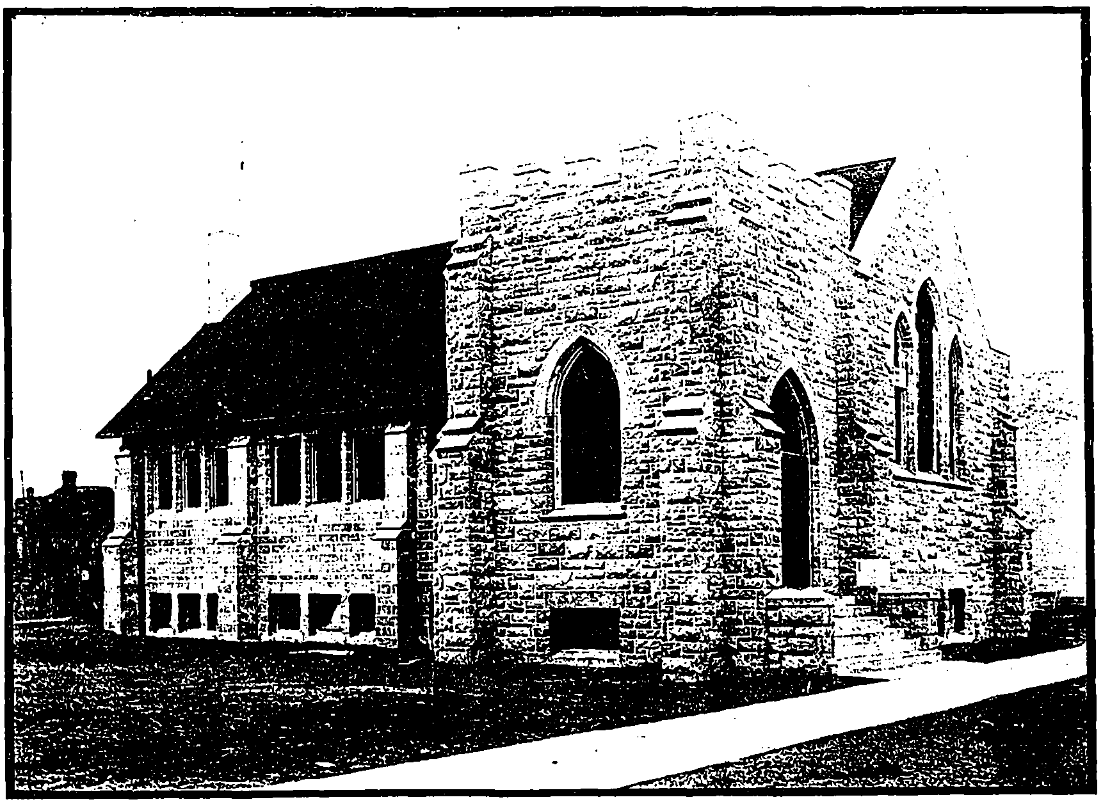
Medical Building, McGill University, Montreal. An Important Structure in Which the Interior Construction Throughout is Rendered Fire-Resisting in Character by the Use of Concrete on Galvanized Expanded Metal Lath. Brown and Vallance, Architects.

which the brushing or acid washes are employed. Mr. Richard L. Humphrey, in an address before the Concrete Institute in London some months ago,

(Concluded on page 67).



Cement Stone Trimmings on Brick Background, as Seen in the Dovercourt Presbyterian Sunday School. Simpson & Young, Architects.



St. Paul's Lutheran Evangelical Church, College and Markham Streets, Toronto. Built of Broken Ashlar Cement Stone. Note how Successfully Monotony of Appearance has been Eliminated in the Face of the Stone, and the Close Resemblance it Bears to Pitched Sandstone. C. F. Wagner, Architect.

CONSTRUCTION

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

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Vol. 4 Toronto, March, 1911 No. 4

CURRENT TOPICS

AT THE ANNUAL MEETING of the London Builders' Exchange the following were elected officers for 1911: Past President, George Everett; President, John Jones; First Vice-President, William J. Nutkin; Second Vice-President, E. R. Dennis; Secretary-treasurer, G. S. Gold; Auditors, D. Ferguson and T. R. Wright; Directors, George Belton, Thos. Ridge, John Pulerborough, Charles Gould and John Maker. Messrs. Ferguson and Wright were appointed to represent the Exchange on the Western Fair Board.

* * *

DOCK AND HARBOR improvements, aggregating $70,000,000, to be carried out on the Thames estuary, has been recommended by the port authorities of London. The scheme contemplated is far-reaching in its scope, and includes the dredging of the river channel from Tilbury to London Bridge, together with the construction of three docks at the former place of 65, 126 and 138 acres respectively, to accommodate the largest vessels now afloat or projected. The adoption of the proposals made by the engineers is said to be imperative if London is still to maintain its prestige as the first port of the world.

A LIMIT OF 200 FEET is to be placed on all buildings erected in Chicago after September 1st next. This was voted for by the Committee on Buildings at a recent meeting, and is now before the City Council for final sanction. It was agreed to permit the 260-foot limitation (20 storeys) which has prevailed for several years, to continue in force for a reasonable period, in order to allow property-owners sufficient opportunity to start construction if it was their intention to build above the new limit when the land was acquired.

* * *

AN OLD LANDMARK OF QUEBEC to pass out of existence is the large stone grist and saw mill on the Black River at St. Pie, which was recently destroyed by fire. The mill was built about eighty years ago by Seigneur Descelles of St. Hyacinthe, whose seigneury extended for many miles about. According to the old tenure laws the seigneur was obliged to build the mill for his tenants and they in turn were required to bring their grain to him to be ground. In the early days before roads were built, settlers were often seen carrying a single bag of grain along footpaths through the wood to the old "grist," which for some time back had ceased to operate in this capacity.

* * *

IN THE NEW SIXTEEN STORY office structure to be erected at King and Yonge streets, Toronto, the C.P.R. will have the tallest building in the British Empire. It will be one story higher than the Traders Bank building, which now has that distinction. The construction will be of steel and hollow tile, with glazed terra cotta exterior walls, while a feature of the design is to be the colonnade work of either facade. Accommodations are to be provided for the general passenger, freight, express and steamship offices, telegraph headquarters, solicitor's department, central public ticket offices, and the offices of all executives in charge of the Ontario division. The building will cover a ground area of 8,500 square feet, and will cost complete over a million dollars.

* * *

THERE IS A PROBABILITY that the Dominion Government will either make extensive improvements to the present Government House at Ottawa, or else erect a more palatial residence for the Governor-General. At least this is to be inferred from the recent remarks of the Minister of Public Works, who, in reply to a question brought up in connection with an appropriation for immediate repairs to Rideau Hall, stated that while improvements involving an expenditure of $300,000 were proposed, it would be better to dispose of the property, which is valued at $700,000, and erect a new Government House—one that would be more in keeping with the dignity of its purpose—on some commanding site in the city. Rideau Hall, in the opinion of Dr. Pugsley, was not a credit to the country.

CALGARY IS JOINING in the movement recently inaugurated in a large number of cities in Canada and the United States to limit the height of buildings. Both Fire Chief Smart and Building Inspector Harrison are of the opinion that a measure should be passed prohibiting structures from extending up over eight stories or between 90 and 100 feet. The contention advanced is that Calgary, like most other Western cities, has unrestricted territory for development on all sides, and that a regulation of this kind would render conditions less dangerous in case of fire, prevent inflated land values, and operate more to the economic advantages of the city in general.

* * *

A RECENT VOTING CONTEST was held in the United States among architects and architectural students, with the object of securing the views of the profession as to the ten most beautiful buildings in the United States. The buildings which were given this distinction were as follows: The Capitol and the Congressional Library in Washington; the Public Library and Trinity Church in Boston; Columbia Library, Trinity Church, St. Patrick's Cathedral, the City Hall, and Madison Square Garden in New York, and the Vanderbilt residence, Biltmore, in North Carolina. All of these buildings are in the east. Three of them are libraries and three are churches. One capitol, one city hall, one place of amusement, and one residence complete the list. Not a single State capitol, or theatre or gallery of art, or monumental museum has a place.

* * *

OFFICERS OF THE ALBERTA ASSOCIATION of Architects for the current year, as elected at the annual meeting recently held at Calgary, are as follows: J. C. Hopkins, Edmonton, honorary president; S. M. Lang, Calgary, president; R. W. Lines, Edmonton, honorary secretary; L. M. Gotch, Calgary, secretary; D. S. McElroy, Calgary, treasurer; G. M. Lang, W. S. Bates, James Henderson, L. M. Gotch, and R. W. Lines, examiners; A. Pierie, J. J. O'Gara, auditors; R. W. Lines, librarian. The report for the past year, which was adopted, showed the affairs of the association to be in a very satisfactory condition. In addition to transacting a large amount of important business during the period of three days the convention was in session, a deputation from the Calgarv Builders' Exchange, which came to urge upon the association the advisability of adopting a standard form of contract, was also received. After considerable discussion it was decided to appoint a committee of architects to meet delegates from the various Exchanges throughout Alberta, for the purpose of going fully into this subject, with a view to adopting a form of contract for the province that will be satisfactory to all parties. The visiting architects were hospitably entertained by the local Chapter, and over thirty members in all were in attendance at the daily meetings. Calgary was the unanimous choice for the next assembly, and in all probability will become the permanent headquarters for the association.

ONE OF THE MORE IMPORTANT constructional works now in progress in the United States is the mile-wide $20,000,000 dam which is being built across the Mississippi River at Keokuk, Iowa. Some idea as to the enormity of the project is gained from the fact that it will give steady employment to a force of 750 men for a period covering thirty months. The dam will generate 250,000 horse-power, to be used in the development of electrical energy for towns and cities in the Mississippi belt. Already 60,000 horse-power has been contracted for St. Louis, 200 miles distant. This will be the first dam to extend entirely across the Mississippi, and it was necessary to secure a franchise from Congress before the work could be started.

* * *

THE ENGINEERS' CLUB OF TORONTO has elected the following officers for the ensuing year: President, Capt. Kilealy Gamble; first vice-president, Willis Chipman; second vice-president, W. H. T. Haultain; third vice-president, Chas. H. Hays; directors, J. J. Ashworth, R. A. Baldwin, C. H. Acton Bond, C. H. Burke, W. A. Bucke, C. M. Canniff, W. E. Douglas, E. A. James, L. J. Street, Jas. B. Tyrrell and P. F. Young; secretary-treasurer, R. B. Wolsey. The registration of the club is now about 400, and the remodelled and enlarged quarters makes it an ideal meeting place for the members. The property adjoining the old rooms on the east has been secured and altered and redecorated to form a part of the general suite. The lower floor has also been leased and converted into a large modernly appointed dining-room, thus making the advantages of the club complete.

* * *

ENGLAND'S FIRST SKY SCRAPER, as the new building now under construction for the Royal Liverpool Insurance Company is called, is the most important commercial or office structure having concrete as its basic material that has yet been undertaken in the British Isles. It is 301 feet long, by 177 feet 6 inches wide, with a height of 360 feet from the basement to the top of the dome. Concrete reinforced by steel is used as a base for the walls, over which a veneer of granite is being placed. The estimated quantity of concrete used in the framework of this building is about 17,000 cubic yards, which is prepared by an electrically driven mixing machine, provided with a tank which automatically discharges the correct volume of water for each bach made, the water tank being connected with the city mains. The whole of the mixing plant is located in the basement of the building in order that the component parts may be delivered in chutes from the street level to the bins below. The work turned out for a day of nine hours with this mixing plant is said to be upward of 100 cubic yards. All the concrete is transported to the floor under construction by steel wagons of the side-tip pattern on hoists, electrically driven from the basement. The concrete used in the construction of this building is composed of 6 parts, as follows: Three parts broken granite, 2 parts sand, and 1 part Portland cement.

RELATIVE MERITS OF PURE AND BLENDED CEMENTS

Report covering results of initial series of thirty year test now being conducted by the German Government.

EXHAUSTIVE DATA relating to two series of official tests made to determine the effect of the blending or adulteration of cement by the addition of tufa and other materials, is contained in the 1909 publication recently issued by the commission in charge of the Royal Prussian material-testing station at Lichterfelde West, near Berlin. Following the initial experiment made in Charlottenburg during the summer of 1898, a large number of tests constituting the first series were carried out at Westerland, on the island of Sylt, in the North Sea, with a view to ascertaining the comparative pressure resistance and tensile strength of mortar blocks made from various pure cements and from cement blended in certain proportions.

The blocks were seasoned in specially constructed containers, one-half of each kind of blocks in fresh water and one-half in salt or sea water. The blocks were made by adding each of the following binding materials to ordinary sand and to raw coarse-grained sand: (1) Portland cement, (2) Portland cement mixed with finely ground tufa, and (3) Portland cement mixed with fine sand. The first provisional report of the tests was made in the fall of 1899 and subsequent reports at various times until 1908. The results indicate that in fresh water the blended mortars remain inferior to those unblended, in both resistance and tensile strength, while in sea water the tufa cement mortars were equal to the unblended mortars in tensile strength, and after a year the compressive strength of the blended mortars was nearly as great as that of the unblended. The commission therefore decided that, within certain limits, Portland cement might profitably be blended with tufa in mortars to be used in sea water constructions, and especially in mortars whose cement content is comparatively low.

The second series of tests now being carried out at Westerland were begun in 1902, by a specially appointed commission of the Prussian Ministry of Public Works, and are to continue during a period of 30 years. The purpose is to test various cement mortars and concretes, blended and unblended, when used in the construction of quays; to determine the chemical effects of sea water upon these materials, as compared with fresh water, and the mechanical washing effects of the tides, open sea, etc. Mortars and concretes of various percentages of (1) cement and sand, (2) cement, tufa, and sand, and (3) tufa, fat lime (Fettkalk), and sand, were used in making (1) concrete facing blocks of the dimensions used in quay constructions, (2) large concrete cubes or blocks to be tested with reference to their compression resistance, and (3) smaller sample pieces of mortar and concrete for testing their compression resistance and tensile strength.

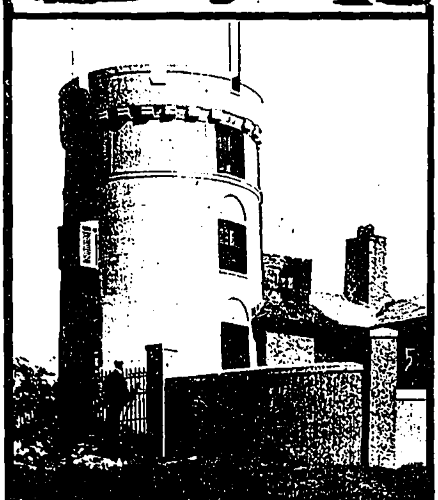
The concrete facing blocks were allowed to season under a covering of moist sand—one-half of each kind of mortar or concrete mixture—for a period of three months, and the other half for a period of one year. The facing blocks after being seasoned were used in quay constructions where they are continually being observed with reference to the chemical and mechanical effects of the sea water. The large concrete blocks of each mixture were seasoned, first in sand, some for nine days and some for one year, after which they were stored in special containers, one-half of each kind in fresh water and the other half in sea water. Tests of the compressive strength of the large blocks were made after periods of 28 days, 1 year, and 5 years, and are still to be made after periods of 15 and 30 years. The sample mortar and concrete pieces were subjected to the same seasoning conditions and were tested with reference to compression and tensile strength at the same time as the corresponding concrete blocks.

The results of the observations of 140 concrete facing blocks, which are given in the report from the Royal material testing station, have led the commission to decide that, from the point of view of durability when exposed to the action of the open sea, the blending of cement with tufa is of questionable or at least only limited value. The results of the tests thus far made of the compressive strength of the large concrete blocks and of the compressive and tensile strength of the sample mortar and concrete pieces seem to corroborate the conclusions reached by the commission in the first official series described. The conclusions are to the effect that the chemically disintegrating effects of sea water upon cement concretes and mortars in closed containers, and therefore not exposed to the washing effects of the open sea, are somewhat counteracted and diminished by blending with tufa, and especially in concrete and mortar whose cement content is low.

REINFORCED CONCRETE.—By Prof. P. Gillespie.—Cont'd from page 63.

stated that one discovery he had made on his recent trip abroad, was that concrete could be polished as successfully as marble. This led him to remark that he felt that there was for artificial stone to be used for ornamental purposes, a most encouraging future. In conclusion, let it be said that reinforced concrete, like all other materials of construction, has many limitations. While almost ideal for certain situations and types of construction, it is quite impossible for others. Structurally and æsthetically, its best service is secured often when in combination with other materials. While in the past efforts to secure pleasing results, architecturally, have not usually been successful, this has generally been traceable to the much-to-be-expected influence of traditional methods of treatment belonging properly to older and different materials. A logical style is undoubtedly on the even of development, the dominating principle of which must be the harmonization of treatment with function and characteristics of the material employed.

The Manifold Uses of Concrete as Exemplified in Various Phases, comprising Structural, Architectural and Decorative Work. :-: :-: :-:



1—Huge Reinforced Concrete Bridge Built Across the Maumee River at Waterville, Ohio. This Structure is Designed to Carry Over 500 Tons on Each Span. It is 1,200 Feet Long and 45 Feet High, and Was Erected at a Cost of $77,000. There are Twelve Spans in all, the Two Largest of which (90 Ft. Each) are Seen in the Accompanying view.

2—Interior of Fireproof Residence. Showing Solid Reinforced Concrete Staircase in a Design that is Admirably Suited to the Material. Both this Feature and the Walls, Which are Built of Cement Blocks of a Rich Texture, Reveal the Natural Qualities of Concrete in a Scheme that is Both Highly Acceptable and Pleasing.

3—Building of the Sphinx Senior Society, Dartmouth College, Hanover, N.H., which Shows in the Treatment of its Doorway and Cornice the Adaptability of Concrete for Decorative Purposes. The Walls Consist of Two Separated Concrete Sections, the Inner Wall Being Vertical and the Outer One Slightly Battered.

4—Detail of Concrete Caps, and Sun and Serpent Plaque Over Doorway, Sphinx Building, Dartmouth College, Which, Together With the Columns, Seen in Fig. 2, Were Cast in Glue Molds.

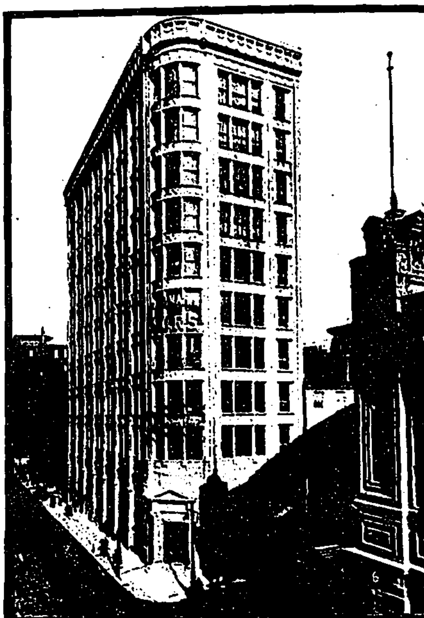
5—Blue Hill Observatory of A. Lawrence Rotch, at Milton, Mass. A Strikingly Singular Monolithic Building in Circular Design, Which Shows an Unusual and Interesting Adaptation of Concrete to a Difficult Form of Structural Work.

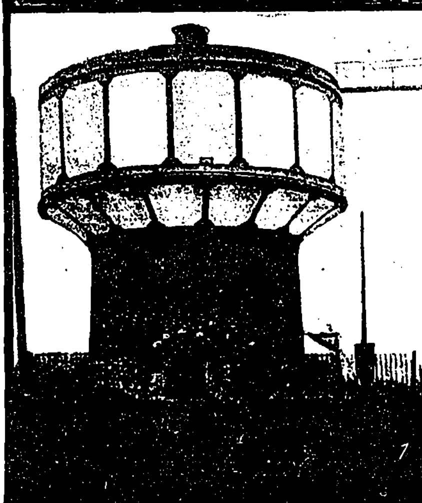
6—The People's Trust Building, Philadelphia, Pa., Used for Banking and Manufacturing Purposes, and Built Throughout of Reinforced Concrete. It is Notable as an Example of One of the Types of Modern Commercial Structures in Which this Form of Construction Has Been Successfully Adopted.

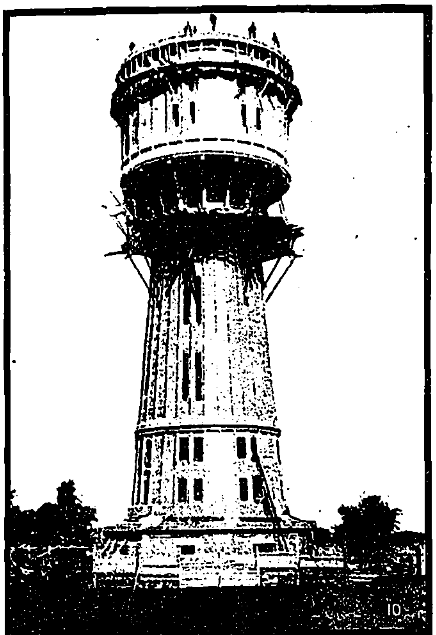
7—Elevated Water Tank at Nanterre, Paris, Representing a Class of Work in Which Concrete is Now Quite Generally Employed. Here the Supporting Mass is Finished With Field Stone. Note the Boldness of Design and the Stability of Character Which the Materials and General Treatment Denotes.

