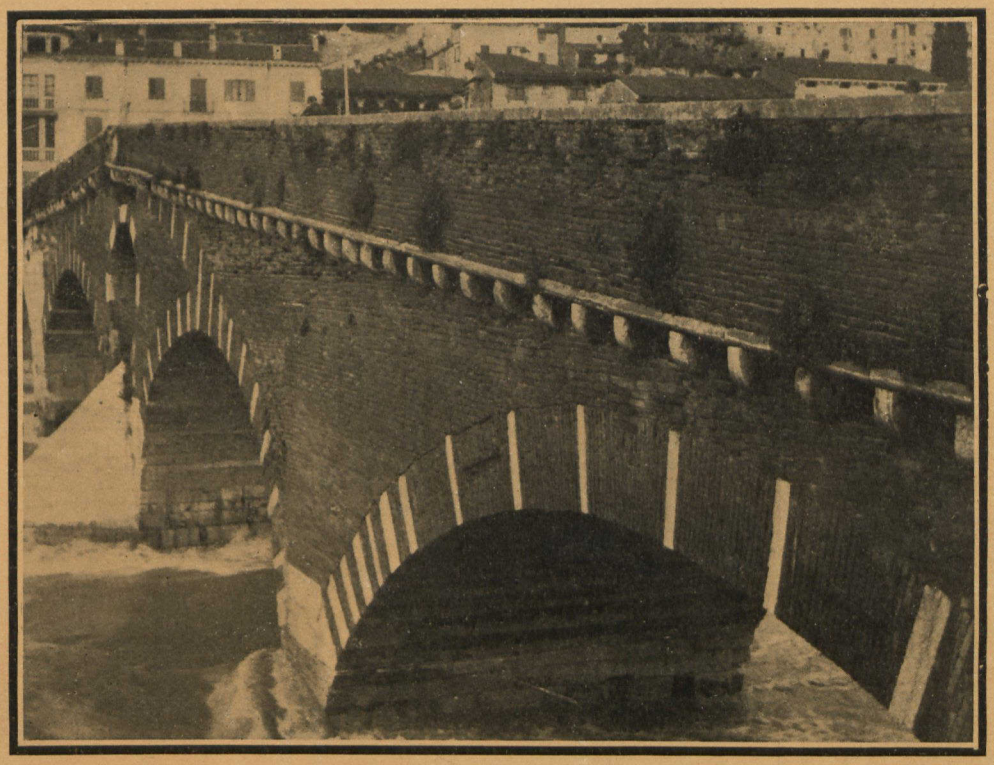
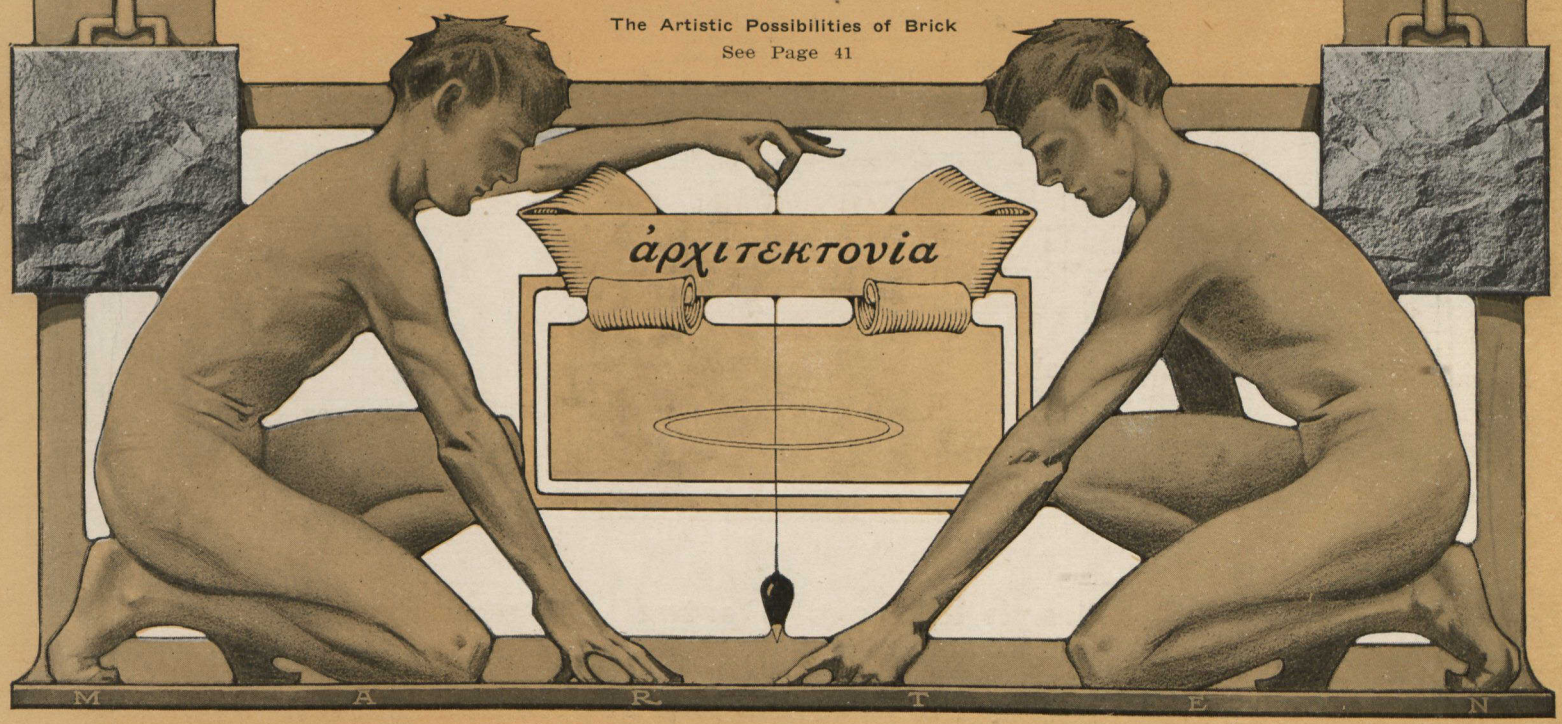
CONSTRUCTION

A JOURNAL FOR THE ARCHITECTURAL ENGINEERING AND CONTRACTING INTERESTS OF CANADA

Vol. 2, No. 7. MAY, 1909 $2.00 PER YEAR 25c. PER COPY



The Artistic Possibilities of Brick
See Page 41



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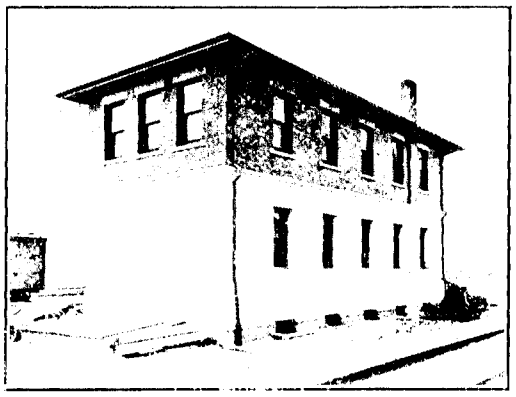