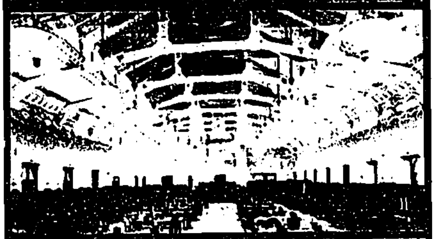
8—One of the Four Concrete Lions Forming the Decorative Features of the Newels at Either End of the Connecticut Avenue Bridge, Washington, D.C.

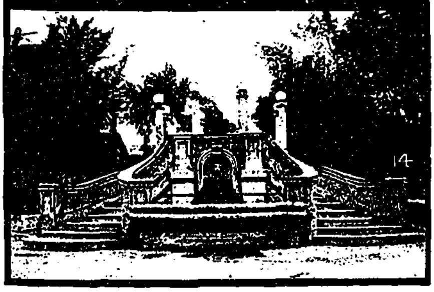
9—Palacio Tornquol, Belgrano, Buenos Aires. A South American Example of Concrete Block Construction in Residential Work of the More Expensive Type.











Concrete in Devious Forms of Structural Expression Illustrating the Broad Possibilities of the Material and Its Successful Adoption in Specific Instances. :-: :-: :-:

10—Concrete Block Water Tower at Uccle, a Suburb of Brussels, Belgium. This tower was Built for the International Exposition of 1910, and probably has no equal as an Example of Artistic Concrete Block Construction Either on this Continent or in any Other of Europe. It is 145 Feet from Base to Summit and has a Tank with a Capacity of 280,000 gallons.. The Blocks are used Without Moulding of any kind Excepting that seen in the Concrete Reinforcing Struts Surrounding the Base of the Tank Proper. On the Interior is a Continuous Winding Staircase Connecting six Floors, Divided off into Rooms or Compartments.

11—Interior of Central Telegraph Hall of the General Post Office, Budapest—Showing the System of Reinforced Concrete Roof Trusses, which were Calculated as Rigid Frames (lattices without diagonal struts), with the Aid of the Theory of Elastic Deformation. This Interior is Noteworthy as Demonstrating both the Engineering Advantages and Scope for Architectural Treatment Which Reinforced Concrete Offers.

12—Gothic Window and Canopied Niche, Second Congregational Church, Lynn, Mass., in which the Under Cut Tracery and Mouldings So Necessary to the Architectural Success of a Building of this Style, is Executed in Concrete Stone.

13—Interior of Second Congregational Church, Lynn, Mass., Showing the Chancel and Wall Arches, Columns, Traceried Windows and Frames, all constructed of Cement Stone.

14—Concrete Band Stand and Fountain at Port Henry, N.Y. The Material Used in this Structure Consists of One Part Cement to Eleven Parts Ore Tailing, and the Resultant Composition, together with the Graceful Architectural Lines and General Treatment Produces a Most Beautiful Effect.

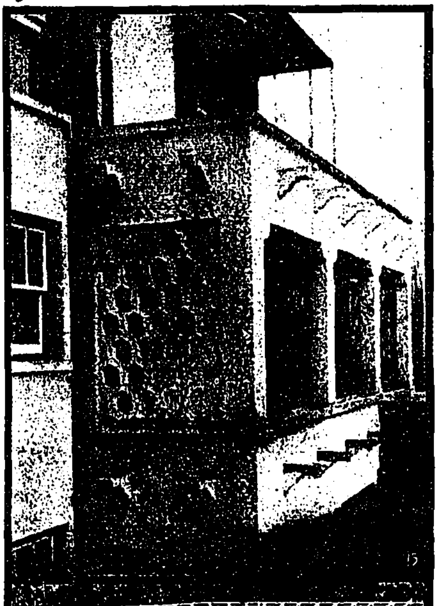
15—Hexagonal Grille of Reinforced Concrete Forming an Effective Screen for Simple Designed Flower Boxes of a Modern Residence.

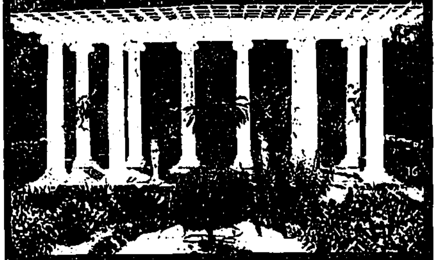
16—Pergola of Cement Concrete. An Interesting Garden Feature Designed by McKim, Mead and White.

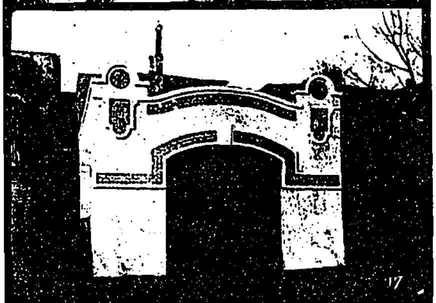
17—Reinforced Concrete Garage. Emile G. Perrott, of the firm of Ballinger and Perrot, Architects and Engineers, Philadelphia, Pa. Showing a Simple, Interesting, Decorative Effect Produced by Colored Moravian Tiles, which were Set in the Panels after the Forms were Removed and the Concrete had Hardened.

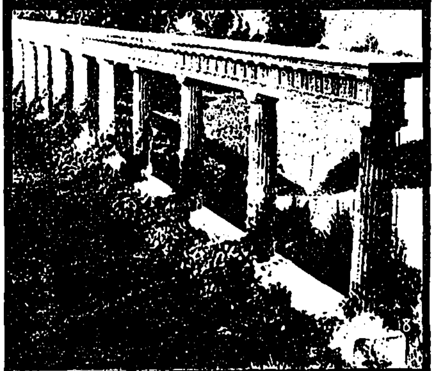
18—Peristyle of Cement Concrete at Washington, Conn. Note the Detail and Finished Treatment which the Columns and Entablature in the Foreground Indicate.

19—Home of Carlton Macy at Woodmere, Long Island, showing an Interesting Application of Concrete to Residential Design.









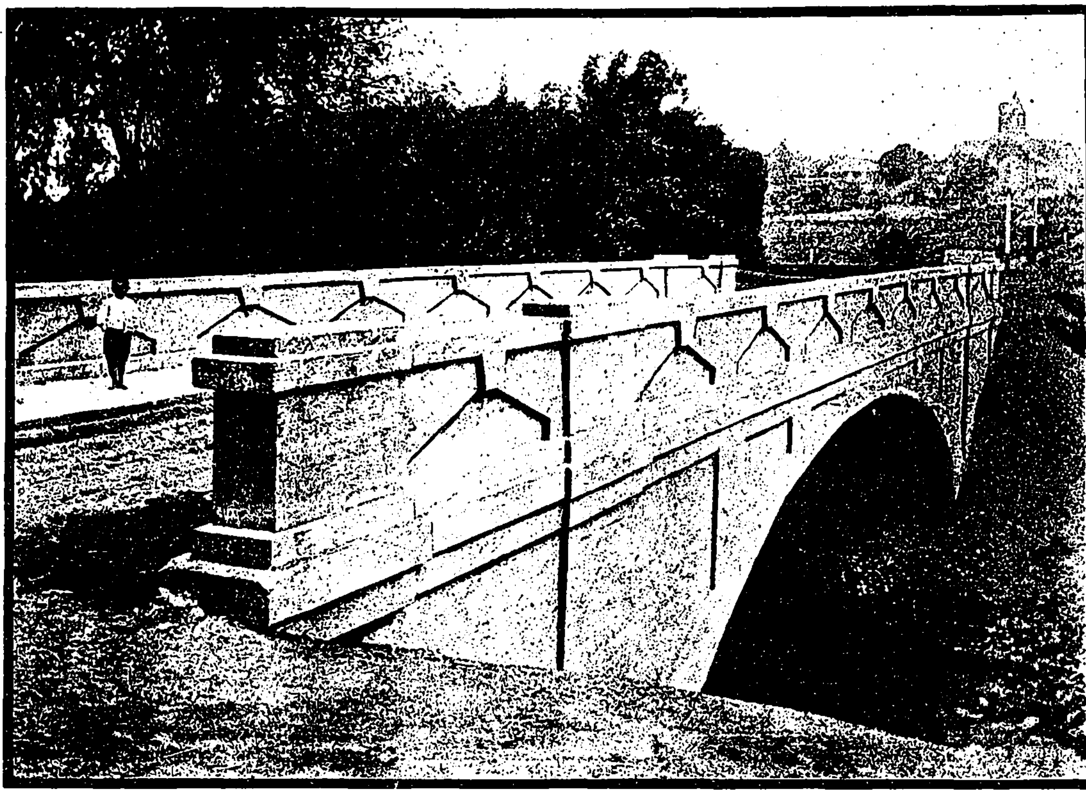


Fig. 5.—Arch Bridge of 60 Feet Span, on Timothy Street, Newmarket. This Structure Being a Permanent Bridge in a Growing Town, Special Care was Taken to Secure a Pleasing Appearance by Accentuating the Arch Ring, Relieving the Spandrels by Pilasters and Employing a Special Decorative Feature in the Railing. Barber & Young, Engineers.

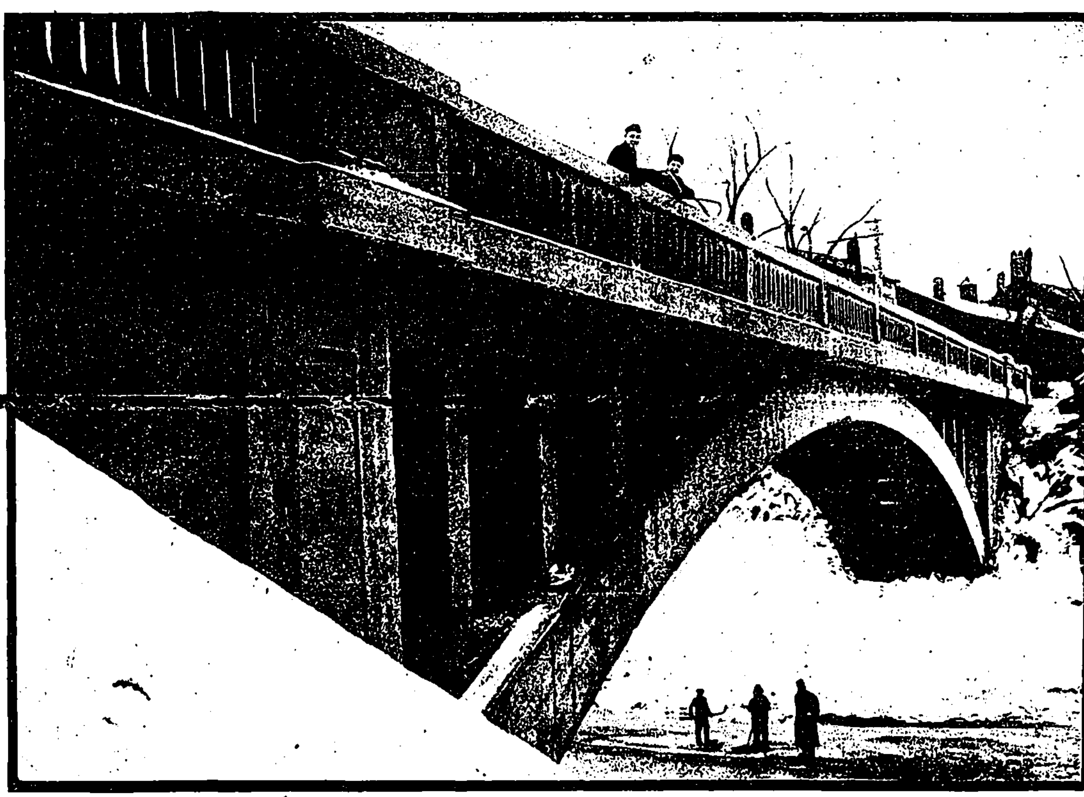


Fig. 6.—The Wadsworth Arch Bridge over the Humber River at Weston, Ont. It is Believed that the Span of this Bridge, 118 Feet 6 Inches, is the Longest Yet Attained in Concrete in Canada, and that This is the Only Completed Example of a Ribbed or Open Spandrel Arch in the Country. Barber & Young, Engineers.

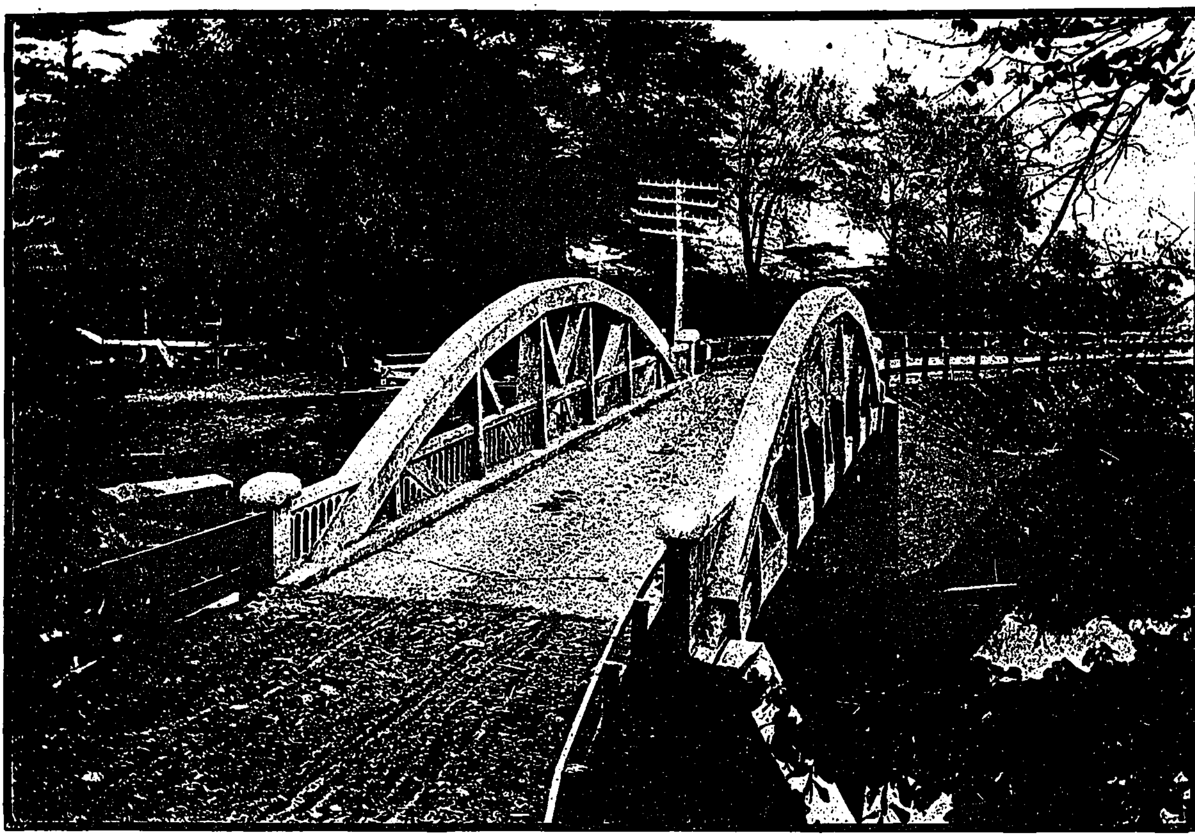


Fig. 1.—The Middle Road Bridge over the Etobicoke River Between the Counties of York and Peel. This 82-foot Span is the Only Concrete Truss Span in Canada, and One of the First in America. Existing Masonry Abutments and a 5 Per Cent. Grade were Among the Conditions Responsible for its Adoption. Barber & Young, Engineers.

THE FITNESS OF CONCRETE FOR HIGHWAY BRIDGES

By C. R. YOUNG*
A.M. Can. Soc. C.E.

A consideration of the properties of concrete construction affecting its suitability for employment in Highway Bridge Work.

WHEN ANY NEW material of construction is introduced, it becomes the duty of the engineer to thoroughly and impartially investigate its properties and fitness for use in engineering works. No one who has the interests of sound and economical construction at heart can afford to adopt a new material without question, or, on the other hand, to dismiss it with a wave of the hand as unworthy of consideration. Who can say that in actual construction, or under service conditions, it may not exhibit serious defects in no way evident upon a first examination, or that it may not possess properties of a value and importance far beyond one's original expectations? Some of the comments made by eminent engineers twenty years ago concerning the improbability of steel ever being extensively used in bridge construction now afford interesting and humorous reading. No small service is therefore rendered the race by any one who aids in defining the value and limitations of a new material of construction.

Reinforced concrete construction has in the past generation demanded and been given that close scrutiny due any promising innovation. While *concrete* is in no sense a new material, having been extensively used well nigh upon twenty centuries ago, the composite material *reinforced concrete* is of modern origin. The earliest recorded use of it was by M. Lambot, a French constructor, who in 1855 built a boat of this material, employing a wire netting to bind the mass together and secure it against cracking. Not long after, in 1867, M. Joseph Monier, a French gardener, constructed pots for shrubs, tanks, reservoirs and other receptacles of the same material. From these small beginnings the use of the material has grown to the most phenom-

*Member of firm of Barber & Young, Bridge and Structural Engineers, Toronto.

enal proportions in little more than a generation. So extensive has its application become, and so unique have been some of its uses, that we are now equally prepared to find it applied to the construction of household vessels and utensils or great arch bridges hundreds of feet in span. This rapid development of a constructional practice must necessarily have been accompanied and rendered possible by a great

Fig. 2.—Deck Girder Bridge of 33 Feet Span on Beecher Street, Brockville. The "Stubby" Appearance of Short Span Concrete Girders with Solid Parapets is Avoided by the use of a Gas-Pipe Railing. Barber & Young, Engineers.

deal of investigation and experiment. The properties of the material and the forms of construction most suitable for its employment have been the subject of patient study and research by thousands of investigators and engineers in Europe and America who have made this particular field the centre of their activities. No phase of the subject has necessitated more careful attention and impartial weighing of evidence than the many serious and disquieting failures which have occurred in reinforced concrete structures and particularly so since in the case of a comparatively novel form of construction the fault is ascribed by most people to the unsuitability of the new departure for strong and permanent engineering works. If in the face of this critical investigation and in spite of many disastrous failures, the use of the material has grown by leaps and bounds, as has been the case, even its most hostile critics cannot but admit that reinforced concrete must possess some very valuable properties and must tolerably well satisfy the test of a suitable material for engineering construction. In discussing the application of the material to bridge work, it will be of particular interest to ascertain how well it conforms to the exacting requirements of this particular class of construction.

The important requirements of any material for bridge work, or of a form of construction depending upon the use of that material, may be stated as follows:

(1) Low initial cost.
(2) Local distribution of expenditure.
(3) Ease and rapidity of field construction.
(4) Reserve strength and reliability.
(5) Adaptability to special construction.
(6) Low cost of maintenance.
(7) Durability.
(8) Freedom from vibration and excessive deflection.
(9) Æsthetic properties.

Low Initial Cost.

(1) Undoubtedly the first test which any new material or form of construction for bridge work must pass is its commercial practicability. In this regard concrete, both plain and reinforced, possesses some important merits. It is well known that while concrete, like stone, has but little resistance to tension, it has a high compressive strength. A field of application for the resistance of stresses might therefore be found in such parts of a structure as are subjected to compression, but its practicable use in these parts would depend upon the cost being lower than for steel or some other material performing an equal service.

Under ordinary commercial and constructional conditions now obtaining, the cost of the concrete required to resist a certain compressive stress is less than that of the steel required for the same purpose. Assuming permissible compressive and bending stresses on concrete as 450 and 650 pounds per square inch respectively, and similar stresses on structural steel in columns and beams as 12,000 and 16,000 pounds per square inch, and further, assuming the cost of concrete in columns and beams as $10.00 per cubic yard, including forms, and the cost of structural steel at 5 cents per pound erected, we find that plain concrete columns or posts cost about two-thirds as much as steel columns and the compression halves of beams about 40 per cent. as much as the similar portions of steel beams.

With this in view, it is to be expected that a saving in cost may be effected in many instances by using concrete rather than steel in viaduct posts, beam or girder spans and arches. For example, the writer's firm found recently as a result of a careful estimate that the bents of a viaduct 48 feet high could be constructed of reinforced concrete for 70 per cent. of the cost of steel bents. Short girder spans can

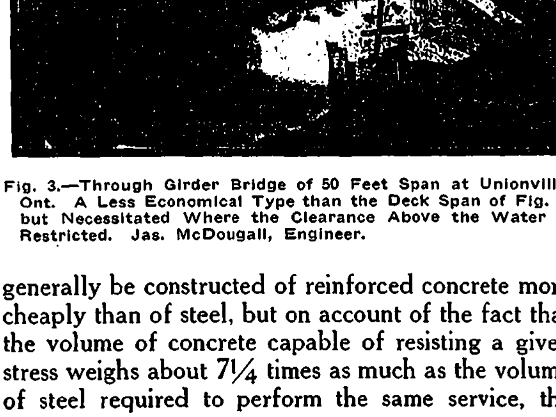


Fig. 3.—Through Girder Bridge of 50 Feet Span at Unionville, Ont. A Less Economical Type than the Deck Span of Fig. 2, but Necessitated Where the Clearance Above the Water is Restricted. Jas. McDougall, Engineer.

generally be constructed of reinforced concrete more cheaply than of steel, but on account of the fact that the volume of concrete capable of resisting a given stress weighs about 7¼ times as much as the volume of steel required to perform the same service, the weight of girder spans much over 50 feet in length becomes very great and they can no longer be built in competition with steel. Thus, the cost of the superstructure of the Beecher street bridge, Brockville (Fig. 2), a structure of 33 feet span, was, according to actual tender, some 10 per cent. less than

Fig. 4.—A Comparatively Plain but Pleasing Arch Bridge of 70 Feet Span at Kirkham's Mills, Township of Scarboro'. This is a Type of Permanent Structure Suited to Rural Situations where the Foundations and the Rise are Satisfactory. Barber & Young, Engineers.

it would have been if constructed of steel, and the same may be said of several similar spans built for the same town during the last year. The 50 ft. concrete girder span at Unionville, Ont., shown in Fig. 3, illustrates a structure of about the limiting size for economical girder construction in reinforced concrete. On account of the special care required with the foundations of arch bridges, the relative costs of concrete arch bridges and of steel structures is largely governed by this feature. It may be said, however, that assuming the same treatment of foundations in the two cases, very often a concrete arch bridge may be constructed at no greater cost than a steel bridge of the same capacity as in the case of the Timothy street bridge, Newmarket (Fig. 5), the Kirkham bridge, Township of Scarboro (Fig. 4), and the Wadsworth bridge, Weston (Figs. 6, 7 and 8). For highway spans of over 50 feet the exigencies of competitive bidding quite frequently throw the advantage one way or the other, showing that there is little difference in cost under the same conditions.

Local Distribution of Expenditure.

(2) The distribution of the expenditure for a bridge is often of importance to a community. For example, if a bridge is to be constructed in a town possessing a bridge shop employing local labor, it would be of some advantage to the community to have part of the cost of the superstructure returned to the people in wages. Such cases are not very common, however, since it generally happens that a steel structure is purchased at some distance from the location of the bridge and the cost of it is taken out of the district. With concrete structures, on the other hand, a large part of the cost is returned to the residents of the locality for sand, stone or gravel, lumber, teams and labor. In general, the cement and reinforcing steel must be purchased elsewhere, but in the typical case, assuming an all-concrete structure, 75 or 80 per cent. of the total cost would be spent in the community as against 40 to 50 per cent. of the cost of a steel bridge with concrete substructure.

Ease and Rapidity of Field Construction.

(3) Concrete superstructures are, in practice, not generally erected as quickly or as easily as superstructures of steel, whatever may be said in theory. In the case of the latter, assuming reasonable delivery of steel from the mills and promptness on the part of the contracting bridge company, the steel for a bridge of moderate proportions can be delivered at the site of the bridge by the time the substructure is completed and sufficiently seasoned to allow erection to proceed. This being the case, the steel bridge can be completed in quicker time, since the construction of falsework and the assembling, riveting up and construction of the floor is a much less laborious and lengthy operation than is involved in the building of falsework and forms for a concrete bridge, the placing of reinforcement and concrete, curing, stripping, and finishing. In any work in which the element of time is an all-important factor, the choice of a steel superstructure is therefore advisable. Although concrete work has been, and is constantly, carried on

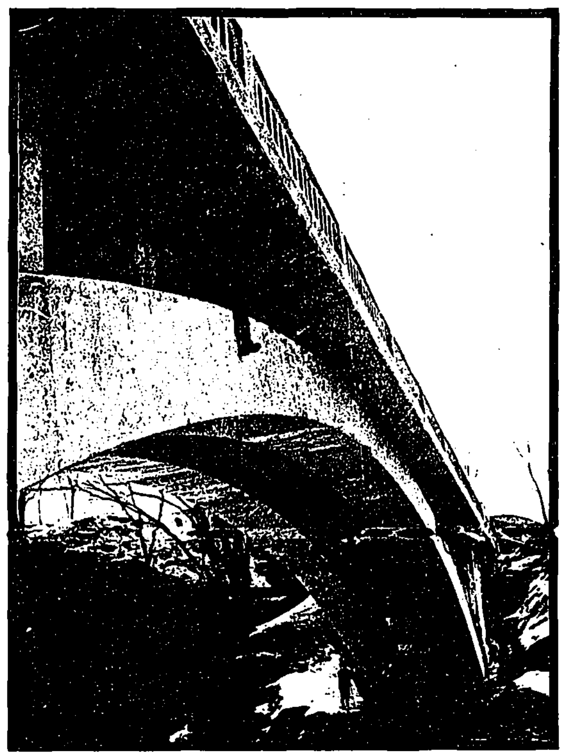


Fig. 7.—A View of the Wadsworth Bridge, Weston, from Underneath. The Massiveness of the Ribs and the General Size of the Structure is Apparent by Comparison with the Figures in the Illustration. Barber & Young, Engineers.

successfully in frosty weather, its prosecution is always attended by added cost and trouble, so that the liability of construction work continuing into cold weather should be given full consideration in the choice of the kind of bridge.

Reserve Strength and Reliability.

(4) A property of concrete of great importance in bridge construction is its increase of strength with age. Instead of growing weaker as time passes, its powers of resistance are augmented so that a *good* concrete a year old is 45 per cent. stronger than the same concrete when a month old, and the growth of strength still proceeds, but at a less rapid rate. This does not, of course, mean that the strength of an entire bridge of reinforced concrete increases with age or that it will safely accommodate a heavier loading than that for which it was originally designed. To take this advantage of the increased strength of the concrete, it would be necessary to make special provision in designing the portions of the structure subjected to tension by increasing the amount of reinforcement.

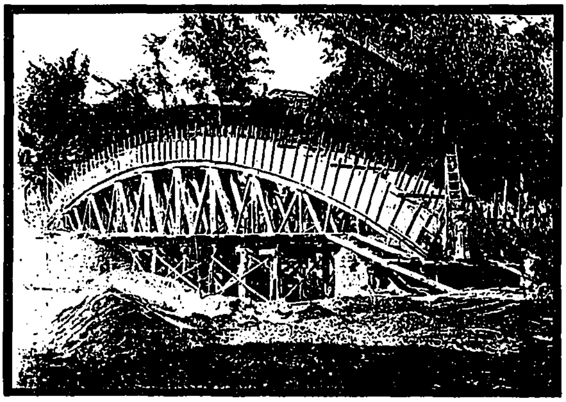


Fig. 8.—The Wadsworth Arch Bridge, with the Rib Forms Erected. These Forms were Supported by Distributing Trusses Resting Upon Timber Bents Founded on the Rocky Bed of the River. Barber & Young, Engineers.

The degree of confidence which may be reposed in a concrete bridge is in direct ratio to the care with which it has been designed and constructed. On account of the *apparent* simplicity of concrete construction, much more liberty is taken with it by the layman than would be thought of with a steel structure. Quite frequently the design is by a local handy-man, or if not, the construction is probably supervised by some one whose previous experience with this material is limited to the building of a barn wall or a silo. Little wonder need therefore be expressed if the materials are bad, the mixture poor, the reinforcement misplaced or insufficient, the foundations shallow and the entire work sloppy and disreputable. With such work many disastrous failures have occurred and will continue to occur until those interested learn that the design and construction of reinforced concrete bridges is a matter requiring a great deal of special knowledge possessed only by engineers experienced in this class of work.

Adaptability to Special Construction.

(5) Since concrete may be moulded in almost any form, it is of great use in bridge work for many cases of special construction. Thus its use in floors for steel highway bridges has become practically universal in Ontario during the last 10 or 15 years, and has solved the problem of the increasing difficulty of securing suitable timber for such work at a reasonable cost. Although the material has been used for a great many years in sub-aqueous work in piers and abutments, its use above water has revolutionized the construction of bridge substructures in 15 or 20 years. While formerly timber or stone masonry were used exclusively, but very few examples of recent construction of this type could be found in the country. Moulded rails and railing posts for bridges with concrete superstructures make it possible to employ a harmonious design throughout, as in Figs. 2, 4, 5 and 6. Fitting a bridge to a particular local condition is often facilitated by the use of concrete. For example, in the case of a horse-shoe culvert for the Toronto and York Radial Railway at Newmarket (Fig. 9), the structure was fashioned to support and retain the fill with the least possible amount of material.

Low Cost of Maintenance.

(6) Concrete bridges which have been properly designed and constructed so that no cracking has occurred to permit the entrance of water to the embedded steel, and which contain no poor or deteriorating material, should require no maintenance. Painting, an important item of expense in steel bridges, is sot necessary in structures of concrete. Indeed, the only maintenance charge on a properly constructed concrete bridge would be the re-gravelling of the roadway for a structure carrying a fill and possibly the re-filling or re-caulking of expansion joints.

Durability.

(7) No concrete bridge work (except sub-aqueous foundations) of an age over 15 to 20 years existing in Canada, an estimate of the probable life of such structures in our climate must of necessity be based upon conjecture. In other lands there is abundant evidence of long life for such bridges. In ancient Rome, concrete bridges and domes built upwards of 2,000 years ago are standing to-day, but little impaired by time. Some 75 miles below the City of Mexico there is an old concrete highway bridge consisting of two spans of 40 feet each, built in the early part of the sixteenth century. The fact that it is

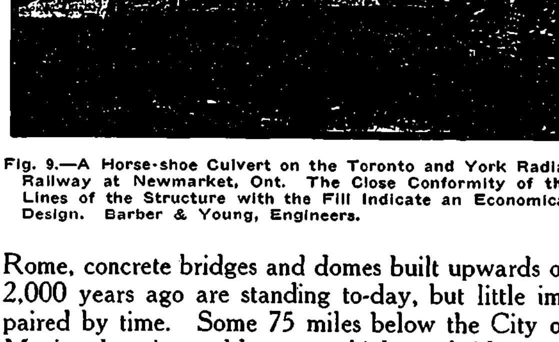


Fig. 9.—A Horse-shoe Culvert on the Toronto and York Radial Railway at Newmarket, Ont. The Close Conformity of the Lines of the Structure with the Fill Indicate an Economical Design. Barber & Young, Engineers.

now used as a railway bridge is satisfactory proof of its successful defiance of the elements for four hundred years. The earliest reinforced concrete bridge in America was an arch span erected in Golden Gate Park, San Francisco, in 1889, or some 21 years ago, and while its existence has not been of long duration, it has during that time proved entirely satisfactory. Basing one's opinion upon the evidence obtainable from structures in other lands, and bearing in mind that stone masonry, a material offering greater opportunity of attack by the elements, has endured for centuries in our climate, it seems reasonable to expect of well-constructed concrete bridges a life of at least a hundred years, and in all probability one of much greater duration.

Freedom from Vibration and Excessive Deflection.

(8) On account of the great weight of a concrete bridge in relation to the loads to be supported, the vibration accompanying the rapid passage of moving loads is almost imperceptible. For this reason there is little likelihood of an all-concrete highway bridge ever being prejudicially affected by the trotting of horses over it. The trifling impact effect resulting from any such causes would be quite insufficient, in the opinion of the writer, to ever break the bond of the steel to the concrete—the only serious development which might be feared. The deflection in an all-concrete bridge under live load is also trifling and capable of determination only by precise measurements, for the reason that the load is in general small in comparison with the dead weight of the structure itself. This in itself conduces to longevity of the bridge, since the racking effect of secondary stresses on the joints is thereby reduced to a minimum. Apart from the probable effect of excessive vibration and deflection on the life of a bridge, it is wise for sentimental reasons alone to avoid these, since most people regard a bridge which is subject to pronounced vibration and deflection as a weak and unsafe bridge. In this regard the application of concrete to bridge work has effected a most valuable improvement, for no other form of structure except the masonry arch is so singularly free from these objectionable characteristics.

Æsthetic Properties.

(9) Concrete being so closely akin to stone, the material in which the development of architecture has taken place, permits of artistic expression not possible with wood or steel. Slavish copying of constructional features from stone architecture does not give the desired results, however, and new and artistic forms are being developed in which the suggestion of a poured material is conveyed by long curves and the absence of joint lines. Forms of structures not generally built in steel for small bridges because of increased shop costs, may sometimes be moulded of concrete at no additional cost over less attractive ones. For example, the reinforced concrete trusses of the Middle Road bridge (Figs. 1 and 10) cost no more with a curved top chord than they would have cost with parallel chords. One serious drawback which concrete possesses from the æsthetic point of view, however, is its unsightly appearance unless given a special surface finish. No matter how well designed or carefully constructed a bridge may be, if *the* surface is blotched or discolored and exhibits pronounced form marks or evidences of patching, the good work of the engineer in all other particulars will be overlooked. There is no use, therefore, in attempting to secure a pleasing design unless the surface is left of even texture and of uniform color by some suitable finishing process.

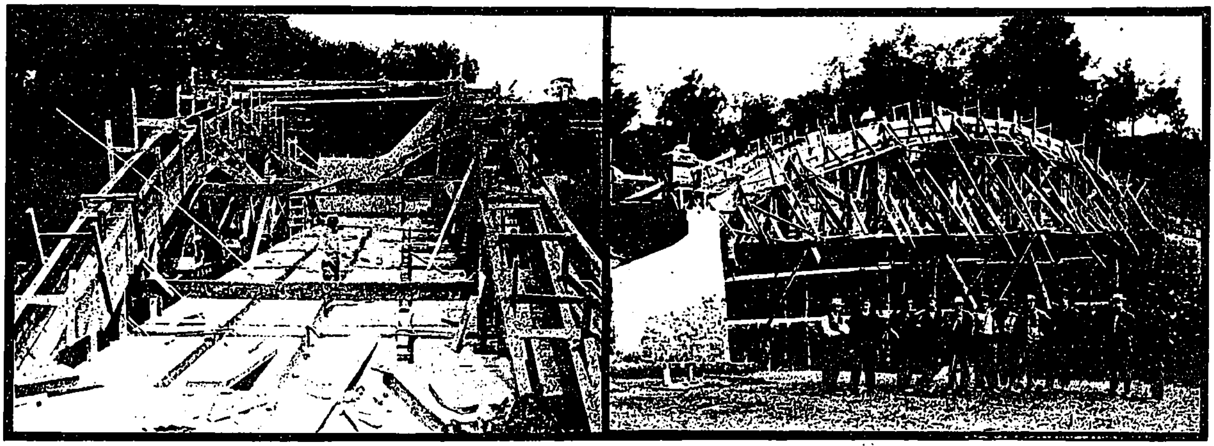


Fig 10.—Two Stages in the Construction of the Forms of the Middle Road Bridge. In this Type of Structure the Form Work Constitutes a Large Part of the Cost, but is Largely Offset by Economy of Material. Special Care was Taken to Detect and Prevent any Lateral Movement of the Trusses During Concreting. Barber & Young, Engineers.

Types of Concrete Bridges.

The forms of concrete structures, heretofore found desirable for bridge work, are the girder, the arch, and the truss span. Each of these forms possesses its own special merit and the choice of type for a given situation will be governed solely by a careful study of local conditions.

The concrete girder has, as has already been pointed out, the virtue of employing a relatively cheap material—concrete—for its compression flange, and using steel only where concrete would be incapable of economical service. In the form of the deck girder, that is where the main girders lie wholly beneath the floor, as in Fig. 2, the concrete girder has its most economical application, for the floor slab in this case performs the double duty of transferring the loads to the girders and acting as the compression flanges of the girders The through girder span, shown in Fig. 3, is not as economical since the main girders must be placed far enough apart to provide the prescribed clear roadway, and since heavy reinforcement must generally be provided in the top flanges of the girders to compensate for the small area of concrete available. In many instances, of course, the through type must be adopted because of restricted height above the water.

In the form of the arch, concrete had its first introduction to bridge work. As a material exactly analogous to stone it would be expected that a field of application would first be found for it as a substitute for the older material and the most rational employment of it was in arches or in the only situation where stone could be employed in bridge work. While within the legitimate field of the reinforced concrete girder—under 50 or 60 feet in span—there is little difference in cost between a girder and an arch span for the same crossing, the spandrel-filled arch, at least, possesses two most valuable points of superiority. The loads which most seriously tax our bridges and are generally the immediate cause of their replacement are the heavy and constantly increasing concentrated loads consisting of threshing engines, road rollers or motor trucks. Such loadings as these produce maximum stresses in the floor system of a girder span or of an open spandrel arch, but do not affect spandrel filled arches at all seriously. The uniformly distributed load of a large herd of cattle is more serious on such a structure than a concentrated rolling load, but since the former loading does not increase in weight from year to year a properly designed bridge of any type is not likely to suffer from this cause. The spandrel-filled arch therefore possesses important reserve strength for future increases in rolling loads not shared by the girder. Another advantage attaching itself to the concrete arch of either the full or the open-spandrel type is the fact that the reinforcement of the rib of a properly-designed arch is never called upon to perform full duty except during the conjunction of a special loading with the extremes of heat and cold, and then only for a short time. Since the probability is that these particular loads will not happen to pass over the bridge at the time when the temperature at the bridge site is at the extreme limit, an every-day additional element of security exists in the reinforced concrete arch. On the other hand, the engineering difficulties attending the design and construction of a concrete arch span are very much greater than for a girder span. The safe and economical design of an arch is an exceedingly laborious and difficult proceeding. Unless the designer wishes to take chances or is willing to waste material, this work cannot be avoided. Securing a structure against cracking by proper reinforcement or by expansion joints is another delicate task not at all likely to be appreciated by the layman. Further, the adoption of the concrete arch is indefensible unless a rigid, immovable foundation bed can be secured. In general this will preclude the construction of arches on soft clay or sand foundations, although it can be done successfully by careful batter piling or by the provision of abutment ties. In no particular is more sane judgment required than in the foundation problems connected with arches.

Beyond the natural field of application of the reinforced concrete girder and where an arch is impracticable because of insufficient rise or poor foundations, the reinforced concrete truss span such as shown in Fig. 1 may be advantageously employed. In spite of the objections which have naturally been raised to a structure of this novel type, there is no reason why it should not be employed wherever economically practicable. There may be some just cause of objection to the concrete truss span without diagonals, in which the distortion of the panel must be resisted wholly by the stiffness of the joints, but the same objection cannot be registered against the truss with diagonals, such as that of Fig. 1. If it is legitimate to employ reinforced concrete beams in which exist tensile stresses of as great magnitude as the compressive stresses, surely it is permissible to use a form of structure containing tension members of reinforced concrete, especially if ample reinforcement is inserted at the joints to take care of secondary stresses, as was done in the case of the Middle Road bridge.

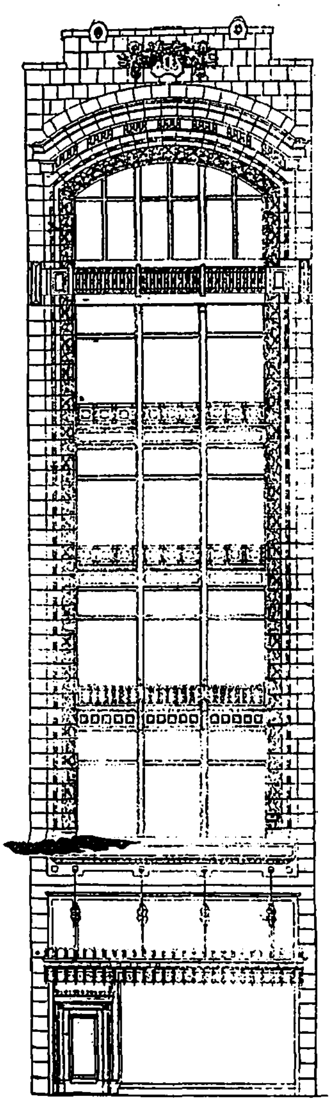
Having regard, therefore, to the tests to which a new form of construction must conform in order to possess fitness for bridge work, it appears that concrete is in general a very satisfactory material and one which, when properly employed, cannot fail to prove a most valuable asset to the constructor. It must be pointed out, however, that it possesses some serious limitations, among which is the *apparent* simplicity of its use. Persons possessing no special knowledge of the material or of the forms of construction to which it is applied, are thereby often led to attempt, to their subsequent sorrow, work which only an expert would be justified in undertaking.

The structures illustrated in this article are among those recently designed and erected under the supervision of Barber & Young, Bridge and Structural Engineers, Toronto, with the exception of the Unionville girder (Fig. 3), which was designed and erected under the former engineer of the County of York, the late James McDougall.

CONCRETE AND SAWDUST is a somewhat unusual combination adopted in the super-floor construction of the new public library at Springfield, Mass., in order to secure a suitable base on which to lay a cork carpet and into which nails could be driven. Several experiments were necessary to get the exact proportions required for a durable surface, but this was eventually determined to the satisfaction of all parties concerned.