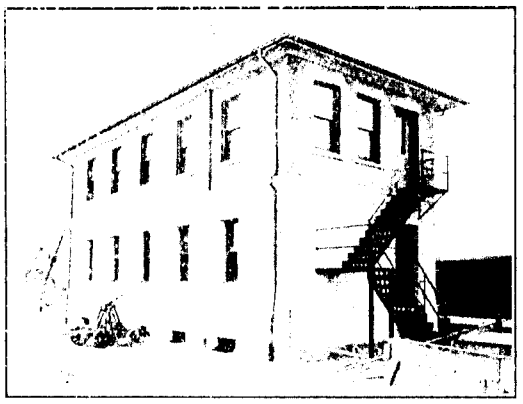

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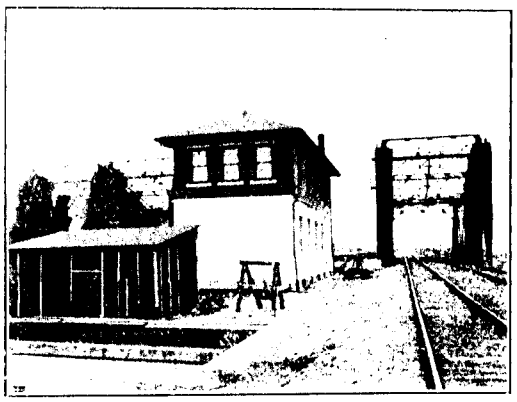

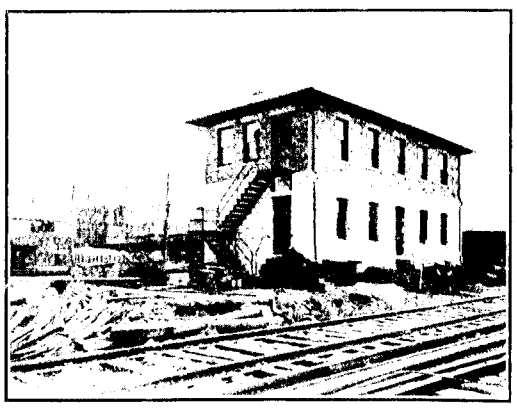

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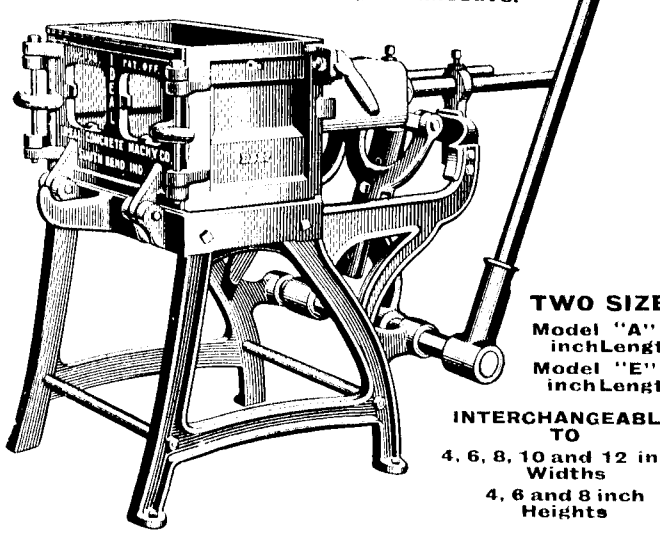

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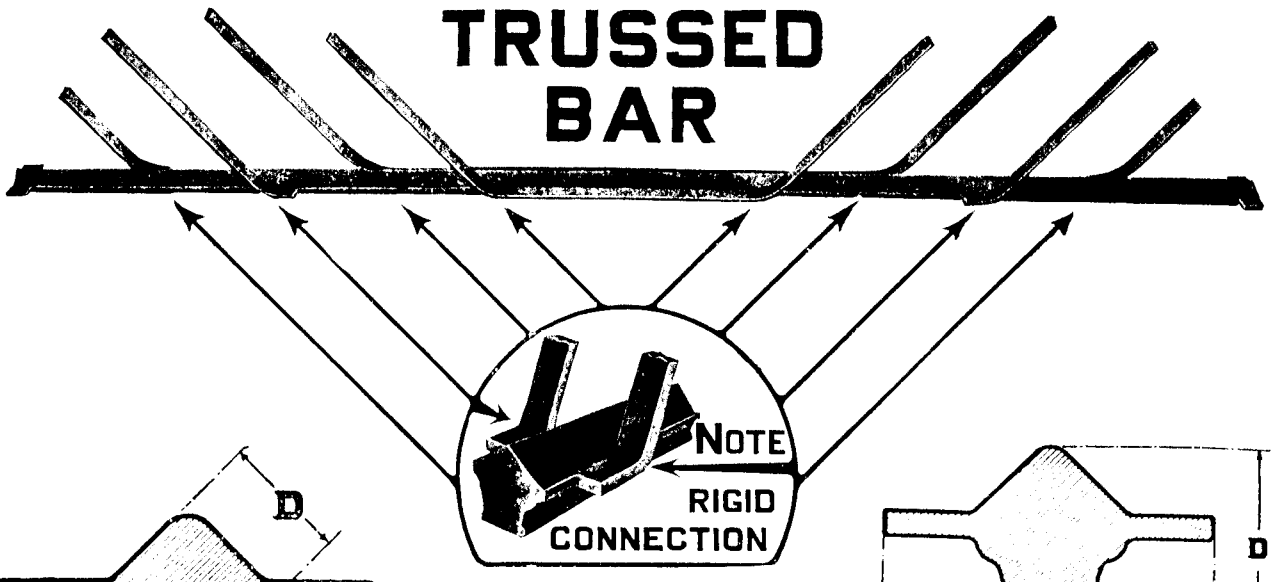

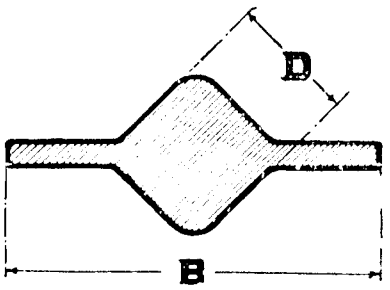

D & B	Weight per lineal foot	AREA	Length of Diagonals
1½ x 2½ in.	4.4 lbs.	1.1 sq. in	6 in., 8 in., 12 in.
1½ x 2 3-16 in.	2.7 lbs.	0.70 sq. in	12 in., 8 in., 18 in.

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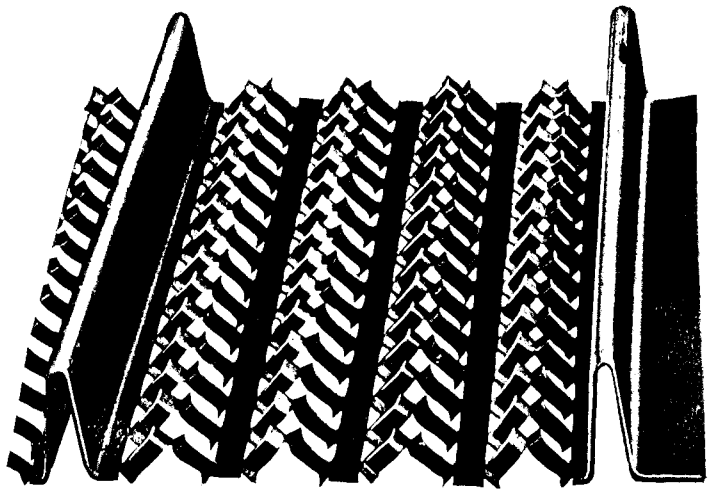
1½ x 2½ in.	6.8 lbs.	2.00 sq. in.	24 in., 18 in., 30 in., 36 in.
2 x 3½ in.	10.2 lbs.	3.00 sq. in.	30 in., 24 in., 36 in., 45 in.