MASON & RISCH PIANO WAREHOUSE TORONTO

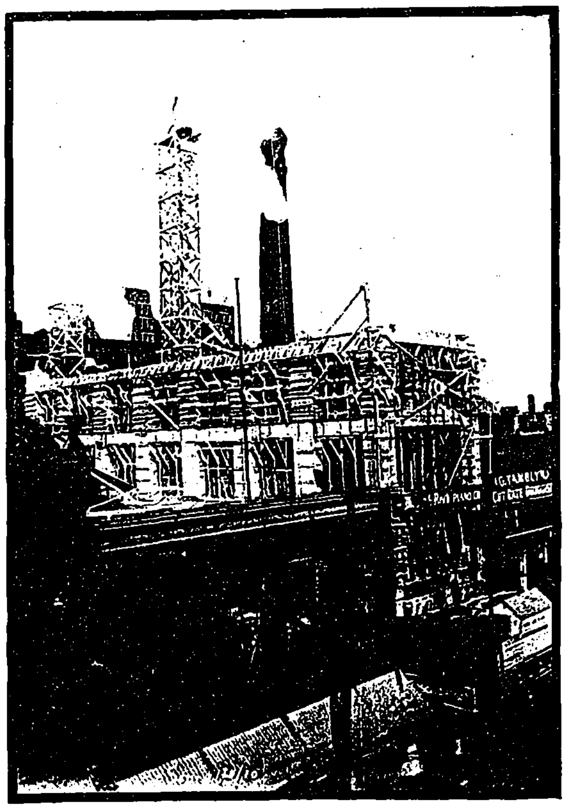
An exemplification of the use of concrete and hollow tile in modern building construction. Problems encountered and overcome, and features of plan.



Front Elevation, Mason and Risch Piano Warehouse, Yonge St., Toronto. Bond and Smith, Architects.

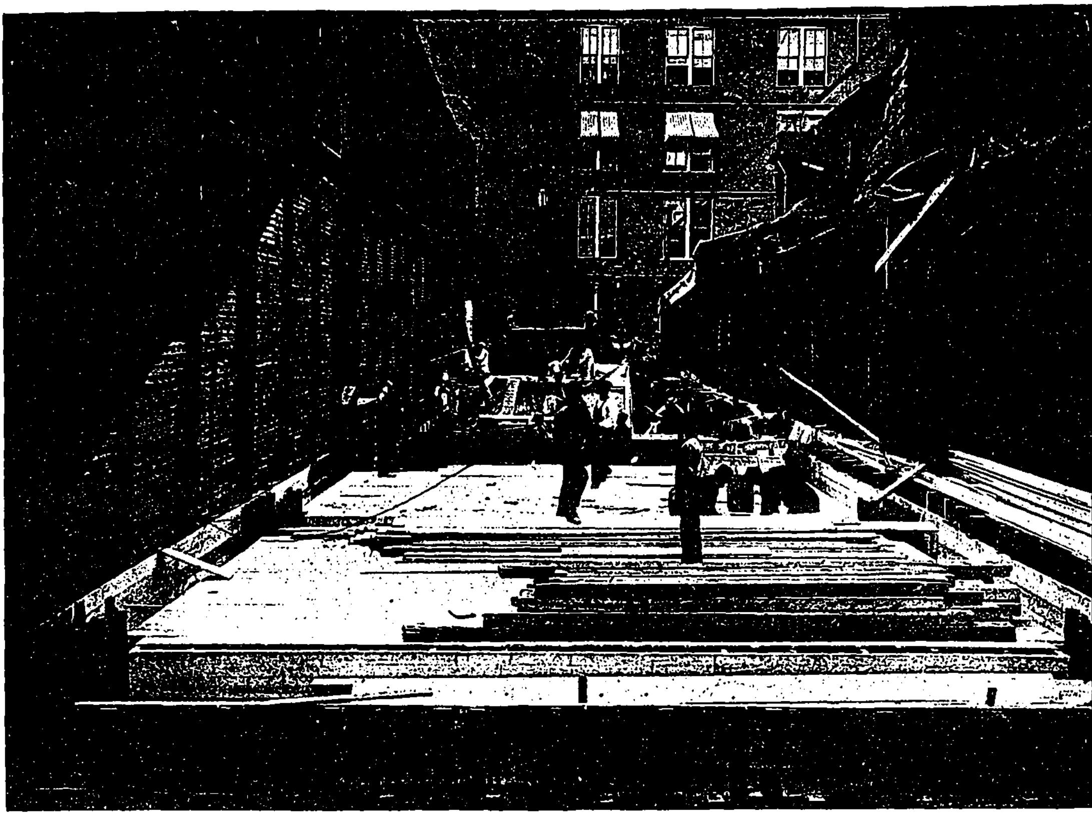
THE MASON & RISCH piano warehouse, now under construction at 230 Yonge street, Toronto, presents many noteworthy and interesting features. Ultimately it will be a ten story building, and the footings and columns have been designed with this end in view. At the present time, however, not more than six storeys and basement will be built.

On account of the narrow lot it was necessary to scrutinize very carefully the different methods of construction to determine which would take up the least room. As large buildings are contemplated on either side, an arrangement was entered into by which the centre line of the walls and columns of the Mason & Risch building would coincide with the party line in each case, thus saving to each interested party as much space as would ordinarily have been occupied by half the thickness of the walls. In other words, the walls and columns are built to be common to both buildings. Skeleton construction in reinforced concrete was finally decided on, both on account of the economy in space as well as cost. Only wall columns are employed and these only twenty inches thick, three inches only being on the lots on either side. The necessary strength was secured by enlarging the columns along a line parallel with the longitudinal axis of the building. A special means for providing a connection with the proposed new building had to be devised by the architects. This is illustrated in the small diagram A. The columns are built projecting three inches on the next lot, but they carry the whole of the party wall. The new column required when the proposed adjacent building is erected will have to carry only the floor and roof panels of the new building. Consequently it need not be so large as the present column, which is shown by dotted line in the diagram. It will be seen that in this way the architects have secured an equitable and symmetrical solution of the problem. The

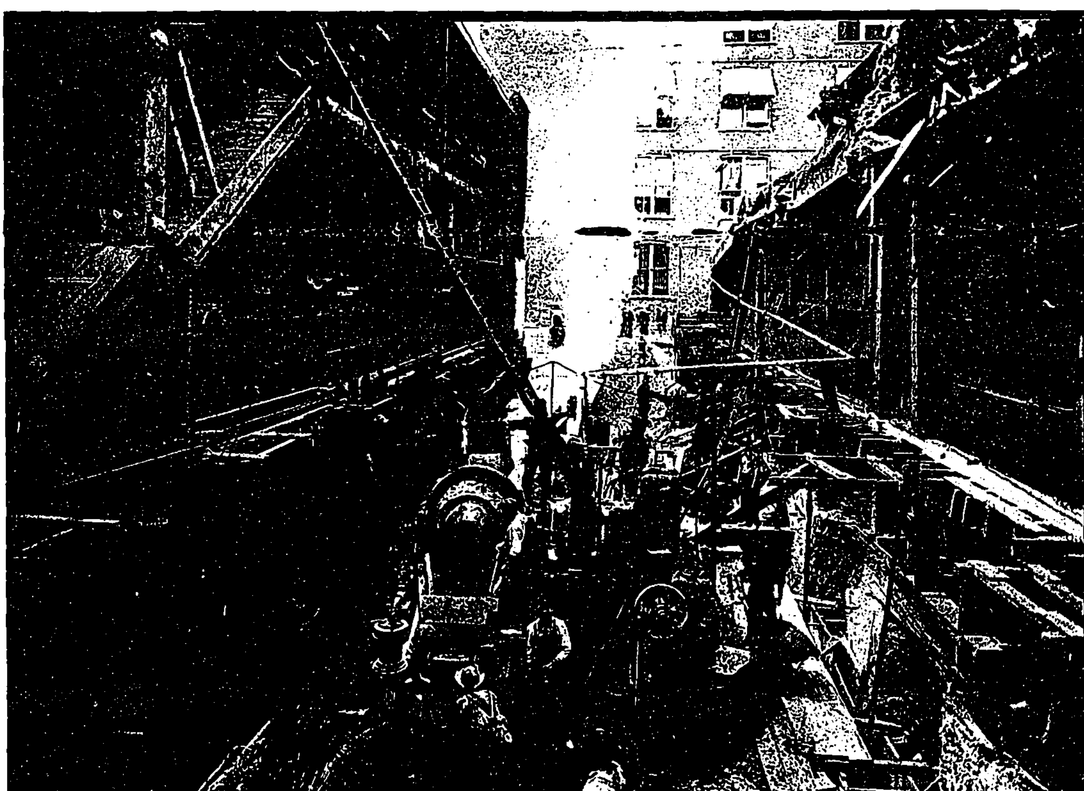


Progress View, Mason & Risch Piano Warehouse, Toronto. Showing the Form Work. The Tower on the Right Indicates the Ultimate Height of the Building. Bond & Smith, Architects.

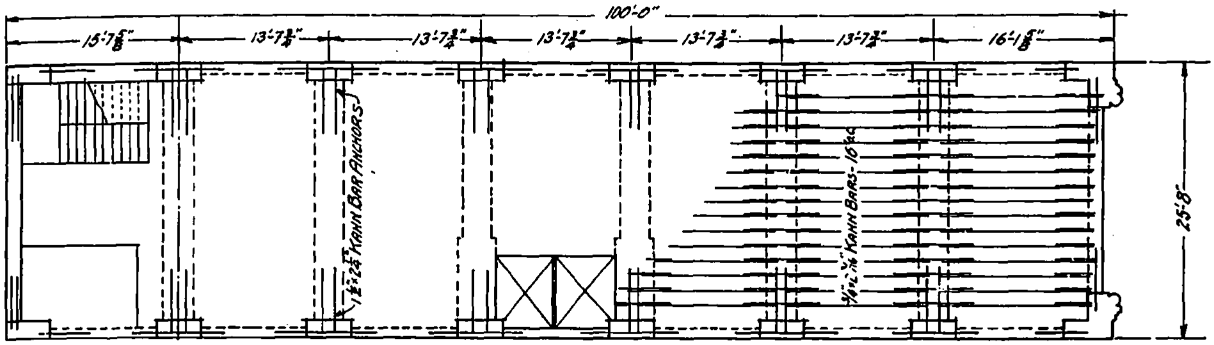
dotted line of course presumes a concrete column. If a steel column, fireproofed, be used, it will naturally be larger, as it will require to be surrounded by about nine inches of brick.



Progress View, Mason & Risch Piano Warehouse, Yonge Street, Toronto. Showing the Hy-Rib Wall (partly plastered) Which was Put in Position to Enclose the McKendry Millinery Store on the South Lot Before the Brick Work of the Intervening Party Wall was Carried Up. Bond & Smith, Architects.

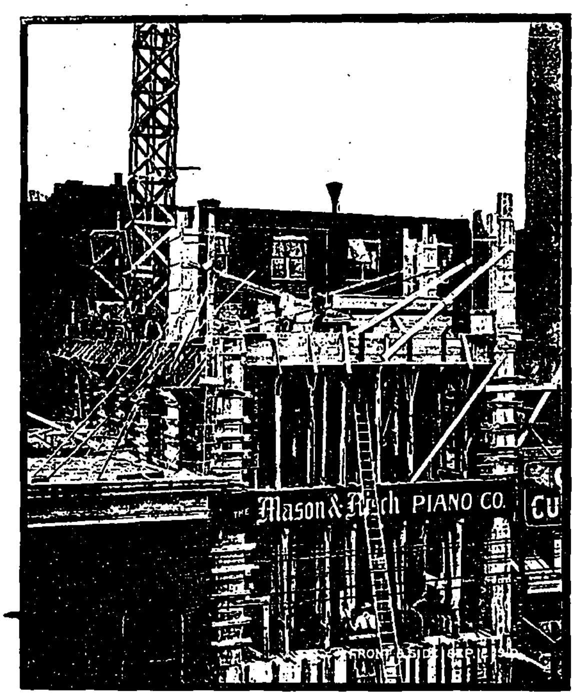


Progress View, Mason & Risch Piano Warehouse, Yonge Street, Toronto. Showing the Concrete Mixer and Limited Space Available in Which to Carry on Operations. On the Left is Seen the Beginning of Column Steel Before Column Boxes Have Been Placed. Bond & Smith, Architects.



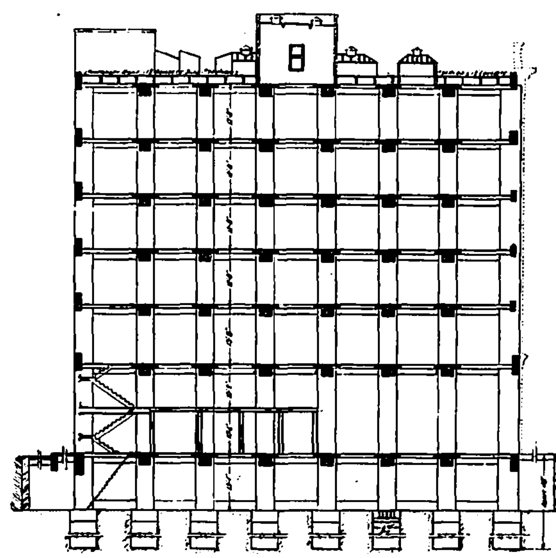
Typical Floor Plan, Mason & Risch Piano Warehouse, Toronto. Showing the Spacing of Beams, Columns and Floor Steel, Together With the Length and Width of the Building. Bond & Smith, Architects.

It was originally intended to have a large concrete footing under the walls and columns, but as the bearing value of the soil when tested was very low,



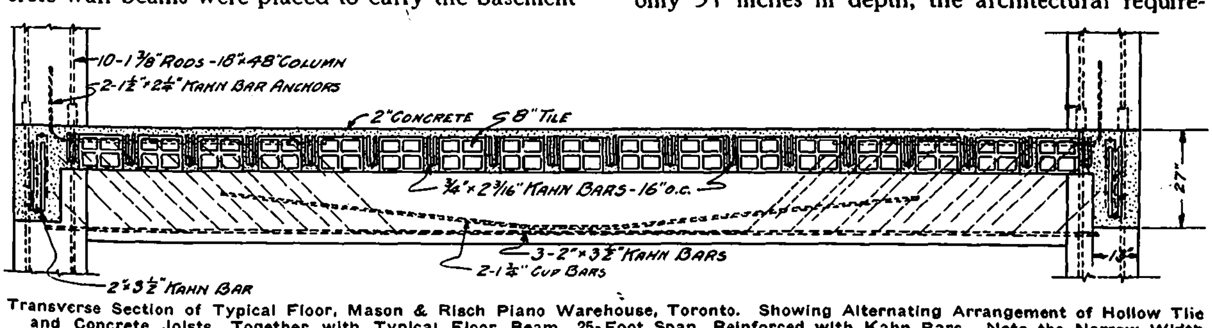
View of Mason & Risch Building, Toronto. Showing the Structure Up to the Fourth Story, Thirty-five Days After Foundation Was Completed. Bond & Smith, Architects.

it was decided to carry caisson footings to solid rock. These caissons are circular in design, 8 ft. in diameter under each column. Rock was reached about 48 feet below the sidewalk level. Between the caissons at about the basement floor level, reinforced concrete wall beams were placed to carry the basement walls. It might be interesting to note just here the adaptability of concrete. The narrow lot made it necessary to economize on every inch. The columns of the Mason & Risch building, as has been said, are only 20 inches thick, but despite this they are of enormous strength. This result is obtained by



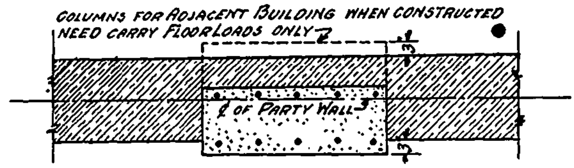
Longitudinal Section, Mason & Risch Piano Warehouse, Toronto. Bond & Smith, Architects.

spreading the column along the longitudinal axis of the building, making it oblong in shape; in other words, the dimensions being 20 inches thick, and 4 feet long. Then again the same facility of concrete for lending itself to particular or exacting conditions may be noted in the construction of the beams. Although these beams have a span of 26 feet and carry 14-foot panels, warehouse loading, they are only 31 inches in depth, the architectural require-

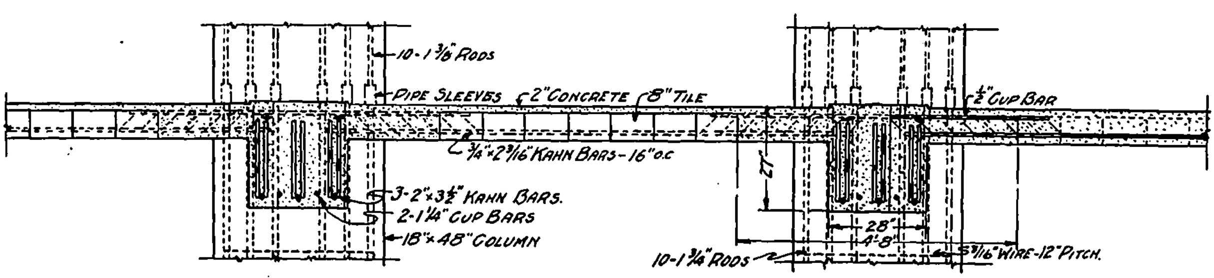


Transverse Section of Typical Floor, Mason & Risch Piano Warehouse, Toronto. Showing Alternating Arrangement of Hollow Tile and Concrete Joists, Together with Typical Floor Beam, 25-Foot Span, Reinforced with Kahn Bars. Note the Narrow Width of Column. Bond & Smith, Architects.

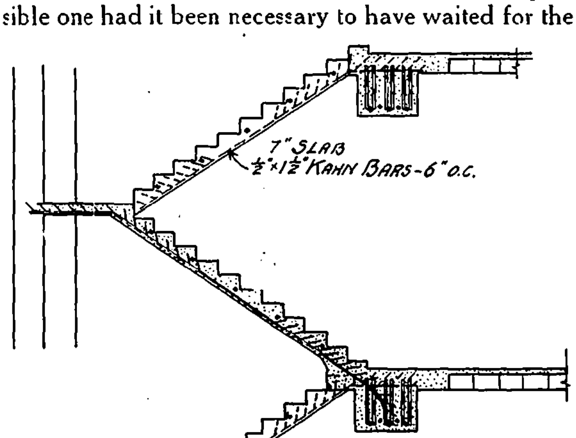
ments imposing this restriction. The necessary amount of concrete in compression is obtained by widening the beams and using a portion of the adjacent slab as a stiffener or for compressive value, the whole being technically known as a "T" beam. Another feature of this building was its rapid erection. The old building was wrecked and site cleared early in July, the excavations completed and caissons and foundations begun on August 1st. In almost two months, these were carried 48 feet below grade level to solid rock, the six-story superstructure and basement built, the roof placed and half the brick walls carried up. This was accomplished in face of the fact that two other large buildings, one on the north and the other on the south, had to be supported, the old walls torn out and replaced with new walls, and that the work had to be done on a site almost inconceivably congested with equipment and materials. Of course this was only possible by working night gangs. A narrow lane at the rear helped matters somewhat, and as each floor was built, or a short time after, additional space became available. Speed was a prime factor, as the owners were bound by agreement to have the walls of the adjoining building, occupied by the Wm. McKendry millinery establishment, rebuilt and finished by August 20th, in time for the fall opening and the National Exhibition. About the 1st of August work was just started above the basement floor level, and it looked doubtful if the owners' undertaking could be carried out. The task in fact would have been an impossible one had it been necessary to have waited for the walls of the new building, but at this point the architects solved the difficulty for all parties with a scheme as novel as it was ingenious, nothing less than doing the plastering and interior finish called for in the McKendry store before the brick wall was carried up to it. Afterwards, the brick wall was built up against the plaster, which reverses the procedure usually adopted. The solution was made practicable in the first instance by a requirement of the City Architect, which at first thought appeared a hardship. It was required that a light steel framework be provided to carry the ends of the joists of the McKendry building while the wall was being rebuilt. This consisted of a light steel column about 14 feet on centres, across the top of which was an "I" beam, supporting the ends of the joists. Since a steel framework was called for, it was utilized as a support for sheets of Hy-Rib, a form of reinforcement for walls, partitions and concrete slabs, consisting of steel lath and channels combined in one sheet and doing away with studs and joists. This Hy-Rib was laid horizontally from column to column and plastered, and a rigid finished wall, which had also been waterproofed, was ready for the McKendry firm on August 19th, on which date they moved back their cases and shelves to the new wall, a day ahead of the specified time. Afterwards the brick wall was built against the plastered Hy-Rib, the Hy-Ribs so called providing furring and a 3/4-inch air space. The floors of the new building were constructed of hollow tile blocks, placed end to end between the beams in rows at 16 inch centres, allowing a 4 inch concrete joist between. These blocks were 12 x 12 x 8 inches in depth. Over all was laid 2 inches of concrete, which in turn will carry a 2-inch strip, or cinder concrete fill having embedded 2-inch wooden strips at 16 inch centres, to which the floor boards will be nailed. This construction gives a floor that is not only light in itself, but sound proof and resonant, which feature is an important consideration in a piano warehouse. Attention might be called in this connection to a novel theory of the owners, which it is proposed to adopt by placing the nailing strips



Mason & Risch Piano Warehouse, Toronto Diagram A, Showing Portion of Party Wall. Note the Method Adopted to Provide Connections for Proposed Building on Adjacent Lot. Bond & Smith, Architects.



Longitudinal Section of Typical Floor, ason & Risch Piano Warehouse, Toronto. Showing Location of Columns and Disposition of Steel Bars. Although the Columns are Approximately 14-Foot Centres, Making the Floor Panel 14x25 Ft., it Will be Noted that the Total Thickness of Hollow Tiles and Concrete Joists is Only 10 Inches. Bond & Smith, Architects.



Details of Concrete Stairs, Mason & Risch Piano Warehouse, Toronto. Bond & Smith, Architects.

in the cinder concrete at regular intervals corresponding to the node points in a musical note.

The concrete used throughout the building was the regular 1:2:4 mix, the cement mortar in the Hy-Rib walls being a 1:3 mix, with Trus-Con waterproofing paste added, which was also used in the basement floors and walls. In carrying out the work, the standard specifications of the Trussed Concrete Steel Company were followed, except where different from the city building by-law, in which case the latter was adhered to.

The foregoing describes in a general way the structural features of this building. When completed it will be as fireproof as modern science can devise and will boast of the most modern installations in heating, lighting and ventilating equipments and in artistic appearance both on the exterior and interior. It is intended to be excelled by no other building of its kind in the city.

The architects, Messrs. Bond & Smith, who evidently spent much time and thought in preparation of the plans and in carrying out the project, have succeeded admirably in solving the many difficult problems which were presented from time to time, owing to the limited space for operations and the limited time for the execution of the contract. As previously stated, one of the considerations which influenced the architects to use reinforced concrete was the question of cost. Tenders were called for on a structural steel job, but the figures submitted were found to be $7,000 in excess of the amount required for erecting the building in reinforced concrete. The Kahn system of reinforced concrete was used throughout. The contractors were the Bishop Construction Company of Toronto and Montreal, who not only turned out a most satisfactory job, but did so expeditiously, and in a thorough workmanlike manner. T. H. Sinclaire was the contractors' superintendent of construction, and Alec. Browning the architects' representative on the ground.

MERIT OF INVESTMENT

A PAPER ENTITLED "Building Construction from an Investment Point of View," was read by Mr. G. Richard Davis of New York, before the recent convention of Building Managers and Owners, held at Washington, D.C. While the author dealt with large apartment buildings in his own city, some of his remarks will prove of interest to Canadian architects.

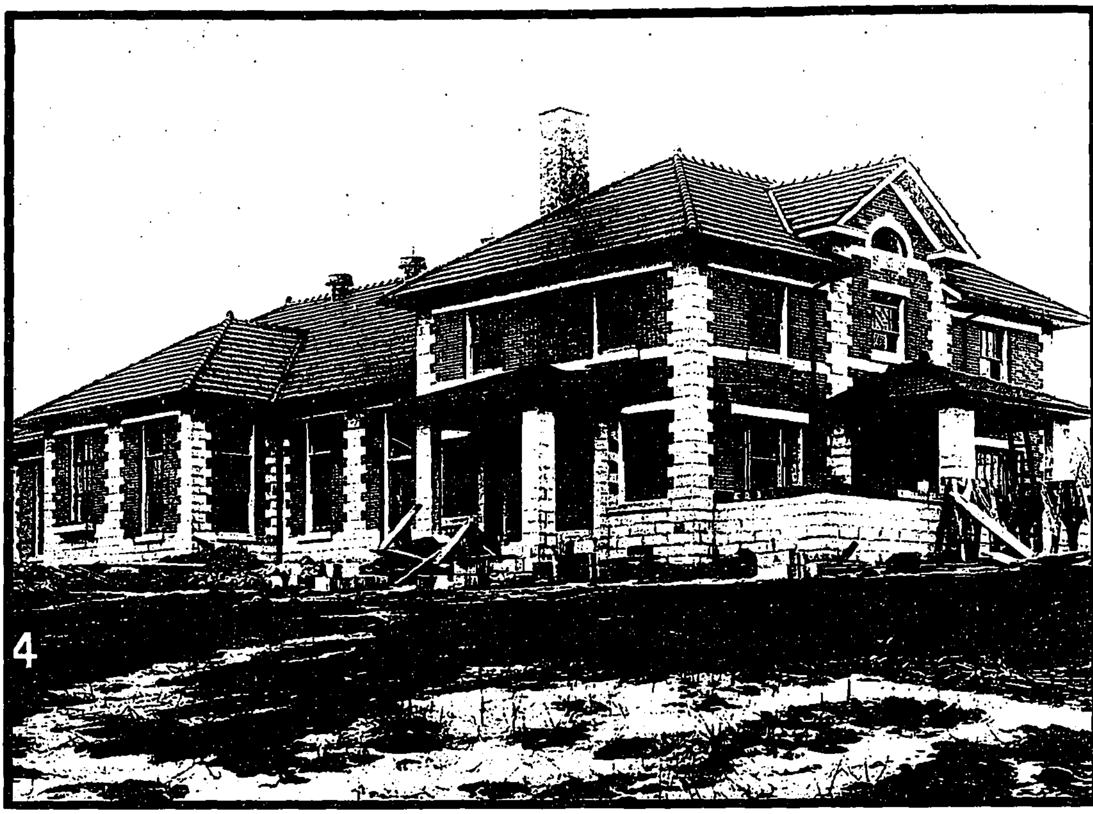
The ideal apartment building, from the standpoint of the investor, he pointed out, is that building which is so constructed as to yield a maximum income at a minimum cost of erection and maintenance consistent with the best methods and workmanship of construction.

The author stated that, interviewing 100 tenants, all occupants of a high-class apartment house, putting to them the question as to what points they considered the most vital in renting apartments, the answers obtained were practically unanimous in placing the importance of the following considerations in this order: First, location; second, light and air; third, size of rooms; fourth, arrangements; fifth, equipment; and sixth, character of finish, style, etc. An important consideration is how the building is finished, for the more attractive the structure the quicker it will draw tenants. A pleasing elevation of a building is desirable, but it is needless to say that extravagance is as bad as false economy, or more so, and the amount of money spent on the front elevation of many of our finest buildings has greatly increased the cost of construction, while adding little or nothing to the rentability of the building.

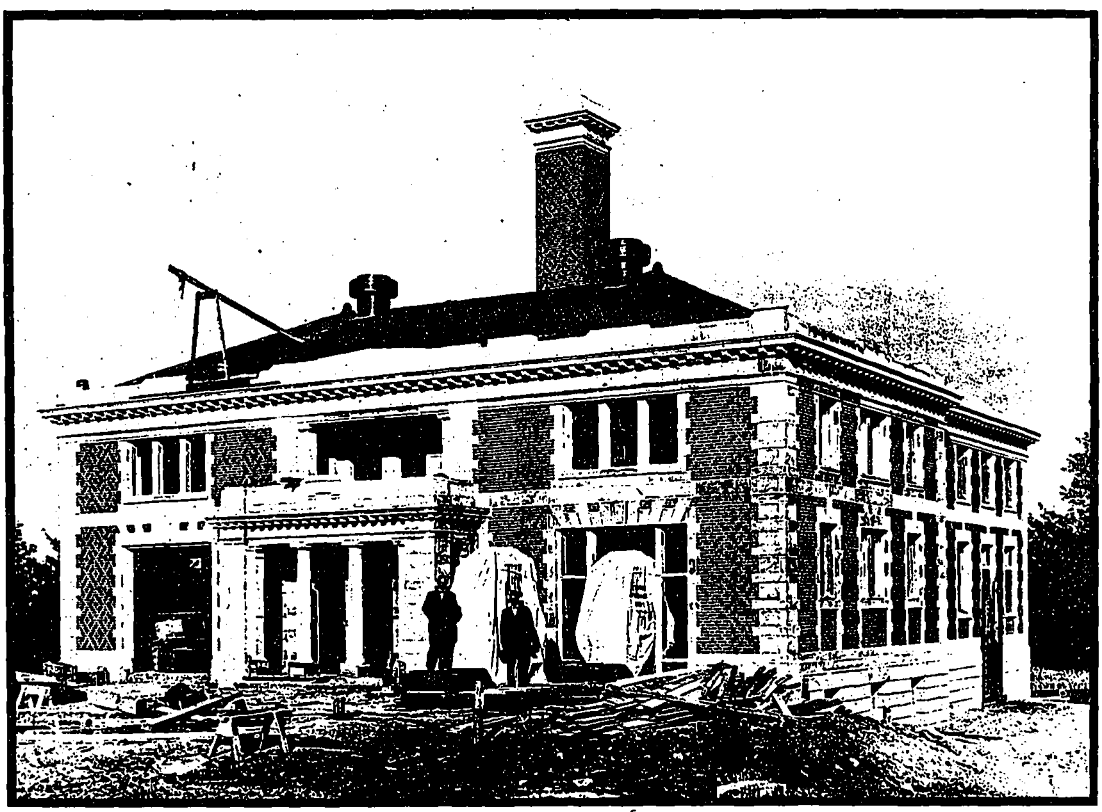
The second point is how to build at a minimum cost consistent with obtaining a first-class structure. A good architect, a good engineer, first-class superintendence and plenty of it, are all vital and necessary. Nothing is too good to put in a building to complete its mechanical and structural equipment. The best lasts a long time, and poor material and workmanship bring continuous trouble and the worst results. A broad knowledge of building construction, of the different kinds of makes and substitutes and the latest inventions in the building material world, the desirability, the cost and substantiality of each of them, are things that every builder should know.

The third phase of building construction is that of obtaining the minimum cost of maintenance after the building is constructed. To do this the building must be properly constructed, properly equipped, and, withal, economically so. Consideration should be given always to the economical cost of maintenance. One boiler in a building of any size is a mistake, no matter how large; two boilers are more economical; their original cost may be greater, but the cost of maintenance is less. A small coal room is a mistake; it costs more to buy coal in small quantities than in large. Two pumps are necessary; the cost of their maintenance is much less by using one pump for one month and the other pump for the following month.

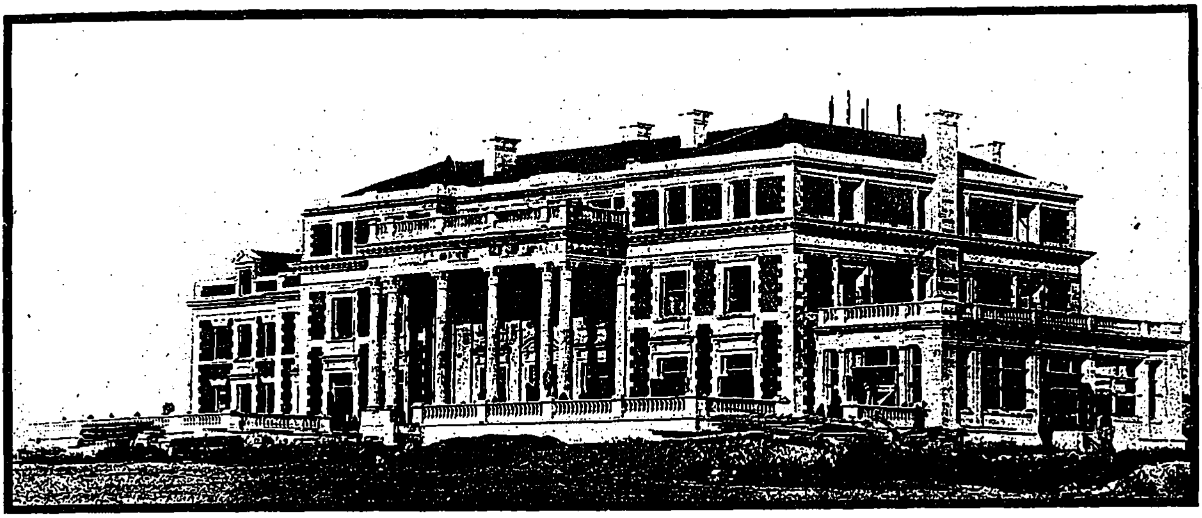
THE BRITISH PARLIAMENT during its coming session will be called upon to consider sixteen bills to confer power for the installation of railless electric car systems. Five of these bills are promoted by the British Electric Railless Traction Co., Ltd., and the first electric cars of this type to operate in Great Britain will be delivered by this company to two Yorkshire towns in the near future. It is claimed that the railless system is as cheap to operate as the ordinary track street car, while the capital expenditure involved in street work is only one-fourth to one-third of the $70,000 to $75,000 per mile required for the usual street car system. The system, it is further maintained, has advantages over petrol motive power, that the cars are lighter than the ordinary motor bus, run with very little vibration or noise, and that the rubber tires prevent any great wear upon road surfaces.



Creamery Building, Estate of O. C. Barber, Barberton, Ohio. Showing the Concrete Blocks of Outside Walls Laid Bare at Corners and Intervals of Surface to Form Decorative Trimming for Brick Panels. Harpster & Bliss, Architects.



One of the Small Buildings, Estate of O. C. Barber, Barberton, Ohio, Which, Like the Residence and Creamery Building, is Essentially of Concrete Block Construction. Harpster & Bliss, Architects.



Country Residence on Model Farm of O. C. Barber, Two Miles East of Barberton, Ohio. Built Throughout of Concrete Blocks With a Brick Panel Veneer on the Exterior. The Interior Walls and Partitions Consist of Rough Blocks, Furred with Expanded Metal and Plastered; the Basement Walls Being Tarred on the Outside and Finished With White Faced Blocks Within. Over 42,000 24-Inch Blocks Were Required in the Construction of this Building Alone. Harpster & Bliss, Architects.

MODERN EXAMPLES OF CONCRETE BLOCK CONSTRUCTION

The textural qualities and logical possibilities of the material as revealed in recent work. Model group of farm buildings and interesting structures of factory, residential and club house design.

ONE CANNOT COMPARE present day work with the early examples of concrete block construction without being impressed with the marked evolution that has taken place in the manufacture of this product. It must be admitted [redacted] years back concrete block construction [redacted] virtually devoid of anything which gave definite promise of the widespread use it has since attained. Most of the early examples, indeed, revealed little to indicate the true textural qualities or logical possibilities of the material. Too often the process of skimping, the sacrifice of quality in an endeavor to produce cheaply, resulted in a product without sufficient cement to properly bind the aggregates together. Again, block manufacturers, in the eagerness to duplicate rock face and other effects, gave their product a stiff and mechanical appearance which greatly detracted from its proper value as a material for architectural expression.

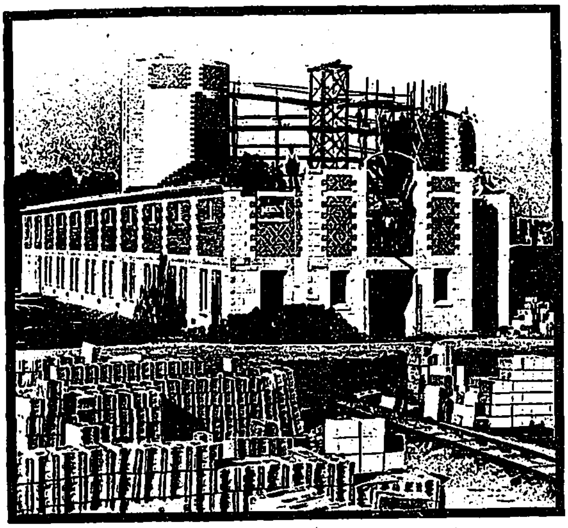
While the outgrowth of a condition which demanded an economical form of permanent building construction in communities where suitable clay for the manufacture of brick was unavailable, concrete blocks are not only being extensively adopted today in almost every type of building, but are competing with no little success in localities in which other materials have heretofore been exclusively specified. Gradually but surely, the early prejudices which led building designers to reject this character of product as an undesirable architectural element, are being successfully overcome. As a structural unit, the value of a well made concrete block has never been doubted. Realizing its worth in this respect, manufacturers have come to the conclusion that a material having merits of its own should not be an imitation of another product,

Cattle Barn, Estate of O. C. Barber, Barberton, Ohio, in Which 82,000 24-inch Concrete Blocks Were Used. This Building is 280 Feet Long and 50 Feet Wide. An Interesting Feature is the Concrete Block Silo, Which is 50 Feet High and Has an Outside Diameter of 24 Feet. Harpster & Bliss, Architects.

Residence of Rev. William Potter, Dundas, Ont. A Six-Room and Attic Dwelling Structure Constructed of Concrete Blocks, and Erected at a Complete Cost of $2,600. M. H. Hewitt, Architect.

Sydenham Club, Owen Sound, Ont., which Shows an Attractive Use of Plain-Faced Blocks in Wall and Gable Treatment. Forster and Clark, Architects.

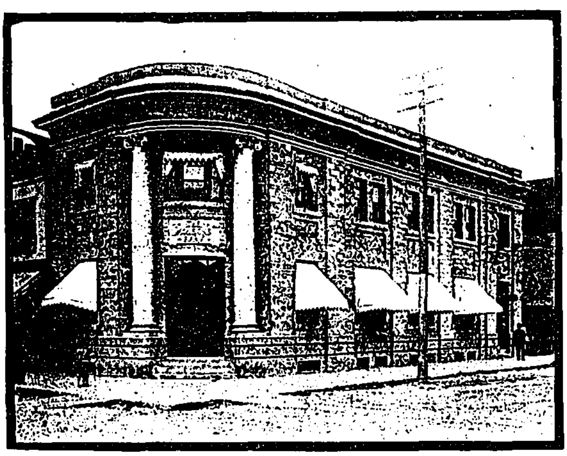
but should denote in character what it really is, and nothing more. Furthermore, they have turned their attention to producing blocks with every care to precision of detail, so as to meet in every way the most exacting requirement of the architect's design;



View of Another Large Concrete Block Building on the Estate of O. C. Barber, Barberton, Ohio, Which Also Shows Two Silos in Course of Construction. Harpster & Bliss, Architects.

and are relying on the author's adaptation to give fit and proper expression to the new material he employs.

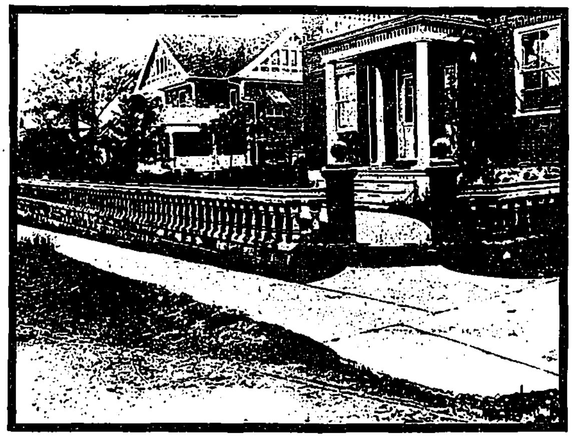
As with all other materials, the artistic side of concrete block construction must primarily be the outgrowth of its structural application. The attempt at the offset, to make it "a thing of beauty and a joy forever" without consulting the canons governing architectu[illegible]sign, [illegible] deplorable mistake —one which fortunately the manufacturers quickly realized and undertook to rectify. Recent work, as shown in the accompanying illustrations, when compared with early examples, shows the admirable



Concrete Block Building of Molsons Bank at Revelstoke, B.C.

progress that has been made, and how thoroughly logical and acceptable concrete blocks are as a building material when carefully produced and properly applied. These views illustrate in a limited way the use of concrete blocks in farm buildings, residence, factory and club house construction. Among them are several buildings of an interesting group recently erected on the model country estate of O. C. Barber, about two miles east of Barberton, Ohio, which is noteworthy as the largest concrete block contract that has yet been executed. It might be interesting in this connection to note that the brick panels seen in the illustrations form an exterior surface veneer only, and that brick work is used to this extent only. The wall construction and partition work throughout are of concrete blocks, and this applies to every building on the estate, including residence, cattle barns, power plant, grain storage, silos, etc.