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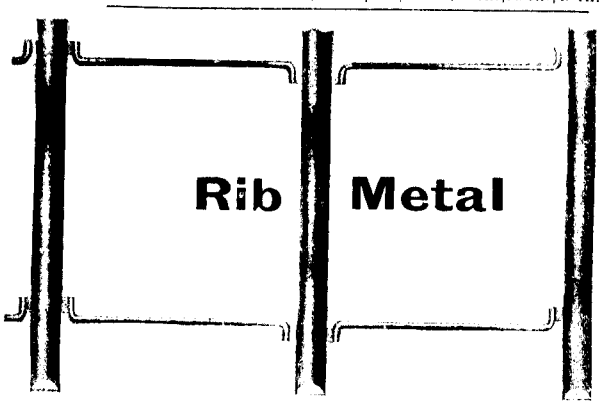
Above gauges carried in stock. Other gauges can be supplied within a reasonable time.



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Size No.	Width of Standard Sheet	Square Feet per Lineal Foot of Standard Sheet	Area per Foot of Width
2	16 in.	1.33	.54 sq. in.
3	24 "	2.00	.36 "
4	32 "	2.67	.27 "
5	40 "	3.33	.216 "
6	48 "	4.00	.18 "
7	56 "	4.67	.154 "
8	64 "	5.33	.135 "

Other Kahn System Products are: Column Hooping, Cup-Bars, Rib-Lath, Rib Studs, TRUS-CON Chemical Products a special product for each branch of concrete work.

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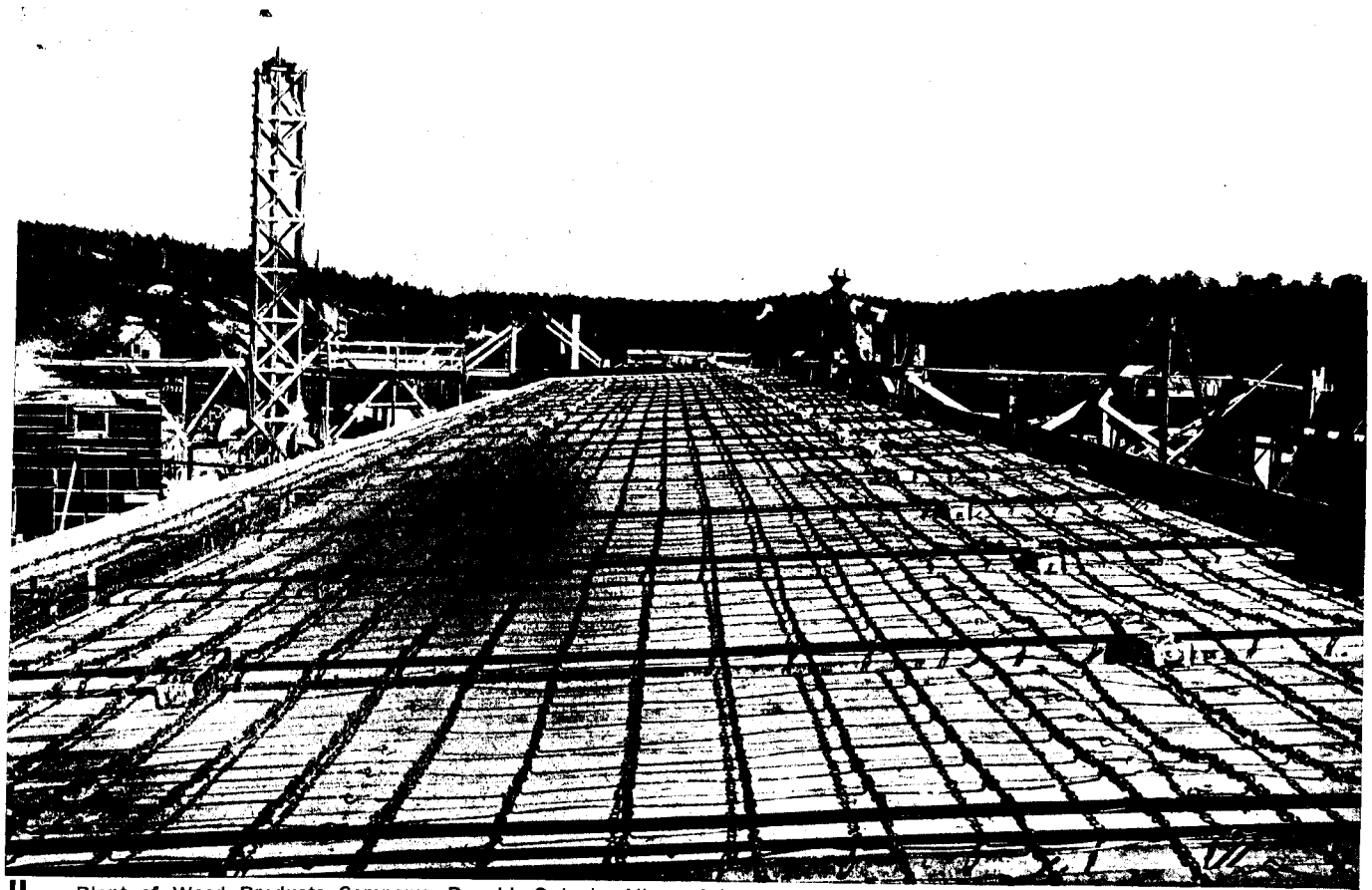

Plant of Wood Products Company, Donald, Ontario—View of Lower Floor of Still House—17 Feet Wide and 128 feet Long, Showing Oneida Coommunity Chain Fabric in position to Receive Concrete. E. D. Pitt, Designing and Constructing Engineer.

$2,500 Saved

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COMMUNITY CHAIN REINFORCEMENT

THE whole trend of slab reinforcement is toward forms of Fabric made up so as to provide mechanical bond, and enable cost of applying to be reduced to the lowest possible limit. Previous to the introduction of COMMUNITY CHAIN FABRIC, this has been accomplished by plain wire and sheet metal Fabrics.

Plain wire has no mechanical bond, and sheet metal Fabric is apt to be of low working stress, and poor in quality.

In COMMUNITY CHAIN FABRIC, we present a material having perfection of material, an ideal articulated mechanical bond, and of a flexible form which permits the lowest cost for labor in applying.

We are confident, as a result of the present season's work in this material, that COMMUNITY CHAIN REINFORCEMENT has points of advantage possessed by no other material; we have proved it, and are in a position to prove it to prospective builders, architects and engineers, who are looking for the ideal reinforcement for concrete.

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Pressed Brick Absorption, 7.7%. Compression, 6,573 lbs. per sq. inch
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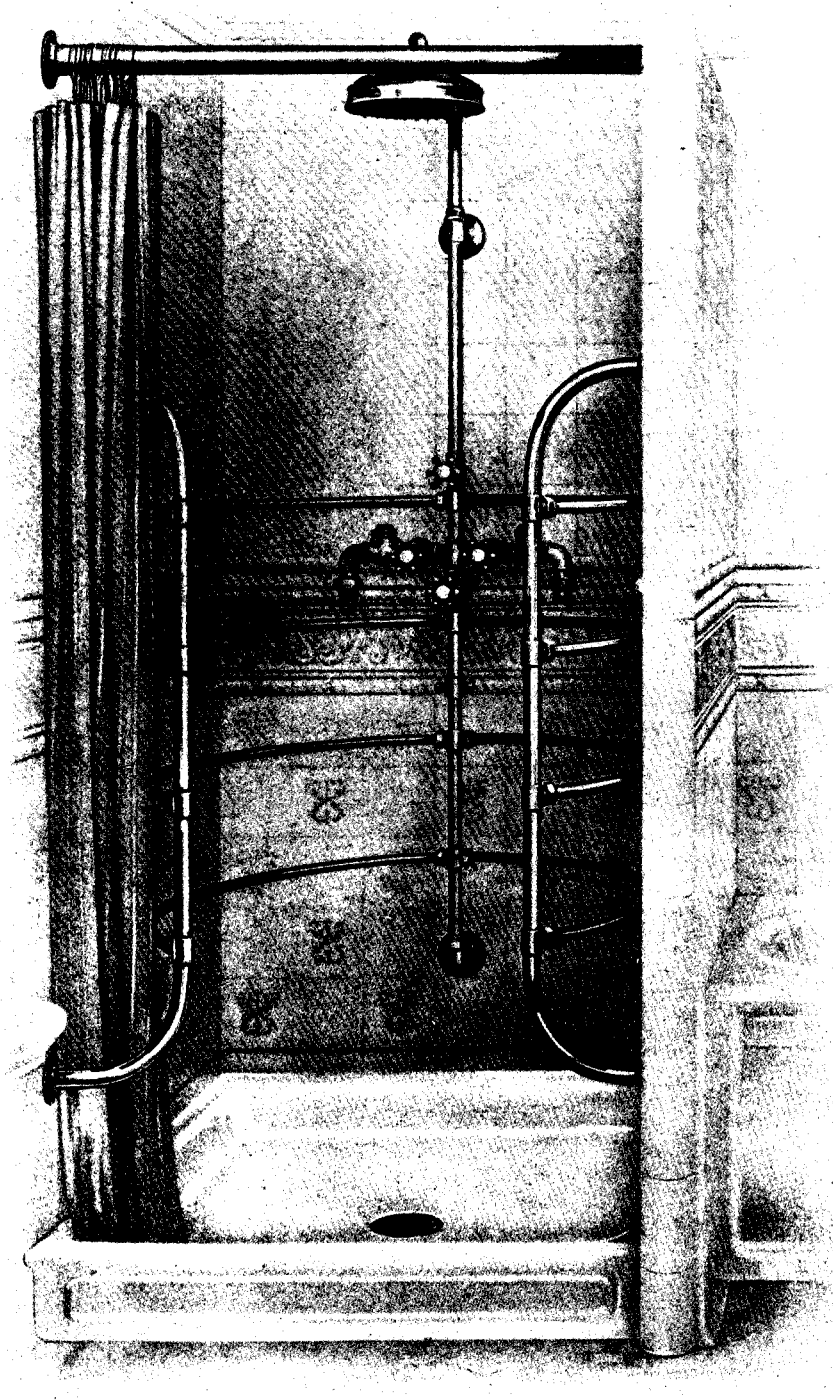


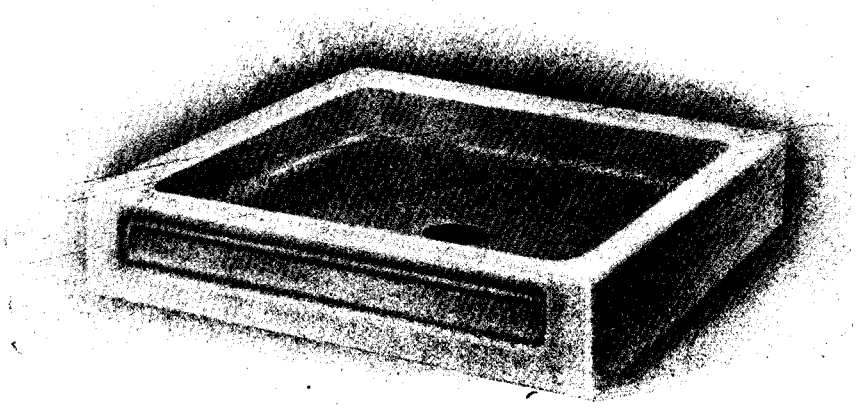
"ALEXANDRA WARE"—PLATE F. 040. First Grade Enamelled Outside and Inside Recess Receptor with Nickle-Plated Brass Combination Needle and Shower, Curtain Rod and Hooks, Strainer, Coupling and Rubber Curtain. *DIMENSIONS*—Length Outside, 39 inches; Height, 8 inches; Width over all, 40 inches; Depth, 6 inches.

The Standard Ideal Company Ltd.

"Alexandra" Shower Receptors

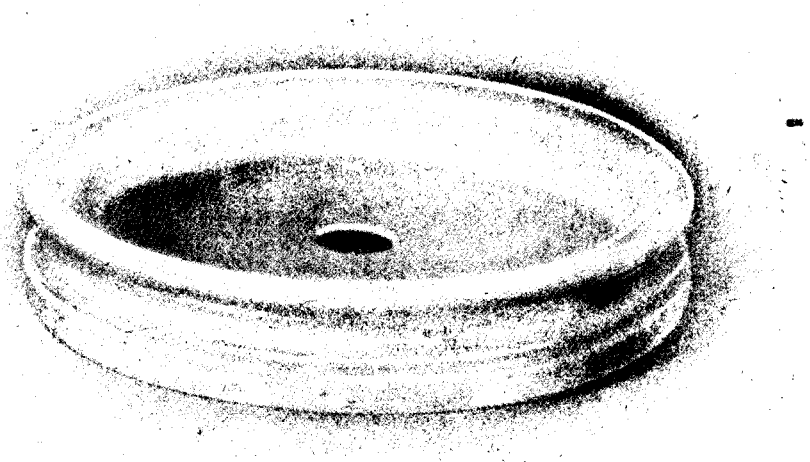
"ALEXANDRA" RECEPTORS are made in sizes and designs to suit every requirement in this line, and the features peculiar to this Snowy White Ware, adapt it most admirably for this Bath-Room Fixture.

"ALEXANDRA WARE" — PLATE F. 043. First Grade Enamelled Outside and Inside Receptor. Nick'e-Plated Brass Strainer and Waste Coupling. *DIMENSIONS* — Length Outside, 36 inches; Width Outside, 36 inches; Width of Roll Rim, 3 inches; Depth Outside, 6 inches.



"ALEXANDRA WARE"— PLATE F. 042. First Grade Enamelled Outside and Inside Shower Receptor. Nickle-Plated Brass Strainer and Waste Coupling. *DIMENSIONS*—Length Outside, 39 inches; Width Outside, 39 inches; Height, 8 inches; Depth, 6 inches.