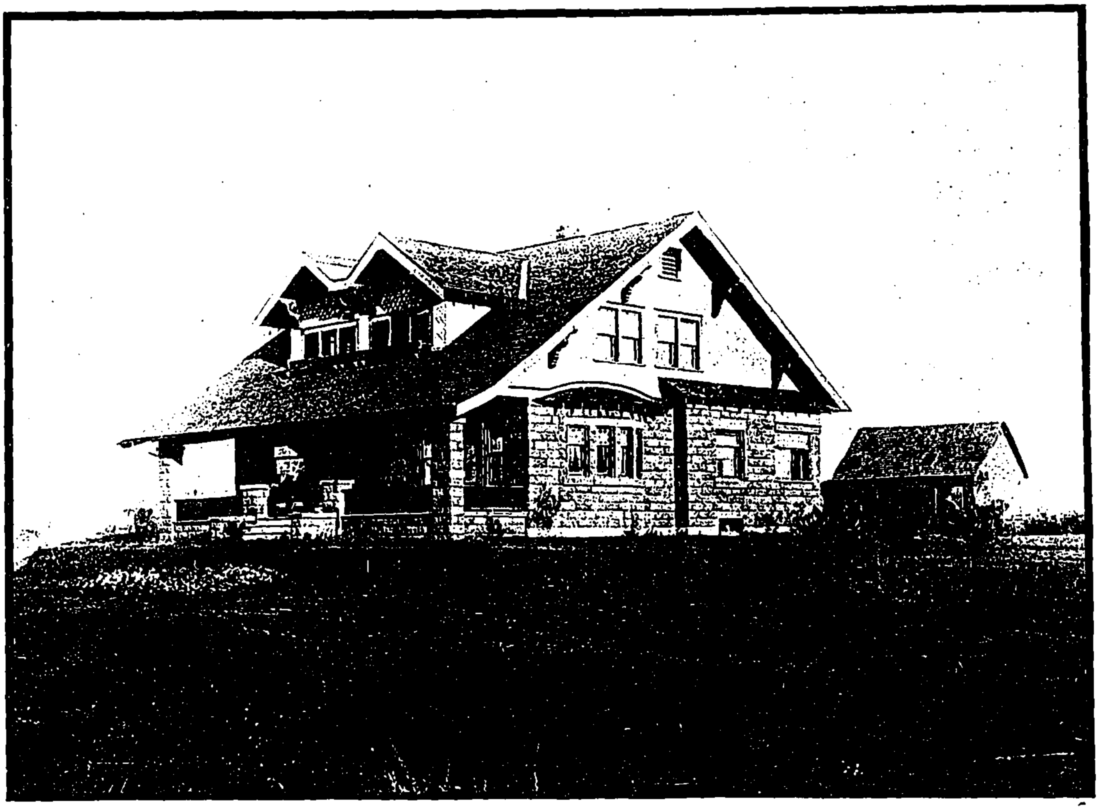
One advantage which concrete blocks offer, is the fact that, consisting of large units, the blocks can be easily handled and laid in the wall at a lower



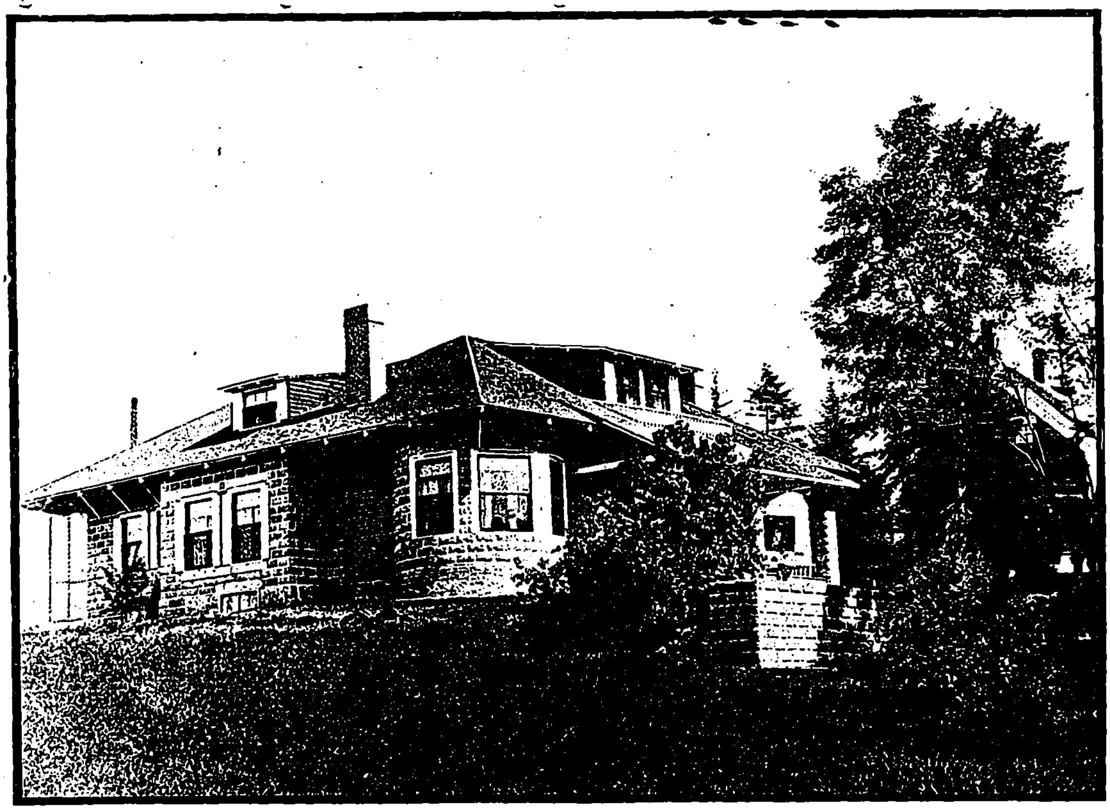
Concrete Fence Built by Henry Prest at Hanover, Ont.

cost than that required when a material of smaller units is employed. Probably it is in this particular more than in the material itself wherein the economy of concrete block construction lies, as a well made block, like a well made brick, requires proper materials and proper seasoning, and cannot be produced without some sacrifice in cost. . The future of the concrete block is indeed a most promising one. In districts where suitable clay is not to be found it is destined to become an acknowledged and accepted material for practically every type of building construction; while in other communities where the older materials have for many years held sway, it will be adopted to no little extent: First, because of its fire-resisting and sanitary qualities; second, because of the economy in construction which it effects, and last, but not least, because its logical possibilities for structural and decorative work are now more fully recognized than ever before.

Relative to the foregoing, the standard specifications approved by the National Association of Cement Users (U.S.A.) for "architectural concrete blocks" appended hereto, will undoubtedly prove of interest to the reader. After a brief reference to the importance of using a standard grade of cement, the draft of the specifications is as follows:



Residence of Judge Smith at Britannia Height, Near Ottawa. An Attractively Designed Nine-Room Concrete Block House Which Was Built at a Cost, Including Hot Water Heating, of $5,400.



Home of G. W. Daniels, St. Stephen's, N.B. A $3,500 Nine-Room House Built of Rock-Faced Concrete Blocks.

Factory of G. C. Conn, Manufacturer of Musical Instruments, Elkhart, Indiana. A Modern Example of Stucco Work on Concrete Block Construction.

Materials.

Fine Aggregate shall consist of sand, crushed stone, or gravel screenings, graded from fine to coarse, passing when dry a screen having 1/4 in. diameter holes, shall be preferably of silicious materials, clean, coarse, free from vegetable loam or other deleterious matter, and not more than 6 per cent. shall pass a sieve having 100 meshes per linear inch. Mortars composed of one part Portland cement and three parts fine aggregate by weight when made into briquets shall show a tensile strength of at least 70 per cent. of the strength of 1:3 mortar of the same consistency made with the same cement and standard Ottawa sand.

Coarse Aggregate shall consist of inert material, graded in size, such as crushed stone or gravel, which is retained on a screen having 1/4 in. diameter holes and will pass a 1 1/4 in. ring, shall be clean, hard, durable, and free from all deleterious matter. Aggregates containing soft, flat or elongated particles, shall be excluded.

Water shall be clean, free from oil, acid, strong alkalies or vegetable matter.

Proportions.

A bag of Portland cement weighing 94 pounds shall be considered as one (1) cubic foot. All concrete shall be prepared and mixed in quantities requiring one or more full bags of cement; the use of any device for mechanically proportioning the materials is prohibited.

Backing. The backing of all block shall be made of one part Portland cement, two parts fine aggregate and four parts coarse aggregate (1:2:4).

Facing. The facing shall consist of one part Portland cement, two parts fine aggregate (1:2), and shall be one (1) inch in thickness. It shall be thoroughly tamped into place in the mold and the backing immediately deposited. In order to prevent checks and hair cracks troweling will not be permitted. Only cement of the same color shall be used. Cements causing efflorescence shall not be used. The facing material shall not be allowed to become lumpy and shall be screened if necessary. Where color is required, only mineral colors shall be used.

Mixing.

The ingredients of concrete shall be thoroughly mixed dry, sufficient water added to obtain the de-

Plant of the Angldide Scale Company, Elkhart, Indiana, in Course of Construction. Showing the Cement Block Walls of a Modern Factory Before the Exterior Stucco Is Applied.

sired consistency, and the mixing shall continue until the cement is uniformly distributed and the mass is uniform in color and homogeneous.

a. Measuring Proportions. Methods of measurement of the proportions of the various ingredients, including the water, shall be used which will secure separate uniform measurements at all times.

b. Machine Mixing. When the conditions will permit, a machine mixer of a type which insures the proper mixing of the materials throughout the mass shall be used.

c. Hand Mixing. When it is necessary to mix by hand, the mixing shall be on a water-tight platform and the materials shall be turned until they are homogeneous in appearance and color.

d. Consistency. The materials shall be mixed so as to provide sufficient water to insure a proper bonding and a dense concrete free from voids.

e. Retempering. Retempering mortar or concrete, *i.e.*, re-mixing with water after it has partially set, shall not be permitted.

Reinforcement.

Bending. Sufficient metal reinforcement shall be provided to carry all stresses produced by the loads to which the blocks will be subjected.

Shrinkage. No shrinkage reinforcement is required in blocks whose least dimension is more than one-third of the length, such length being less than three (3) feet. All blocks less than four (4) inches square shall have in the center at least one bar equal to ½ of 1 per cent. of the cross section. All blocks over four (4) inches square shall have at least four ¼ in. square bars, with mechanical grip, extending throughout the length of the stone, one bar to be placed in each corner. All blocks of over fifty (50) square inches in cross section shall have reinforcement equal to at least ½ of 1 per cent. of the cross-sectional area. The reinforcement shall be placed within ½ in. of the face of the block, and the bars shall not be more than 8 inches between centres, care being taken to place a bar in each corner or projection. Bars shall be hooped with bands or wires not more than 8 inches between centres.

Protection of Corners.

All corners and edges shall be sharp and well defined. They shall have true horizontal and vertical lines and no block will be accepted that is chipped or marred in any manner.

Curing.

Natural Curing. For the purpose of securing proper curing, the blocks shall be protected from the sun and strong currents of air, shall be sprinkled at such regular intervals as necessary to prevent drying, and such other precautions taken as to enable the final set to take place under the most favorable conditions. At least twenty (20) days shall be allowed for curing.

Steam Curing. The blocks shall be removed from the molds as soon as the conditions will permit and shall be placed in an atmosphere of steam saturated with moisture for a period of at least forty-eight (48) hours. The blocks shall then be removed and stored for at least fourteen (14) days before use, being sprinkled three times a day during the first seven days. Care to be taken to maintain the temperature at not less than 60 degrees Fahr.

Laying.

Before laying, the various blocks and adjoining work shall be thoroughly moistened to prevent the absorption of water from the mortar. The mortar shall be composed of one part Portland cement, three parts sand and one part thoroughly slacked lime.

Blocks Cast in Place.

If the blocks is cast in place the forms shall be sandpapered, shellaced, oiled, and if necessary sprinkled. A 1:2 mixture one (1) inch thick shall be placed next to the forms and a backing of very wet concrete of 1:2:4 mixture added. In order to prevent checks and hair cracks troweling will not be permitted. All blocks shall be properly protected until accepted. All blocks shall have uniform color.

The publishers of CONSTRUCTION are indebted to the Ideal Concrete Machinery Company of London, Ont., and South Bend., Indiana, for the loan of photographs from which the illustrations used in connection with this article were reproduced.

THE MANUFACTURE OF SAND-LIME BRICK IN GERMANY

Number of plants in operation shows growing importance of industry.
Recent improvement effected in process of manufacture.
Different methods of production.

WITHIN THE PAST few years, the manufacture of sand-lime bricks, or kalksandsteine as the product is called, has assumed such large proportions in Germany as to come well within the scope of what might be termed the country's rapidly expanding industries. The remarkable development in this direction is forcibly emphasized by the fact that from 1897 to 1902 alone over eight plants were established, while from that time on a steady and consistent growth has been constantly in evidence. In all, Germany has now 280 plants in operation, and the great improvements effected in the process of manufacture enables the concerns thus engaged to turn out an excellent brick both as to texture and color and structural character. As to selling price, sand-lime bricks market at an average cost of 2 marks ($0.476) less per 1,000 than clay bricks. The cost of production is said to be 9 to 12 marks ($2.142 to $2.856) per 1,000, but it is difficult to generalize on this, as no two localities are situated alike as to raw materials. In 1902 the German Reichstag purchased 9,000,000 bricks of this kind for the construction of army buildings, and the material proved so satisfactory in this case that several important contracts have been let for Government work subsequently undertaken.

Original Method of Manufacture.

The elementary facts in the brick business in Germany are that clay does not exist everywhere, whereas sand is found almost everywhere and can be used at a lower cost. The processes of manufacturing sand-lime bricks are numerous, some being protected by patents. The original method of manufacture was as follows:

Fat lime slaked to a thick milk is mixed with 6 to 12 times its own quantity of coarse sand and then carefully kneaded either by hand or in a mixing machine. Bricks are then formed in an ordinary clay press and after 24 hours, being then slightly dry, are stacked together and assume sufficient hardness after three or four weeks. The hardening process is accelerated by dipping the slightly dry bricks in a very thin solution of silicate of potash.

Thus a very cheap material can be produced for agricultural buildings where lime and good sand are available. The bricks are frost proof and rather compact, and no extensive machinery is required. Lime-sand bricks produced upon an industrial scale are the pressed product of a complete mixture of lime and sand hardened under steam pressure of an average minimum compressive strength of 140 kilos per square centimeter (308.64 pounds per 0.155 square inch). This mortar contains 5 to 8 per cent. of lime, and upon being pressed into bricks—which are then exposed to a steam pressure, usually under 72 atmospheres during 8 to 10 hours—the bricks can be used at once.

Increasing Success of this Type.

The foregoing process is based upon the discovery, in 1880, of Dr. Michaelisin, that salicylic acid can be decomposed; that is to say, can be caused to form hydrated silicate of lime by chemical combination with lime, from hydrate of lime only in a very high temperature and in the presence of steam. This high-pressure process has been developed in Germany since 1898, and it is believed that from 800 million to 1,000 million bricks of this kind are being manufactured annually. Bricks of this kind are rivalling clay bricks with increasing success, their adoption being furthered by the facts that (1) an extraordinarily small quantity of lime is necessary, since the poorest mortar requires more sand than lime; (2) sand can be found almost everywhere; (3) the time required to manufacture is short and the general expenses low; (4) and they can be manufactured at all seasons of the year.

Fat lime is used ordinarily in the manufacture of these bricks and hydraulic lime very seldom. Dolomite lime, which slakes slowly, is not available. Any kind of quartz sand which is free from clay and not too coarse can be used.

Variations in Component Elements.

The various processes are distinguished from each other by the method of treating the lime. In some the lime is completely slaked to powder or paste before being mixed with sand, this being the ordinary hydrate process. Elsewhere the lime is ground to powder (quicklime powder), then mixed with sand, and then slaked. The hardening of the bricks is always done in the same manner—in a hardening boiler. According to the first, or hydrate, process, the mixed material remains at first amorphous, and then gradually becomes crystalline, whereas in the quicklime process the mixture assumes a crystalline form immediately, which is said to be why the bricks possess a greater solidity from the beginning. However it is alleged that the quicklime process requires a larger dose of lime, and that the completed bricks are too dense, thus absorbing less water and allowing the passage of less air.

According to Burchartz, there is no material difference between the several kinds of lime-sand bricks, as regards density and water absorption, and all kinds of lime-sand bricks increase in compactness within certain limits.

In the pure hydrate process the lime is slaked to powder in a slaking drum or hardening boiler, after having been ground finely. In the mixed processes it is slaked in drums with part of the sand, and then, or perhaps after having been stored in silos, it is mixed with the rest of the sand. In the quicklime process ground burnt lime is mixed with the entire quantity of sand, water being added steadily to the mixture, which is then pressed, either after having been stored in silos or without previous storing.

Presses of various kinds are in use which have a daily capacity of about 24,000 bricks, which are perfect in shape. Lorries loaded with 900 bricks are moved into cylindrical hardening boilers, which are about 2 meters (6.56 feet) wide and 6.25 meters (20.50 feet) long, in which they remain about nine hours under a steam pressure of 8 atmospheres.

Tests for Strength, etc.

In 255 tests the compressive strength varied greatly, the average, however, being 153 kilos per square centimeter (337.30 pounds per 0.155 square inch), which is the tenacity required in a brick of good quality.

Deviations from the average are less than in the clay brick, a result of the greater symmetry of the lime-sand brick in shape and structure. The loss of strength through the absorption of water averaged 14 per cent., and from the effect of frost 17 per cent. The average absorption of water amounted to 14.9 per cent. weight and 26.3 per cent. volume, percentages also less in the case of lime-sand bricks than with clay bricks. All bricks tested proved to be frost-proof. In fire tests and in practical experience these bricks have shown the same properties as clay bricks in regard to the influence of fire and water used in extinguishing it.

Fireplaces, factory chimneys, ring ovens, etc., have been constructed with lime-sand bricks with good results. The adhesive property of the mortar on the bricks has been tested, by using the same kinds of mortar on lime-sand and clay bricks, the results being generally in favor of the former type of brick. The weight of structures made from this material is but slightly greater than though built with clay, and, according to an order issued in 1907, no greater weight may be estimated in statistical calculations than was ascertained in the use of clay bricks.

Because of their regular form and uniform dimensions, these bricks can be laid more easily, and can also more readily be cut. This regularity of form and their trim appearance has led to a frequent use of lime-sand bricks as facing stones, it being also possible to color them.

Patents for Special Types.

German patents 138935 and 151945 protect the manufacture of nonconducting bricks which are made of a mixture of sand, lime, and fullers earth. After the steaming, bricks of this kind can be burned, and before being burned may be soaked with "wasserglas" (silicate of potassium or sodium). German patent 158615 protects a process for the elimination of the objection that the color of sand-lime bricks changes in rainy weather. According to this process the bricks are covered with a glaze while under steam pressure, which glaze, upon being burned with the bricks, dissolves and combines with the lime silicate in the brick. Various colored glazes may be applied by the process employed.

THE ART OF ARCHITECTURE AND REGISTRATION

Abstract of a paper read before the Guild of Assistants by H. Guicharde Todd, F.S.A. Scot., M.S.A.

THE ARCHITECTURAL PROFESSION in Canada has to a very pronounced degree given consideration to registration. In almost every country in the world this has proven a very live question. Many columns have been devoted to the discussion of this subject in CONSTRUCTION *during the past three years. In England factions have been created both for and against the proposal, in their views as to its ethical and practical effect upon the profession. The following paper, read before the Guild of Architects' Assistants, recently, gives a fair as well as interesting statement of the position of the faction of the profession favoring registration.* —EDITOR'S NOTE.

THE FUTURE OF ART IN ARCHITECTURE and the professional welfare of its exponents are to a great extent in the hands of the present generation, and two policies are put forward for consideration as ameliorations of the present unsatisfactory state of affairs in art and professional practice.

The registration of architects, as has been proved by several plebiscites, is supported by the great majority of architects, who appear to consider that the reorganization of the profession is necessary; and architectural copyright is brought forward by a section which professes to more particularly study the future of our art while protecting the interests of professional men. The policy of registration is particularly worthy of the notice of this Society, for this Guild is described as "the only Society formed and organized by architects' assistants to protect their interests," and it is apparent that the object of this body is to ensure some sort of security to assistants in the architectural profession. Security, that most precious jewel of civilization, is entirely the work of law. Without law there is no security, and consequently not even a certainty of subsistence; and it follows that if this Society is not prepared to support the logical measure which will give security to the architectural profession and its individual members, it will fail in its apparent object, in one direction at least.

It has been said that registration will limit the liberty of the architect and be opposed to the welfare of art; but this contention does not appear to be well founded. Sir James Mackintosh, the eminent lawyer and essayist of the earlier portion of the last century, said: "The description of liberty which seems to me the most comprehensive is that of *security against wrong*. Liberty is, therefore, the object of all government." The registration of architects means the ultimate government of the profession by the profession to ensure *security against wrong;* but it is not only in the personal protection of the members of the profession that the policy of registration is worthy of consideration, and the probable effects of such a policy on art must be studied.

Art in architecture is acknowledged by the majority of our most prominent architects to be in a very unsatisfactory state; and the introduction of an Architectural Copyright Bill at first sight appears to be a necessary measure for the protection of the personal property and standing of the architect; but a reference (at the risk of being personal) to the published opinions of some of our leading architects on the present state of architectural art may be helpful.

The symposium on architecture recently conducted in The New Age by Mr. Huntley Carter is a valuable collection of opinions, which should be of great interest to all architects and artists who look at architecture and art widely; and more particularly to those who, through registration, hope to see the mistress art take a proper plae in our social life. The opinions of the eminent contributors to this symposium show a general despondence as regards the progress of our art, and Mr. Mervyn E. Macartney, F.S.A., F.R.I.B.A., and Mr. Edward Warren, F.S.A., F.R.I.B.A., who contribute interesting articles, are both of the opinion that the present unsatisfactory state of art and architecture is due to the ignorance and apathy of the public.

Mr. Macartney says: "Little more can be done by architects themselves until the public expresses some sort of approbation," and also, "In London we accept all kinds of vulgar fripperies from stockbrokers turned architects." Does it not follow that the public very naturally expresses little approbation of the vulgar fripperies of stockbroker-architects? And does it not also follow that, if "architects themselves" confine the energies of stockbrokers to stockbroking, art and architecture will benefit, and the public express some kind of approbation for the works of a profession which is a definite profession? Mr. Macartney further says: "It would, however, have to be conceded at the outset that the general taste in this, the mistress art, is at a lower ebb than at any time even of the eighteenth century"; and, "In England up to the middle of the eighteenth century taste in architecture was fairly general. Every gentleman understood its principles, and several of them were not without ability in its practice." So that in this, the twentieth century, although we know that "the mistress art is at a lower ebb than at any time even of the eighteenth century," we have stockbrokers, auctioneers and certificated bailiffs as exponents of the mistress art, and supplying "all kinds of vulgar fripperies" acceptable to the greatest city in the world, and this in place of the favorable atmosphere which existed in the first half of the eighteenth century.