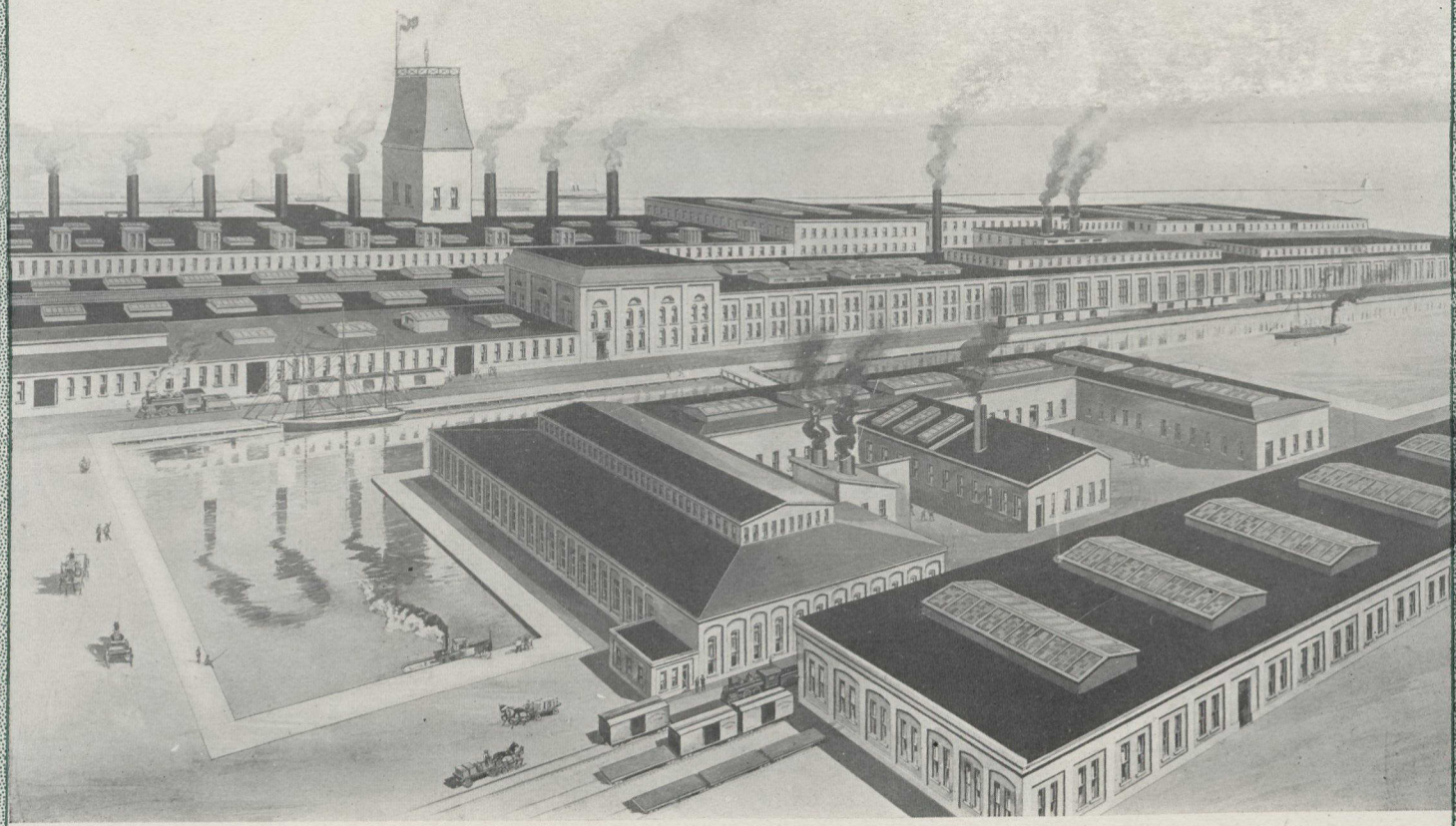
"ALEXANDRA WARE"— PLATE F. 041. First Grade Enamelled Outside and Inside Shower Receptor. Nickle-Plated Brass Strainer and Waste Coupling. *DIMENSIONS*—Diameter Outside, 36 inches; Diameter Inside, 30 inches; Width of Roll Rim, 3 inches; Depth Inside, 6 inches.



ALEXANDRA WARE

REGISTERED SUPERIORITY PURITY TRADE MARK

DURABLE AS THE PYRAMIDS



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500 HANDS EMPLOYED. CAPACITY 110 TONS OF IRON MELTED DAILY.

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MANUFACTURERS OF CAST IRON PORCELAIN ENAMELLED SANITARY WARE.

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ALEXANDRA WARE

"A PERTINENT INSTANCE"—EDITORIAL IN APRIL "CONSTRUCTION" BRINGS TO LIGHT UNWARRANTED USE OF NAME OF PROMINENT ARCHITECTURAL FIRM. - -

UNDER THE CAPTION of "A Pertinent Instance," CONSTRUCTION in its last issue, had some emphatic outspoken things to say on the subject of professional ethics in general, and graft in particular, drawing up a composite case that illustrated very clearly its ideas regarding the evils of professional graft.

In the course of that article, we stated that *"the name of one of the largest architectural firms in Canada (if not the largest) had been carted about the country in promotion of a scheme,"* and that the name of the firm in question *"is associated with the project either with or without their consent."* Also that *"it has even been whispered, confidentially, that one of the members of the firm was financially interested in the enterprise."*

This article has naturally created more or less of a sensation, and has been a subject of wide spread discussion among the professional and commercial branches of the structural industry, and it is perhaps not unnatural that much speculation is rampant as to just what firms were referred to in the article.

Our attack upon the principle of architects' names being associated with enterprises outside their profession, which obligated them to firms whose materials they have the power to specify or reject, has already served one very valuable purpose. It has brought to light the fact, that the name of at least one prominent firm of architects, has been used without their knowledge or consent, in the promotion of a commercial enterprise, and these architects, after investigation, have been enabled to put a stop to any further use of their good name in connection with any such scheme.

It is with considerable pleasure that we state unreservedly, that the persistent and adverse trade comment of the past few months, connecting the name of this particular firm of architects with any such schemes, has been, we find, based on purely circumstantial evidence, and it is gratifying to us, and it must be to the whole profession, to be assured that there is no promoter or firm of promoters of schemes, who have any right to use in any way, shape, or form, in connection with such schemes, the name of this, one of the oldest and most reputable firms of architects in Canada, and, furthermore, if any one has used their name in connection with any such scheme, it has been wholly without their knowledge or consent.

CONSTRUCTION, during its short but aggressive and progressive career, has received not a few compliments from the industry to which it is devoted, regarding its various features, and in particular it has been praised for its fearless and outspoken attacks on the various forms of graft, chicanery, and unprofessionalism, which, unless vigorously stamped out in their inception, would eventually undermine every principle of professional and commercial decency. In following up this definite policy, an occasional concrete exposure of an incipient cancer must be made, and in every instance including those here under discussion, we have received an instantaneous response of approval of our action, from all the leading members of the architectural profession.

We might just add here that the condition of affairs that brings about the use of the names of reputable architects, for the promotion of any commercial undertaking, is most unfortunate, and any and every architect in the Dominion, should be most careful in just how far he permits his name to be used, and he cannot be too cautious, in even the endorsement of a proposition, in which it is the aim to solicit patronage from any branch or branches of the building fraternity.

While on the subject, let us make it perfectly clear to our readers that CONSTRUCTION stands fully back of every word it has said in its previous issues, and its stand against professional graft has the full endorsement of every architectural firm in Canada, including any of those whose names have been used in conection with any such enterprises as referred to. As comment had existed, such an editorial was necessary, and the profession quite concurs with us in this view.

If through CONSTRUCTION'S stand on this very important subject, the improper use of the names of architects by promoters of the various schemes that are annually brought before the contractor, the building material dealer, and manufacturer, we have served no other purpose than making architects more careful how they handle the man, who wants to secure their endorsement or support in soliciting patronage from men with whom the architect's name might have some influence, we believe it has served the profession well.

YANKEE CONTEMPORARY CALLS "CONSTRUCTION" PEVISH AND ITS POLICY AGAINST UNLAWFUL IMPORTATION OF FOREIGN PLANS, MERCENARY. - - -

CONSTRUCTION IS CALLED "PEVISH" by our contemporary, THE WESTERN ARCHITECT, because we were not inclined to accept their charitable advice about the benefits the profession in Canada would enjoy through the encouragement of the importation of plans of American architects.

Our contemporary says American architects do not care, whether or not, foreign architects are allowed to design buildings in the United States. Then why does not the American republic take down its tariff walls against the importation of foreign plans? And why are the U.S. custom authorities so diligent in the collecting of such duties? Our friend in Minneapolis says American architects are not concerned about securing a Canadian clientile. Then why do they go so far as to solicit (business) in Canada and attempt to devise schemes for avoiding the rightful payment of Canadian customs duties?

THE WESTERN ARCHITECT maintains that architects are alike the world over, and that they are not concerned about such boundries as are defined by such a plebian creation as a customs duty. This statement we hardly believe will hold water.

Again it charges that CONSTRUCTION'S stand is prompted by its consideration for the material man "for whose interests CONSTRUCTION wishes to pose as champion, and the prosperous appearance of that journal (CONSTRUCTION) would indicate that he (the material dealer) appreciates its efforts in his behalf." Canadian architects and material dealers know why CONSTRUCTION looks prosperous. We have no explanation to make on this score. However, we would state that CONSTRUCTION does not preceed its editorial pages with a *"Publishers Department,"* a department devoted exclusively to free readers designed to boost the products of its advertisers. Our contemporary makes the still more amusing statement that it is published in the interests of Canadian architects, "from *Nova Scotia* to Vancouver (why not say Halifax to Vancouver) in quite the same proportion that it is, say, on the Pacific Coast from Vancouver to Los Angeles."

At first glance we are inclined to accept this statement, for in looking through the illustrations of the April issue of the WESTERN ARCHITECT, we find two Canadian buildings treated, a residence at Walkerville, Ontario, and a bank at Windsor. Six pages are devoted to the former and one to the latter. But upon closer observation, we discover that one was designed by a Detroit architect and the other by a New York architect.

We believe if nothing else, the publication of these two structures erected in Canada and designed by foreign architects, will convince Canadian architects that THE WESTERN ARCHITECT is entitled to pose as the champion of their cause, and that it is published in the interests of Canadian architects from Vancouver to (Nova Scotia) just as much as it is published in the interests of American architects from Vancouver to Los Angeles.

MORE STRINGENT REGULATIONS URGED FOR PROTECTION OF CANADIAN ENGINEERING PROFESSION—FOREIGNER OFTEN GIVEN PREFERENCE. - - - -

"THEORETICALLY it may be all right to have the engineering profession as broad as the four winds of Heaven, but practically I say it is absolutely absurd and ridiculous." This was a statement made by one of the members of the Canadian Society of Civil Engineers, at one of their sessions of the Annual Meeting recently held in Toronto. This statement was brought forth in a discussion of the question of the employment of foreign engineers on Canadian work. It was pointed out that Canadian corporations had in many cases given foreign engineers the preference while there were many capable young members of the profession in Canada, who had been out of employment during the major portion of 1908.

In the same discussion, it was further pointed out that the qualifications for admission to Associate membership of the Society were greatly at fault, in that it permitted many foreigners who were without qualifications equal to those of the graduates of our schools of Applied Science in Canada. While there were some members that thought the Society should be an international one, there was a strong feeling that some action should be taken to protect the profession in Canada against the incursion of foreign engineers who flocked to Canada, when out of employment in their own country.

Canada, without doubt, offers excellent opportunities for the young engineer. The vast amount of railway construction, municipal work, bridge construction, building construction, water power development, electrical construction, development of mines, and in fact, engineering work of almost every description, will attract engineers from every country in the world.

On the other hand, our schools of Applied Science are sending forth hundreds of young Canadian graduates every year. If Canadian work is to be done by foreign engineers, then must the young Canadian seek employment in other climes. This surely is not a condition to be desired. Why should English or American engineers be permitted to come to Canada, a land foreign to them, and exile our own citizens to foreign lands. Why should we trade a stout hearted Canadian for an American or a German.

If protection is given to the corporation that employs the engineer, why should not the same paternal government protect the engineer. If it is deemed expedient to protect the manufacturer against the dumping of foreign products upon the Canadian market, why should not the professional man be protected against the dumping of foreign, surplus, professional services in Canada.

Canada is a rich country. The Twentieth Century belongs to us. The world is waking up to a realization of this fact, and we must see to it that we hold what we have. It is hard to understand how Canadian corporations can expect the public to sympathize with their plea for more protection when they insist upon going upon the open market for professional services, yes even their labor.

APRIL BUILDING RETURNS FROM REPRESENTATIVE CENTRES IN CANADA SHOW A CONTINUANCE OF MARVELLOUS GAINS.

THE HIGHLY SATISFACTORY condition in the building line, so marked during the first three months of the year, still prevails, and April tacks on a substantial increase over the corresponding month of 1907, to the splendid gains already made so far this season. All sections of the country are enjoying a steady advance in construction work and it seems quite evident in view of the heavy influx of settlers into western provinces of the Dominion and the attendant growth of the middle and eastern portions, that even the high percentage gains already attained will be surpassed within the next few months.

The average gain for April, as based on returns submitted to CONSTRUCTION from fifteen representative centres throughout the country, twelve of which supply comparative figures, is 53.36 per cent., and only one city in the entire list shows a falling off. This decline is noted in the case of Vancouver which, after an extended period of consecutive gains, records a decrease of 42.77 per cent. It is quite probable, however, judging from the indication at hand, that Vancouver will quickly wipe out the deficit as a large amount of work is at the present time on the tables in the various architects' offices.

The largest increase for the month, is that of Fort William, which takes the stellar position by a gain of 1180. per cent., a remarkable advance, especially so, in view of the enormous building strides this city has been making within the past two years.

Peterboro maintains the second place by virtue of a striking gain for the month, of 287 per cent., the total amount for permits issued being $81,721, as against $21,110 for the same month of 1908.

The next largest increase noted is that of London's whose gain for the month is 149 per cent., following the lead of 175 per cent. for the previous month, shows the rapid and substantial growth which she is experiencing at the present time.

Toronto again registers a material gain, by an advance of 71.28 per cent., the total value of permits issued for new buildings being $2,003,398 as compared with $1,169,635 for April, 1908. It is expected that Toronto's monthly showing hereafter will be materially

improved by the recent annexation of West Toronto, as that city is building up very rapidly.

Other places in Ontario which are taking extraordinary steps forward are Berlin, Kingston, and Windsor, as is seen by the amounts set opposite their names in the following table. While none of these cities give comparative figures, all of them so far this year have more than doubled their totals over the corresponding months of last year.

In the eastern portion of the Dominion, Halifax and St. John both show material headway, the former again noting a big gain, (44.29 per cent.) and the latter a large volume of work (no comparative figures submitted) in its total for the month of $108,000.

Montreal's increase for the month, that of 169 per cent, which was received too late to be included in the following table, is the largest and fourth consecutive gain made so far this year; and as the present satisfactory condition promises to continue throughout the entire season, it is quite likely that Montreal will pile up a total annual amount greatly in excess of anything registered heretofore.

In the west every city, with the exception of Vancouver, has over-reached last year's figures for the month. Regina has a most gratifying increase of 131.12 per cent.; Winnipeg records 65.81 per cent.; Calgary 63.59 per cent.; Victoria 45.07 per cent., and Edmonton 6.75 per cent.

Reports as to immediate prospects are most encouraging, as is evidenced in the following notations: Calgary, "excellent"; Winnipeg, "good"; Windsor, "bright"; St. John, N.B., "fair"; Berlin, "exceptionally good"; Edmonton, "good"; Kingston, "very bright"; London, "continues excellent." Vancouver reports "the present outlook is for steady increase over last year for the next six months," while in Toronto, Montreal, Peterboro' and Victoria the indications were never better.