No true architect whose desire is the welfare of his art objects to a stockbroker, auctioneer, or bailiff becoming an architect, provided that the gentleman is qualified by nature and attainments to practise the profession in keeping with the canons of art and professional etiquette; but every architect with a soul above the mere utilitarian routine of business must object to the unnecessary degradation of architecture by the works of the individuals who have given our streets their vulgar fripperies in such profusion. The registration of architects would not necessarily make every building in our streets a work of art, but it would undoubtedly, in future years, prevent the utterly unqualified and ignorant man from practising as an architect. Mr. Macartney truly says: "A tradition in architecture cannot be built up in a day"; but, as public approbation is necessary to the progress of tradition, it is reasonable to expect that by gaining public approbation and notice through a non-controversial Registration Bill, approved by the public through their elected representatives in Parliament, further public approbation, understanding, and appreciation of the profession and its aims would follow.

Mr. Macartney says: "It is only the great gullible public who think that painters alone are capable of producing art, so they muddle along, and when they want a bit of 'art' they buy it from the painter. The assumption that painters can do architecture is doubtless based on this feeling that 'art' may be obtained in sample and applied to building—a square foot or a yard at a time."

In the first place, it is obviously the duty of architects to see that the public are not gulled, and even before "the public expresses some sort of approbation" it is possible for "architects themselves" to do much towards gaining that approbation. It is also due to the art of architecture from its exponents that approbation should be gained, and as in politics measures are supported because of the sincerity and through the personalities of their originators and supporters, so must public approbation of architecture be gained by sincerity and whole-hearted and businesslike action by its practitioners, and by keeping the importance of architecture continually in the public eye.

Architects may not advertise for their own personal benefit; but architects as a body can surely advertise the importance of their art by drawing public attention to it on every possible occasion. The Town Planning Conference has done much to convince the public of the importance of the architectural profession; but it must be remembered that the subject of town planning owes its present prominence very largely to the fact that it has been brought to the public notice through political channels, the Town Planning Bill having been commented on by every journal of importance, and the subject having all the prominence of a political measure.

It is obvious that the introduction of a Bill for the registration of architects would also attract notice and convince a large proportion of the general public of the importance of the architectural profession. The public apathy which Mr. Macartney and Mr. Warren deplore may be in some measure due to the fact that there is no obvious care of the public interest taken by architects as a profession. The public looks after its own interests through local by-laws and surveyors, whose functions are supervisory of the architect's work; and although this is necessary, and probably always will be necessary, it has a tendency to an antagonistic feeling which is regrettable and might be somewhat relieved.

In the medical profession the diploma of public health (D.P.H.), held by so many doctors, has convinced the public that public health is made a serious study by medical men; the profession is looked up to, and the public interests in that sphere are felt to be safe in its hands.

The institution of a diploma in civil architecture might well fill a corresponding place in the architectural profession, and have the same effect in convincing the public that architects are solicitous for their well-being, by endeavoring to give them artistic and suitable as well as sanitary and well-built buildings; but such a diploma could be of little use so long as the professions of stockbroking and architecture are interchangeable.

Public approbation is necessary to the progress of art; but the public cannot be forced to appreciate art and architecture, therefore it must be led to that appreciation; and the first step likely to convince at least a large section of the public of the importance of architecture would be the initiation of the policy of registration, and the consequent access of dignity and standing in the public eye which that measure would confer on the members of the profession.

The benefits of such a consummation are obvious and would be twofold—beneficial to the profession and to the public; for the interests of the public, the profession and the art which it professes are inseparable. The public would be safeguarded against the practice of irresponsible or altogether ignorant practitioners, architects would have a professional standing to lose, and if this were once appreciated by the public the importance of good architectural work would be recognized.

The responsible architect, in keeping with the definition of security already given, can only be the architect who has something to lose, and under registration that would be his professional standing. At the present moment any architect guilty of unprofessional conduct, however gross, provided he keeps within the limits of the law, would only lose his standing in the eyes of his professional brethren, and could not be prevented from describing himself as an architect and a member of an honorable profession and training pupils to any number; but under registration, as generally understood, any such person found guilty of serious professional malpractice would no longer be able to describe himself as an architect or recover professional fees at law.

The registration of architects would make it possible to obtain reliable statistics regarding the profession and all matters concerning it; and, as an executive force, the local influence of the provincial societies would be most valuable, as under a wise measure of registration their standing would be enhanced by their official connection as educational bodies with the central authority; and through the whole of this land societies working in the interests of art and architecture would be supervised to some extent by a central body, possibly similar to the Central Council suggested in the Architects' Registration Bill.

The Central Council hitherto provided for in that Bill would consist of architects of the highest standing, elected to represent the various existing architectural bodies, metropolitan and provincial, in numbers proportionate to the importance of the bodies which they represented, and inclusive of representatives of architects qualified for registration who are unattached to any professional society.

This Council would administer the code of ethics of the profession, and it is hard to imagine how such an arrangement could be prejudicial to art in architecture. In addition to this comprehensive policy, a Bill to protect architectural copyright is proposed, a Bill which should be of great interest to this Society and its members, as well as to the profession generally; to the members of this Guild, as assistants, because it is conceivable that their ideas in many cases will automatically become the copyright of their employers; and to the profession generally, because the promoters of this policy are prepared to hand over, quite unnecessarily, the management of purely professional matters to members of the legal profession, who can hardly be judges of what constitutes originality in architectural design.

It is amusing to find that the first great proposal for many years, professedly in the interests of architects, should be so obviously in the interests of the legal profession, and such a Gilbertian position can only bring ridicule on architects and give the public cause to believe that architects cannot manage their own affairs. Under registration the names of practitioners guilty of the malpractice of unjustifiably copying plans or elevations to the detriment of their professional brethren could be removed from the registration list, and this action would be a parallel to being struck off the rolls in the legal and medical professions. Lawyers and medical men have wisely kept the management of their own affairs in their own hands, and it cannot be said that it presses unfairly on the members of these professions, as only in the case of aggravated malpractice is the power of ejection exercised.

As architects can be the only judges of what constitutes infringement of architectural design, the elevation of some eminent architect to the Bench to deal with all cases under the Architectural Copyright Act would appear to be necessary, in conjunction with an arrangement whereby architects might take silk and plead at the architectural Bar on matters of art. This may appear to be merely fantastic, but, given an Architectural Copyright Bill to protect originality in art in architecture, it appears to be a logical necessity. An Architectural Copyright Bill in conjunction with an Architects' Registration Bill is more attractive; but architectural copyright under existing conditions does not appear to be in the best interests of architectural progress. Registration, on the other hand, would appear to tend towards architectural progress. Mr. Reginald Blomfield, A.R.A., in his contribution to the symposium already mentioned, says that "only a trained architect can be an architect," and as under registration in the next generation all architects would undergo some approved training and their pupils would be also trained it follows that a profession trained to some extent would be the result. Registration could not produce genius, or even tend towards the production of genius; but it would tend towards a reduction of the production of utterly bad works of architectural art, while it would not in any way hamper the practice of gentlemen who are specially qualified to produce works of outstanding merit and originality.

The registration of architects, by binding the members of the profession together, by enforcing a statutory qualification, by emphasizing the necessity for the study of architecture as an art, and, through the power it would have as a united and definite profession able to speak with one voice, could only have the effect of furthering this ideal of carrying our tradition forward and proving to future critics that this generation was solicitous for the well-being of that art which is undoubtedly the truest index to the culture or civilization of any age.

Italy, Spain, Russia, several of the United States of America, the Transvaal, and some of the Canadian Provinces have successfully adopted registration; while Germany and Hungary compel all public architectural officials to have a Government diploma; and from none of these countries do we hear that the spirit of design in architecture has died in consequence.

Registration stands for statutory qualification, which depends upon architectural education; and architectural education, in whatever light we view it, must appear the most important subject that can engage the attention of the architect, and it is most important that he should now support the policy of registration if he wishes architects to control the necessary qualifying examinations and those second-rate colleges which profess to turn out architects ready to practise after very short periods of tuition, and who simply swell the crowds of badly trained assistants. Statutory qualifications, to be really satisfactory, should be managed from one fountain-head, and no body should be allowed entirely independent powers of examination or registration, and the anomalies which exist in other registered professions should be avoided. In the medical profession, particularly, it is possible to practise with qualifications which are very different in standing.

The public have a right to know if every professional man working in such a way has had a proper architectural training, and is held officially responsible for his professional probity. Registration would provide an official register of names and qualifications, which would be an effective check on the abuse of professional titles or the use of titles which have little or no bearing on the profession practised. In short, it is claimed that the statutory qualification of architects would provide an educated and responsible profession, would benefit the progress of architectural art by convincing the public of the importance of the profession and its work, would make it immediately possible to get statistics on which to base proposals for the improvement of the position of the assistant, and generally raise the profession to that standing which it ought to have in the public estimation.

The progress of art depends upon public support, and the public is always impressed by strength. Miligia said: "If massive columns are close to each other they appear more massive still; and slender columns when wide apart appear slenderer still." It is surely easy and natural for architects to apply this architectural maxim to their professional affairs. Every architect is a column in the structure of the profession, and if architects bind themselves together under registration, in the interests of their art as well as in the public interest, the tendency will be for the public to respond by showing appreciation of architectural refinement and excellence, and condemning the vulgar and inartistic.

THE IMPORTANCE OF BENT GLASS IN ARCHITECTURE

Offers vast scope to architects in designing commercial buildings. Brief treatise on subject by Edwin Bell.

THE VALUE of circular and elliptical curves in lineal design are so well understood by architects, as not to require much to be said here in suggesting their use for designs in important superstructures, but merely to remark that the scope of our architects hitherto has been curtailed in making designs for buildings, especially for commercial purposes where glass largely forms a part. This has arisen from glass for window openings being in flat sheets. It is nearly a hundred years since architects sought for glass to be made to given curves, and while the art of bending glass has been practised to a limited extent for upwards of seventy-five years in the district known as "Glass House Fields," London, England, the extensive use of it by architects for buildings is of much more recent date. Especially of late, in London, Paris, Brussels and other Continental cities, its use has become extensive for show windows, composed wholly and partially of large sheets of bent plate glass which are exceedingly attractive and well repay the proprietors. It has become the practice to brilliantly illuminate the streets at night which (in moderate weather) are acceptable promenades. Store or shop keepers advertise their wares after closing hours by a well-lighted window and this is made more effective when the public can go under the shelter of the main buildings; many of the finest shop fronts being so constructed as to admit of this; some receding back for a considerable distance from the street line, almost producing an arcade effect, while others are so arranged as to form a rotunda. These, where frontage admits, have spacious imposing vestibules which are dressed at night in some ready way like an ordinary window. The effect of these display windows is very beautiful, some having their ceilings adorned with mirrors in bold geometrical design interspersed with electric illuminating lamps.

Excellence, utility and even charming effects are secured by using bent plate glass for shop fronts, not obtained by straight lines. Glass, like sheet metal, has imparted to it a stiffness when bent, so that where the superstructure admits of it, bent panes of glass may be joined together in a continuous line by very light bars. In fact, where conditions are favorable, bars may be dispensed with, the two edges of the panes being merely butted together, thereby obtaining a very pleasing effect.

Where bent glass is used, the design should have a bold treatment with the curves to as large a radius as possible. These curves produce the best effect, besides being the cheapest. A section of an ellipse is equally as effective as a segment of a circle; such bent plates being bent over their entire surfaces, however slight it might be. The original richness of plate glass is not only preserved, but is enhanced by the charms of its curvature. Canadian architects have not had the advantage which bent glass affords until quite recently, owing to its having to be imported from Europe. After waiting months for bent glass, it often happened that it would be found to have been broken in transit. Bent plates of very large dimensions are now easily obtained from Canadian glass benders, thus enabling our architects to develop a character of store front design that would compare favorably with the most attractive fronts of Continental creations.

CEMENT FLOORS, particularly in office buildings or warehouses, which do not have the advantage of obtaining the necessary moisture from the atmosphere such as outside floors and sidewalks on which the dew falls at night, if not properly protected and kept damp, become prematurely dry and are therefore more or less porous and weak, causing easy abrasion under foot traffic, or what is commonly known as dusting.

Care should be exercised in keeping such floors damp by covering with wet sand, wet hay or straw, for a week or more until the floor has properly hardened. If this has not been done and the floors are found to dust under foot traffic, the following remedy will be found very easy to accomplish, economical and effective.

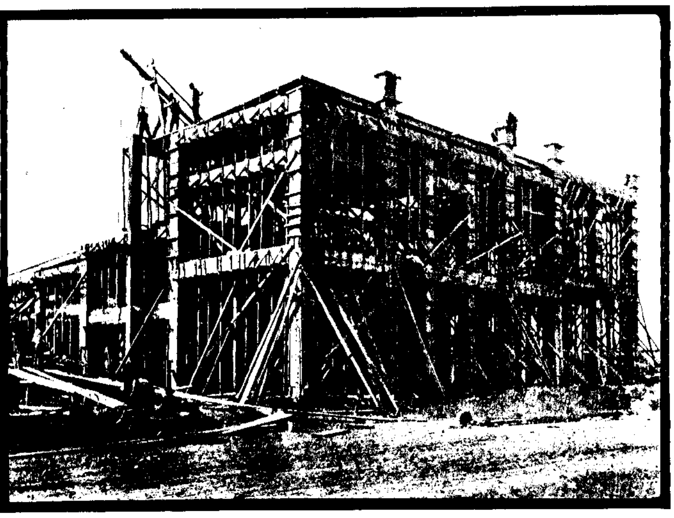
Wash the floor thoroughly with clean water, scrubbing with a stiff broom or scrubbing brush, removing all dirt and loose particles. Allow the surface to dry; as soon as dry apply a solution of one part water-glass (sodium silicate) of 40° Baume, and 3 to 4 parts of water, the proportion of water depending upon the porosity of the concrete. The denser the concrete the weaker the solution required. Stir well, and apply this mixture with a brush (a large white-wash brush with long handle will be found the most economical). Do not mix a greater quantity than you can use in an hour.

If this solution is sufficiently thin, it will penetrate the pores of the concrete. Allow the concrete surface thus treated to dry. As soon as dry, wash off with clean water, using a mop. Again allow surface to dry and apply the solution as before. Allow to dry and again wash off with clean water, using a mop. As soon as the surface is again dry, apply the solution as before. If the third coat does not flush to the surface, apply another coat as above.

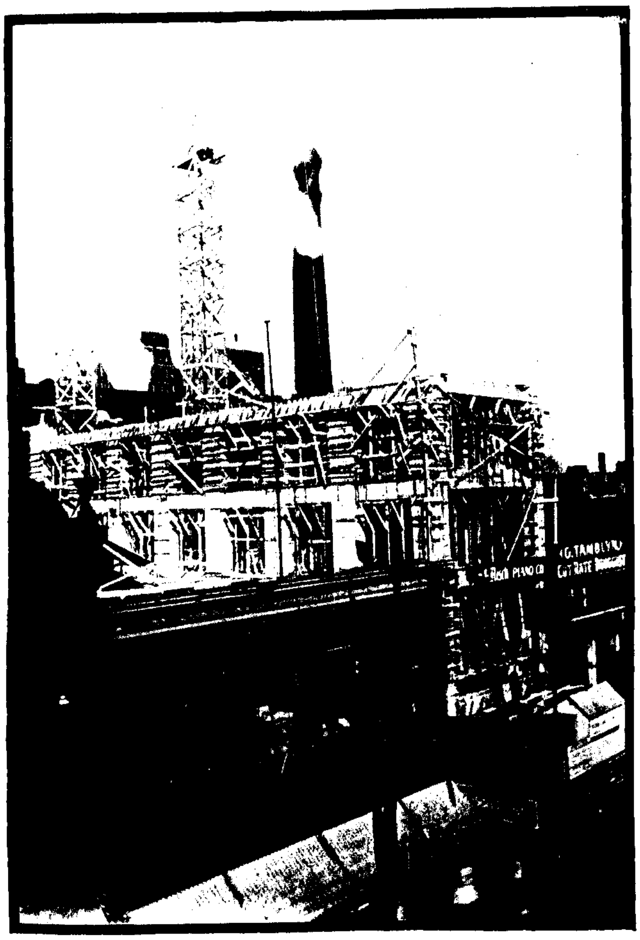
The sodium silicate which remains on the surface, not having come in contact with the other alkalies in the concrete, is readily soluble in water and can therefore be easily washed off, thus evening up the color and texture of the floor. That which has penetrated into the pores, having come in contact with the other alkalies in the concrete, has formed into an insoluble and very hard material, hardening the surface, preventing dusting and adding materially to the wearing value of the floor.

CEMENT PAPERS CONSOLIDATE

CEMENT AGE, of New York, with which *Concrete Engineering* has recently been consolidated, has put in its appearance in its new form, and the publishers are to be warmly complimented on the general excellence of the initial number, which shows several noteworthy improvements over the already high standard of magazine previously issued. By the amalgamation effected, the broad scope of subject matter covered in the past has been greatly enlarged upon, especially as regards the engineering branch of the industry, which vastly increases the usefulness of the publication to architects, engineers and contractors interested in the uses and possibilities of cement and concrete in structural undertakings. As in the past, the publication will be issued under the editorship of Mr. Robert Lesley, vice-president of the American Society for Testing Materials, and an Associate of the American Society of Civil Engineers, who is one of the most prominent figures in the cement industry on the American continent. The new magazine, which is ideal in typographical character and general arrangement, is slightly larger than the previous size of *Cement Age*, and has a type page 6 x 9 inches, thus retaining the distinctive magazine form which has been a popular feature of the older publication. A two-column make-up is a further innovation, and the increased space afforded by the change will undoubtedly prove more acceptable to both readers and advertisers. It is evident from the initial issue that the publishers propose to preserve the best features of both magazines, thus maintaining the prestige each has won. The use of cement from the architectural and engineering standpoints, as well as its manufacture, will be thoroughly covered by the new journal, together with the popular features that are of such great interest to the general public. Allen Brett, editor of *Concrete Engineering* for the past two years, and Arthur E. Warner, formerly business manager, have both become identified with the new publication, the former in the capacity of associate editor and the latter as business manager of the Western field. Aside from this addition to the editorial and managerial end, no change has been effected in the old staff of *Cement Age*, Mr. Lesley continuing as editor; Frederic F. Lincoln as president of the company, in charge of the New York office and Eastern advertising field, and Edward A. Trego as associate editor.



Brewery for the Sudbury Brewing & Malting Co., Sudbury. Henttman & Cramer, Architects.



View Showing Four Stories of Mason & Risch Building, Thirty Days After the Foundation Was Completed.

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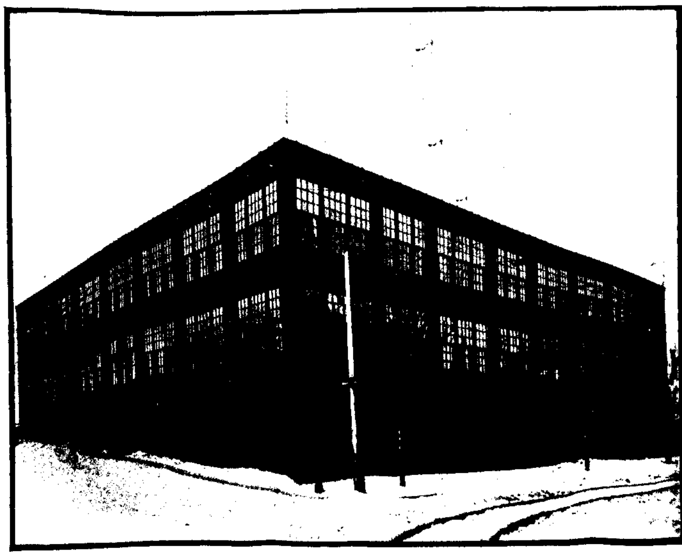
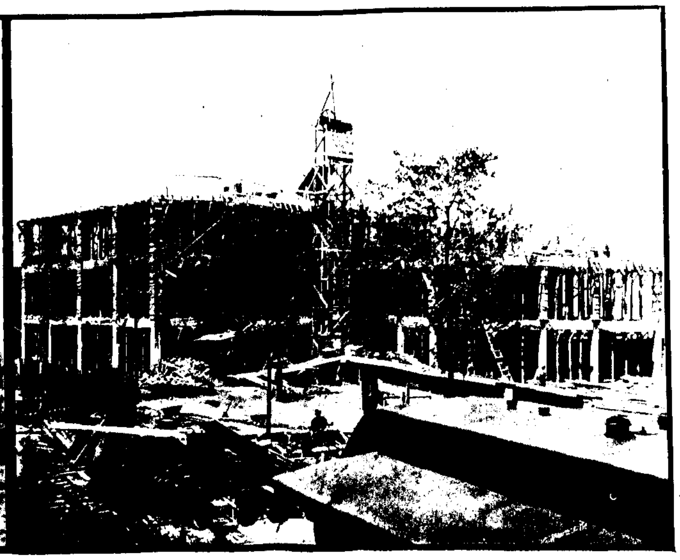
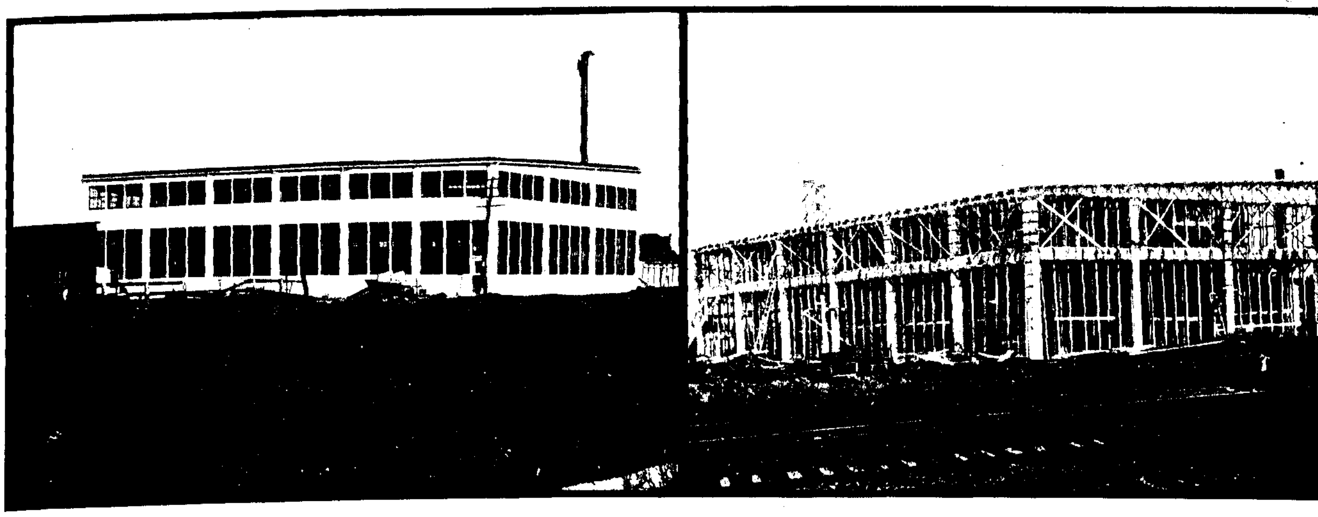




Factory Building for the Peabody Manufacturing Co., Walkerville. Architects, Owners.