	Permits for May, 1909.	Permits for May, 1908.	Increase, Per cent.	Dec., P.C.
Berlin, Ont.	73,300	.....	.....	....
Calgary, Alta.	174,150	106,450	63.59	....
Edmonton, Alta.	210,890	197,453	6.75	....
Fort William, Ont.	1,114,900	86,500	1,188.90	....
Halifax, N.S.	57,125	39,590	44.29	....
Kingston, Ont.	43,000	.....	.....	....
London, Ont.	177,250	71,000	149.64	....
Peterboro', Ont.	81,721	21,110	287.11	....
Regina, Sask.	71,875	31,098	131.12	....
St. John, N.B.	108,000	.....	.....	....
Toronto	2,003,398	1,169,635	71.28	....
Vancouver, B.C.	784,750	1,371,260	.....	42.77
Victoria, B.C.	188,060	129,625	45.07	....
Windsor, Ont.	65,450	.....	.....	....
Winnipeg, Man.	1,066,000	642,900	65.81	....
	5,930,119	3,866,621	53.36	....

ARCHITECT EDEN SMITH, TORONTO, ANSWERS CRITICISM OF HIS LETTERS IN "CONSTRUCTION" BY PRESIDENT OF TORONTO BUILDERS' EXCHANGE. - - -

WE PUBLISHED in the March issue of CONSTRUCTION a letter from Mr. Arthur Dinnis, President of the Toronto Builders' Exchange, in which he deprecated a statement made in a letter by Mr. Eden Smith, published in the February number of CONSTRUCTION, and advocated a closer relationship between architects and builders. We publish below a reply from Mr. Eden Smith.

From the tone of both Mr. Dinnis' letter and that of Mr. Smith, we are inclined to think that there is some misunderstanding between these two gentlemen on the points under discussion.

The following letter arrived too late for publication in April CONSTRUCTION.

Editor of Construction:

I am sorry to ask again to trespass on your pages, but I should like an opportunity to defend myself, as you allowed Mr. Dinnis to select some portions of sentences from my last letter and by means of them to accuse me of calling the Toronto Builders dishonest.

I do not resent his calling me egotistical or pharisaical, Mr. Dinnis' example will help me to cure that, but when the whole intent of that part of my letter was, using his own phraseology, "to boost not to knock," or to show, not that any one was dishonest but rather that some one was honest enough to be allowed about without fetters, I do not object to Mr. Dinnis' imagination making this an attack upon the innocent flock he shepherds, for no other reason, that I can see, but that he may prance up and down and gallantly rush to their rescue.

I only said in my letter that architects were honest, I did not say that builders or any one else were dishonest. Surely "honesty in work" is a phrase familiar enough to every designer, craftsman, or employer of labor to admit of its being used without libelous intent.

I might use Mr. Dinnis' own method of expression and ask him what kind of architects has he been in the habit of dealing with that he so indignantly resents my assertion of their honesty.

My letter contained no personalities. I did not consider my honesty was a part of the discussion and did not seek to advertise it. So far from thanking God "I am not like other men." I dare not claim even equality with Mr. Dinnis when as he points out "honesty admits of no comparative degrees," and that he in this quality is simply perfect. I am really content to be like Verges, "as honest as any man living that is an old man and no honester than I," but I am afraid again I shall offend Mr. Dinnis' grammatical ear when I quote Shakespeare, and I must not, like Hamlet, imagine a man might be "indifferent honest" or that to be "honest as this world goes is to be one man picked out of ten thousand." That would only be an allowance of seven hundred men in the Dominion of Canada, which if there are Builders' Associations in other towns would be so soon used up that it would account for Mr. Dinnis' surprise when I said architects were honest.

But for Mr. Dinnis' assurance that beyond all degrees of comparison he is absolutely honest, I should have considered it not quite straight forward to quote a portion of my letter which when read by those who did not know its context or the subject of the letter would be taken as an objectless expression of ill will.

Yours truly,

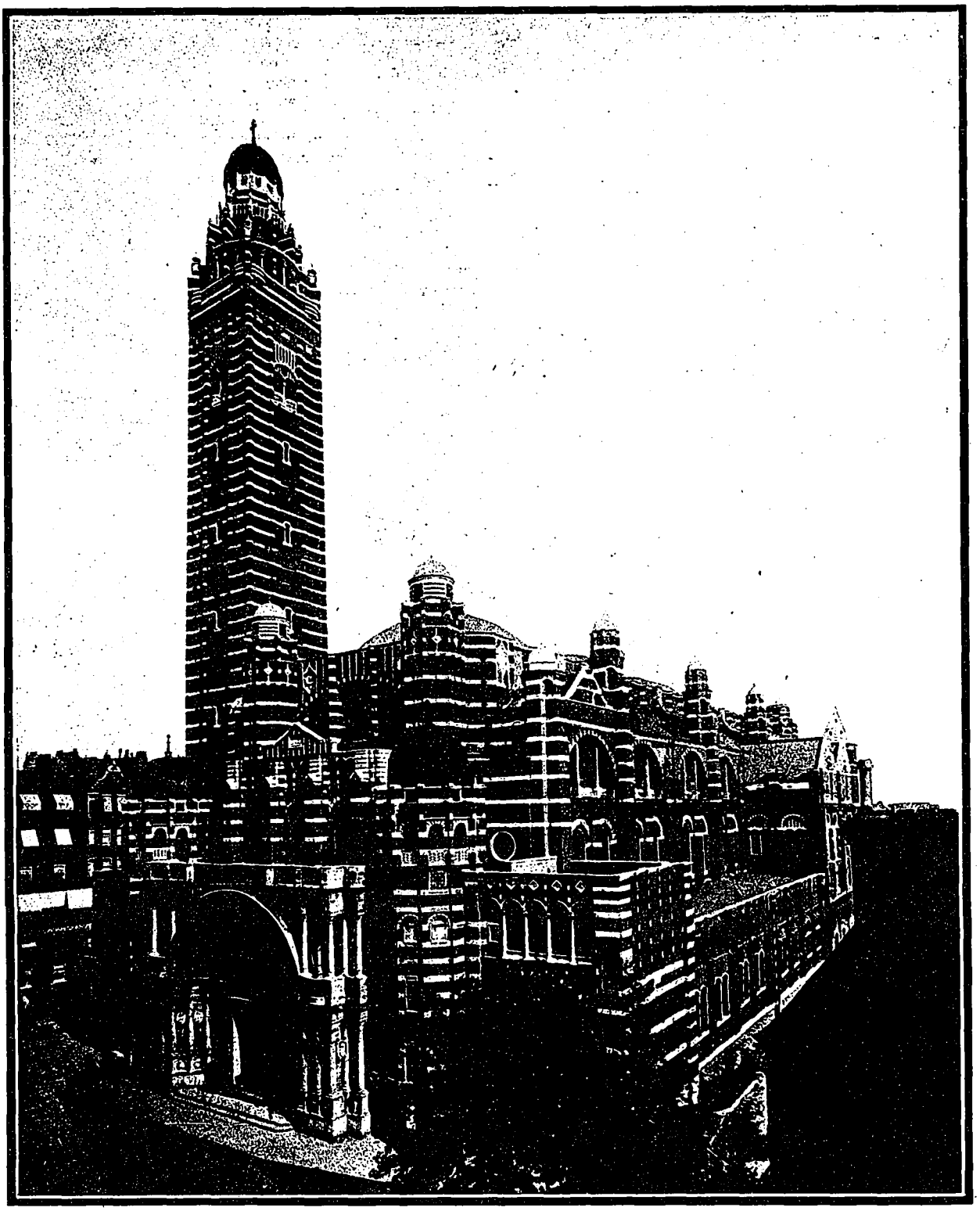
Toronto, April 13, 1909. EDEN SMITH.