Factory Building for The MacGregor-Banwell Fence Co., Walkerville. Mr. J. Simpson, Architect.



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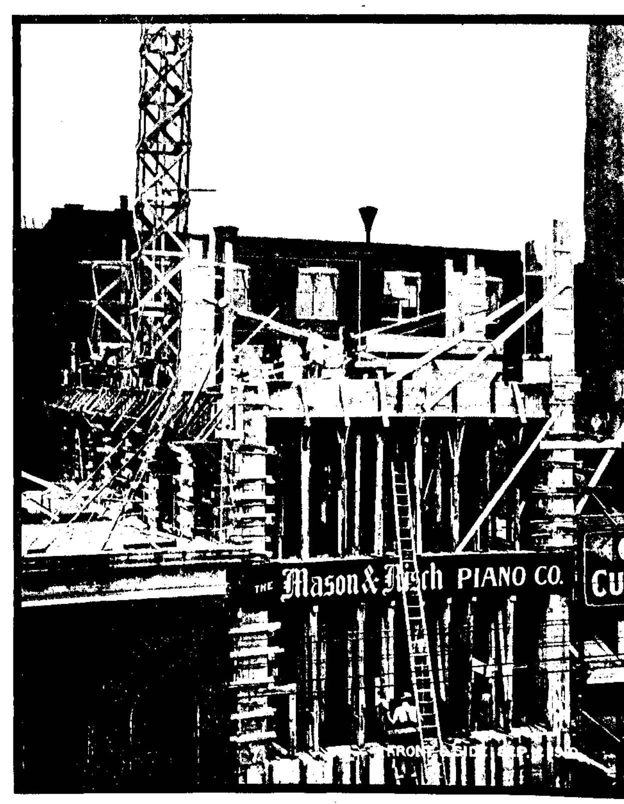

View of Mason & Risch Building, Showing Depth of Structure, Taken Thirty-five Days After Foundation was Completed. Bond & Smith, Architects.

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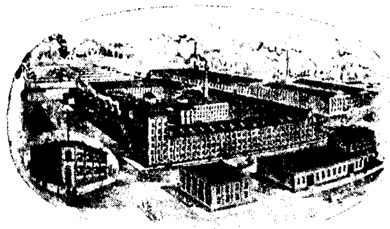

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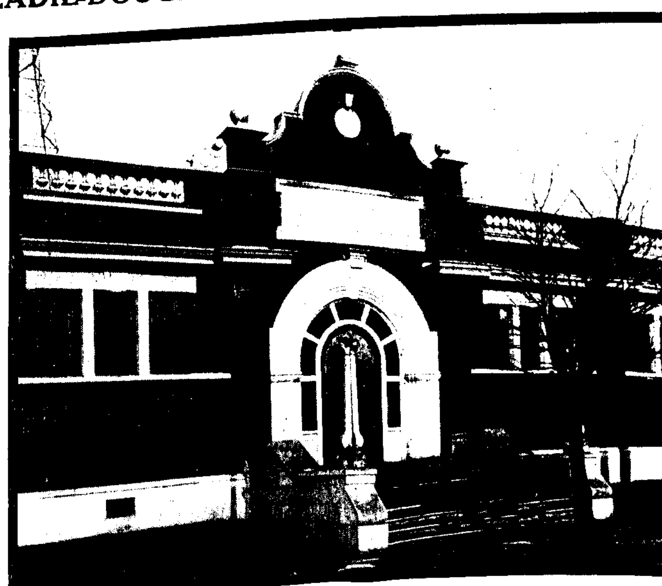
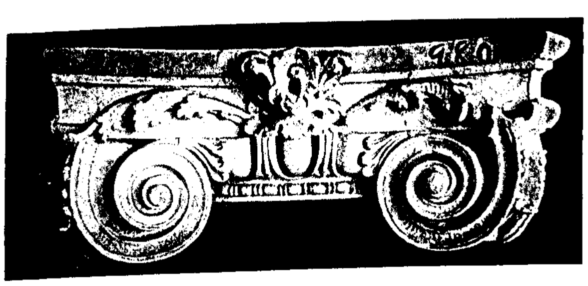
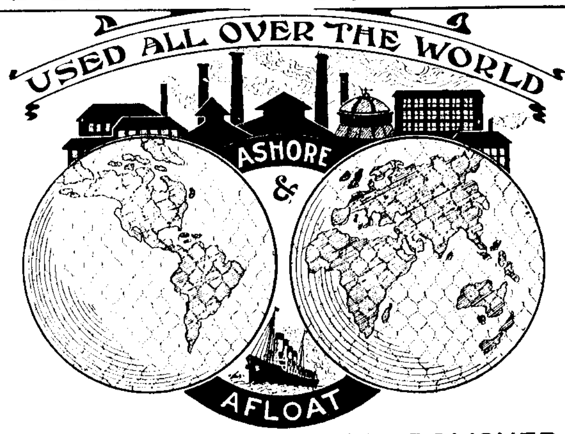
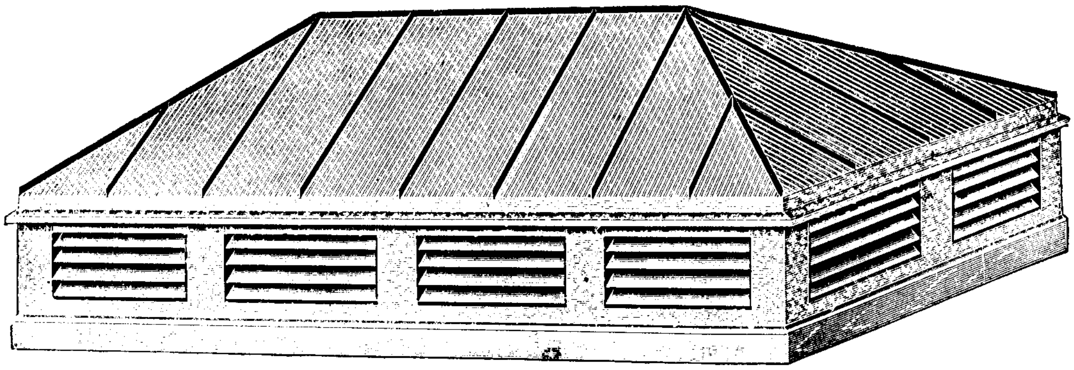


Entrance to Poultry Building, Canadian National Exhibition, Toronto. George W. Gouinlock, Architect.

The Carling Warehouse and Office, Simcoe Street, Toronto. Victor Moore, Architect.







Hipped Turret Skylight, Movable or Stationary Louvres—No. 8057, Page 29, Catalogue C.

A DIRECTORY FOR ARCHITECTURAL SPECIFICATIONS & CONTRACTORS' SUPPLIES & MACHINERY

Adamant Plaster.
Stinson-Reeb Builders' Supply Co.

Antique Furniture.
B. M. & T. Jenkins.

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Meadows, Geo. B. Co.
The Pedlar People.

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Canada Foundry Co.
Canada Wire Goods Mfg. Co.
Dennis Wire and Iron Works Co., Limited.
Meadows, Geo. B. Co.

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Canada Wire Goods Mfg. Co.
B. Greening Wire Co., Ltd.
Dennis Wire & Iron Works Co. Limited.
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General Brass Co., Limited.
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A. B. Ormsby, Limited.
The Pedlar People.

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E. F. Dartnell.
Eadie-Douglas Co.
Port Credit Brick Co.
Stinson Reeb Builders' Supply Co., Ltd.

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Dartnell, E. F.
McGill, David
Rogers, Alfred
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Ideal Concrete Machinery Co., Limited.
London Concrete Machinery Co.
Mussens, Limited

Cement Brick Machinery.
Ideal Concrete Machinery Co.
London Concrete Machinery Co.
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London Concrete Machinery Co.
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Goold, Shapley & Muir.
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Rogers Supply Co.

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W. D. Beath & Son.

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Mussens, Limited.

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Miller Bros. & Toms.
Mussens, Limited.
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John Maloney & Co.
Rogers Supply Co.
Stinson-Reeb Builders' Supply Co.

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Canadian Art Stone Co., Ltd.
Cement Products Company.
E. F. Dartnell.
Fred Holmes & Sons.
Roman Stone Co., Limited.

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W. A. Murray & Co.
Waring & Gillow.

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J. & J. Taylor.

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Eugene Dietzgen Co., Ltd.

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Sheldons, Limited.

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Turnbull Elevator Co.

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The Tungstolier Co. of Canada, Ltd.
Toronto Electric Light Co.

Electro-Plating.
Dennis Wire and Iron Works Co.

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Elevators (Passenger and Freight).
Otis-Fensom Elevator Co., Limited.
Turnbull Elevator Co.

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Otis-Fensom Elevator Co., Limited.

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Benjamin Moore Co.
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Randall Bros.

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Bowman & Connor.
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Mussens, Limited.

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Sheldons, Limited.

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Bishop Construction Co.
Clark & Monds.

Expanded Metal.
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Expanded Metal & Fireproofing Co.
Galt Art Metal Co.
Metal Shingle & Siding Co.
Stinson-Reeb Builders' Supply Co.
The Pedlar People.
Trussed Concrete Steel Co.

Fire Brick.
David McGill.
E. F. Dartnell.
Stinson-Reeb Builders' Supply Co.
Alexander Gibb.
B. & S. H. Thompson & Co., Ltd.

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

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General Fire Equipment Co., Ltd.

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Canada Foundry Co.
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Meadows, Geo. B.

Fire-Place Goods.
Canada Wire Goods Mfg. Co.
John Kay Co.
T. Eaton Co.

Fireproofing.
Clarence W. Noble.
David McGill.
Don Valley Brick Works.
E. F. Dartnell.
Eadie-Douglas Co.
Expanded Metal & Fireproofing Co.
Page Wire Fence Co.
Port Credit Brick Co.
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Trussed Concrete Steel Co.

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A. B. Ormsby, Limited.
Stinson-Reeb Builders' Supply Co.
The Pedlar People.

Fireproof Windows.
A. B. Ormsby, Limited.
Galt Art Metal Co.
Hobbs Mfg. Co.
Metal Shingle & Siding Co.
Pilkington Brothers, Ltd.
Stinson-Reeb Builders' Supply Co.
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Bird, F. W. & Son, Hamilton.
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Georgian Bay Shook Mills.
Seaman Kent Co., Limited
Siemon Bros.
Toronto Flooring Co.
Wilson Bros.

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Clare Brothers & Co.
Gurney Tilden Co.
King Radiator Co., Ltd.
Pease Foundry Co., Ltd.
Record Foundry & Machine Co.
Taylor-Forbes Co., Limited.

Furniture.
John Kay Co.

Galvanized Iron Works.
A. B. Ormsby, Limited.
Galt Art Metal Co.
Metal Shingle & Siding Co.
Sheldons, Limited.
The Pedlar People.

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

Glass.
Pilkington Bros., Ltd.

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Jas. C. Claxton & Son.

Grille Work.
Canada Wire Goods Mfg. Co.
J. & J. Taylor.
Meadows, Geo. B.

Hardware.
Gurney, Tilden & Co., Ltd.
Taylor-Forbes Co.

Hardwood Flooring.
Georgian Bay Shook Mills.
Page Wire Fence Co.
Seaman Kent Co., Limited.
Siemon Bros.
Wilson Bros.

Heating Apparatus.
Clare Brothers.
Dominion Radiator Co., Ltd., Toronto.
Goldie & McCulloch Co., Ltd
King Radiator Co., Limited.
Pease Foundry Co.
Record Foundry & Machine Co.
Sheldons, Limited.
Taylor-Forbes Co., Limited.

Heating Engineers and Contractors.
O'Connell, M. M.

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

Heating Engineers.
Canadian Domestic Engineering Co., Ltd.

Hinges.
Soss Invisible Hinge Co.

Hydrants.
Kerr Engine Co.

Iron Doors and Shutters.
J. & J. Taylor.

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

Iron Supplies.
Kerr Engine Co.

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

Interior Woodwork.
Burton & Baldwin.
Georgian Bay Shook Mills.
Globe Furniture Co.
niture Co.
Seaman Kent & Co.
Siemon Bros.
Wilson Bros.

Jail Cells and Gates.
Canada Wire Goods Mfg. Co.
Dennis Wire & Iron Works Co., Limited.
J. & J. Taylor.

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

Lamp Standards.
Canada Foundry Co., Ltd.
Dennis Wire & Iron Works Co., Limited.

Lath (Metal).
Beath, W. D. & Son.
B. Greening Wire Co., Ltd.
Canada Wire Goods Mfg. Co.
Clarence W. Noble.
Expanded Metal & Fireproofing Co.
Galt Art Metal Co.
Page Wire Fence Co.
Stinson-Reeb Builders' Supply Co.
The Pedlar People.
Trussed Concrete Steel Co.

Laundry Tubs.
H. C. Bedlington & Co.

Leaded Glass.
Hobbs Mfg. Co.
McGill, David.
Pilkington Brothers, Ltd.

Lodge Furniture.
Canadian Office & School Furniture Co.
Globe Furniture Co.

Mantels.
John Kay Co.
T. Eaton Company.

Marble.
B. & S. H. Thompson & Co., Ltd.
E. F. Dartnell.
Missisquoi Marble Company.
Smith Marble & Construction Co., Limited.
The Hoidge Marble Co., Ltd.

Metallic Sash.
Expanded Metal Co.
Hobbs Mfg. Co.
Stewart, Wm. & Co.

Metal Shingles.
Galt Art Metal Co.
Metal Shingle & Siding Co.
The Pedlar People.

Metal Store Fronts.
Hobbs Mfg. Co

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

Municipal Supplies.
Mussens, Limited.

Opera Chairs.
Canadian Office & School Furniture Co.

Ornamental Iron Work.
Canada Wire Goods Mfg. Co.
Canada Foundry Co., Ltd.
Dennis Wire & Iron Co., Limited.
International Supply Co.
Meadows, Geo. B., Ltd.

Packing.
Dunlop Tire & Rubber Co., Limited.
Gutta Percha & Rubber Mfg. Co.

Paints and Stains.
Benjamin Moore Co.
International Varnish Co.
Randall Bros.

Perforated Steel
Canada Wire Goods Mfg. Co.

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

Plasterers.
W. J. Hynes.

Plaster Corner Beads.
The Pedlar People.

Plate and Window Glass.
Consolidated Glass Co.
Hobbs Mfg. Co.
Pilkington Brothers, Limited.

Plumbers' Brass Goods.
General Brass Co.
Jas. Robertson Co., Limited.
Standard Ideal Co., Ltd.

Plumbing Fixtures.
Jas. Robertson Co.,Limited.
Standard Ideal Co., Limited.

Pneumatic Tools.
Mussens, Limited.

Porcelain Enamel Baths.
Jas. Robertson Co., Limited.
Standard Ideal Co., Limited.

Radiators.
General Brass Co.
Gurney, Tilden Co., Ltd.
King Radiator Co.
Taylor-Forbes Co., Limited.

Radiator Valves.
Kerr Engine Co.

Refrigerating Machinery.
Kent Company, Limited.
Linde British Refrigeration Co., Ltd.

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

Reinforced Concrete.
Expanded Metal & Fireproofing Co.
McGill, David.
Noble, Clarence W.
Page Wire Fence Co.
The Pedlar People.
The Canadian Siegwort Beam Co., Ltd..
Trussed Concrete Steel Co., Limited.

Relief Decoration.
W. J. Hynes.

Roofing Paper.
Alex. McArthur & Co.
The Pedlar People.

Roofing
Bird, F. W. & Son, Hamilton.

Roofing (Slate).
A. B. Ormsby, Limited.

Roofing Tile.
David McGill.
E. F. Dartnell.
The Pedlar People.

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

Safes, Vaults and Vault Doors.
Goldie & McCulloch Co., Limited.
J. & J. Taylor.

Sand and Gravel Screens.
B. Greening Wire Co., Limited.
Canada Wire Goods Mfg. Co.

Sanitary Plumbing Appliances.
Jas. Robertson Co.
Standard Ideal Co., Limited.

School Furniture.
Globe Furniture Co.

Screens.
Watson, Smith Co.

Shafting Pulleys and Hangers.
Goldie & McCulloch Co., Limited.

Sheet Metal.
A. C. Leslie & Co.

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

Shingle Stains.
Benjamin Moore Co.
International Varnish Co.
Randall Bros.
Sturgeon, F.

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

Sidewalk Lifts.
Otis-Fensom Elevator Co., Limited.

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

Slate.
Vallango Slate & Marble Co.

Stable Fittings.
Canada Wire Goods Mfg. Co.
Dennis Wire & Iron Works Co., Ltd.

Staff and Stucco Work.
W. J. Hynes.

Steam Appliances.
Kerr Engine Co.
Sheldons Limited.
Taylor-Forbes Co.

Steam and Hot Water Heating.
Dominion Radiator Co., Limited.
Gurney, Tilden Co., Limited.
King Radiator Co., Ltd.
Taylor-Forbes Co., Limited.
Warden King, Limited.

Steel Casements.
David McGill.
Wm. Stewart & Company.

Steel Concrete Construction.
Beath, W. D., & Son.
Expanded Metal & Fireproofing Co.
Noble, Clarence W.
The Pedlar People.
Trussed Concrete Steel Co.

Steel Doors.
A. B. Ormsby, Limited.
Canada Wire Goods Mfg. Co.
The Pedlar People.

Structural Iron Contractors.
Dominion Bridge Co.
Hamilton Bridge Co.
Jenks-Dresser Co., Ltd.
Reid & Brown.
Structural Steel Co., Ltd.
Stratford Bridge & Iron Co.

Structural Steel.
Dennis Wire and Iron Works Co., Limited.
Dominion Bridge Co.
Hamilton Bridge Co.
Jenks Dresser Co., Limited
Reid & Brown.
Stratford Bridge Co.
Structural Steel Co., Ltd.

Store Fixtures.
Canadian Office & School Furniture Co.

Terra Cotta Fireproofing.
David McGill.
Don Valley Brick Works.
Eadie-Douglas Co.
E. F. Dartnell.
International Supply Co.

Tile (Floor and Wall).
David McGill.
E. F. Dartnell.
Smith Marble & Construction Co.

Varnishes.
Benjamin Moore Co.
International Varnish Co.
Randall Bros.

Valves.
Kerr Engine Co.
Taylor-Forbes Co.

Ventilators.
Sheldons, Limited.
Stewart, Wm., & Co.

Wall Finishes.
Benjamin Moore Co.
Berry Bros.
International Varnish Co.
Randall Bros.

Wall Hangers.
Taylor-Forbes Co.

Wall Hangings.
John Kay Co.
T. Eaton & Co.
W. A. Murray & Co., Ltd.

Waterproofing.
Bird, F. W. & Son, Hamilton.
Cresit Waterproofing Co.
Eadie-Douglas, Limited.
Grose & Walker
Stinson-Reeb Builders' Supply Co.

Waterworks Supplies.
Kerr Engine Co.
Mussens, Limited.
Standard Ideal Company, Limited.

Wheelbarrows.
Mussens, Limited.

White Lead, Putty and Oils
International Supply Co.

Window Guards.
B. Greening Wire Co., Limited
Canada Wire Goods Mfg. Co
Page Wire Fence Co.

Window Shades.
Wm. Bartlett & Son.

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

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