O.A.A. ARRANGES WITH CANADIAN NATIONAL EXHIBITION BOARD FOR EXHIBIT OF ARCHITECTURAL DRAWINGS. - - -

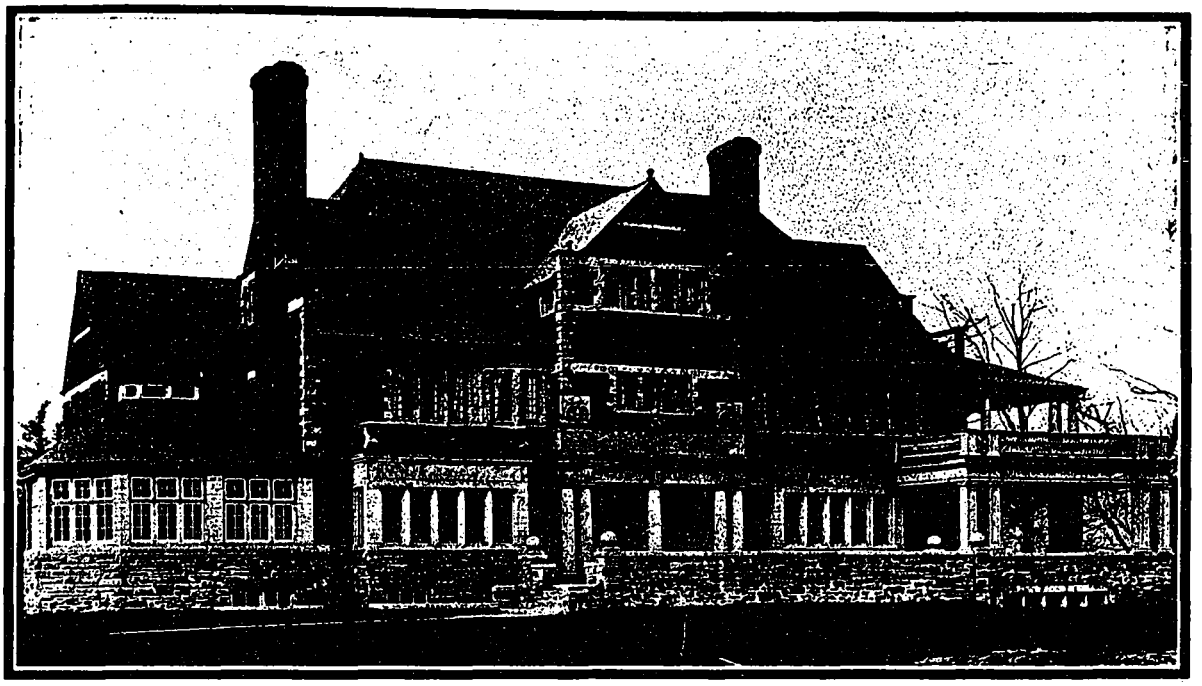
FOR THE FIRST TIME in the history of the Toronto Exhibition, will there be space allotted for the special purpose of exhibiting architectural drawings. At this great Exhibition, attended by from 600,000 to 800,000 people annually, the securing of suitable space wherein noteworthy architectural drawings from every part of the Dominion may be exhibited, means much to the architectural profession in Canada. We know of no conditions under which the exhibition of architectural drawings could be held, that would make it possible to have the exhibits viewed by so large a number of people.

The Ontario Association of Architects are to be credited with this great victory for the profession, for it was through their efforts that the Exhibition Board consented to set aside space. Mr. Edmund Burke is chairman of the committee in charge of the exhibition, and he begs to announce that the committee is now prepared to receive drawings from architects from every portion of Canada, and, in so far as the space is somewhat limited, the committee will have to exercise a great deal of discretion in the selection of the most praiseworthy designs.

It is to be hoped that the architectural profession in Canada will show their appreciation of the consideration given them by the Exhibition Board, by doing their part to make this architectural exhibition as interesting as possible, so that this space may be retained year after year.



The new Roman Catholic Cathedral at Westminster, London, the finest and most extensive example of Byzantine architecture in England. This style of architecture is particularly interesting in that in its development the architects of Byzantine were the first to demonstrate the possibilities of brick in decorative work.



Residence of J. B. O'Brian, Upper Scarth Road, Toronto.—A recent adaptation of domestic architecture in which the artistic use of brick is seen. Eden Smith and Sons, Architects.

ARCHITECTURAL POSSIBILITIES OF BRICK.---The Early Uses and History of Its Development.---Examples of the Middle Ages in Northern Italy.---Modern Brick Buildings.---Brickwork, Ancient and Modern. By F. W. FITZPATRICK.---Brick from the Mason's Viewpoint. By T. B. KIDNER.---Ideals in Brickmaking. By A. BERG.

FROM A VERY REMOTE PERIOD in the history of man, down to the present day, brick has been more or less of an important factor in the architectural development of the world. It was an exigency placed by nature upon the Babylonian—the absence of quarries and forests—that first led to the utilization of clay as a building material, and if, as is asserted by eminent authorities, the earliest civilization was formed in Babylonia, brick, therefore, may be deemed the earliest material used in permanent construction, as well as the basis for the invention of the arch, dome, tunnel and other methods of vaulting which had their origin at the time.

Walls and ruins of brick have been discovered dating long before 4000 B.C. Both Egypt and Assyria early adopted the use of this material, although with the former the use of brick was not so general, owing to the abundance of building stone at hand. Assyria, however, followed Babylonia more closely, using stone hardly at all, except occasionally for foundations and facings. Two kinds of brick were generally employed—the crude or sun-dried, and the kiln-dried or fired brick, the latter being used principally for the facing of masses of crude brick so as to preserve them from disintegration, especially by water, and for thin and inner walls. The Babylonians allowed the bricks to dry thoroughly before use, but the Assyrians were satisfied with brief and imperfect desiccation; for usually it has been possible to detect separate courses and even separate bricks in Babylonian ruins, but in the Assyrian walls all individuality has been lost through the adhesion of moist surfaces.

Possessed of an innate sensuousness, the builders of those days were not slow to recognize the value and possibilities of the material they had at hand, and very substantial progress was made both as to quality and variety. Besides the regular sized burned bricks, others were moulded in special shapes and sizes—segments of circles for use in columns; wedge shapes for use in arches; triangular for corners, and even convex and enamel bricks came prominently into use. Usually one of the flat sides was stamped with the name and titles of the reigning king, and it is due to this means that archeologists have been enabled to fix the dates of many of the early temples and palaces in Babylonia and Assyria.

Other countries also took up the manufacture and use of brick. The Roman began by using crude brick almost exclusively, and sun-baked brick of ancient date have been found in the mud walls of old towns in India. The Greeks, owing to their possessing plenty of stone, cared little for building with burned clay, yet it is quite certain that crude brick was in general use among them, especially in the earliest times.

The Romans employed a smaller brick than any hitherto made—a norm 12 x 6 inches being adopted—and for the first time the square form was abandoned. At the time of the reign of Augustus, fire brick had largely substituted the crude, in both public and private buildings; and the adoption of concrete faced with fire bricks in place of the earlier stone walls, gave permanent prominence to this kind of construction throughout the civilized world.

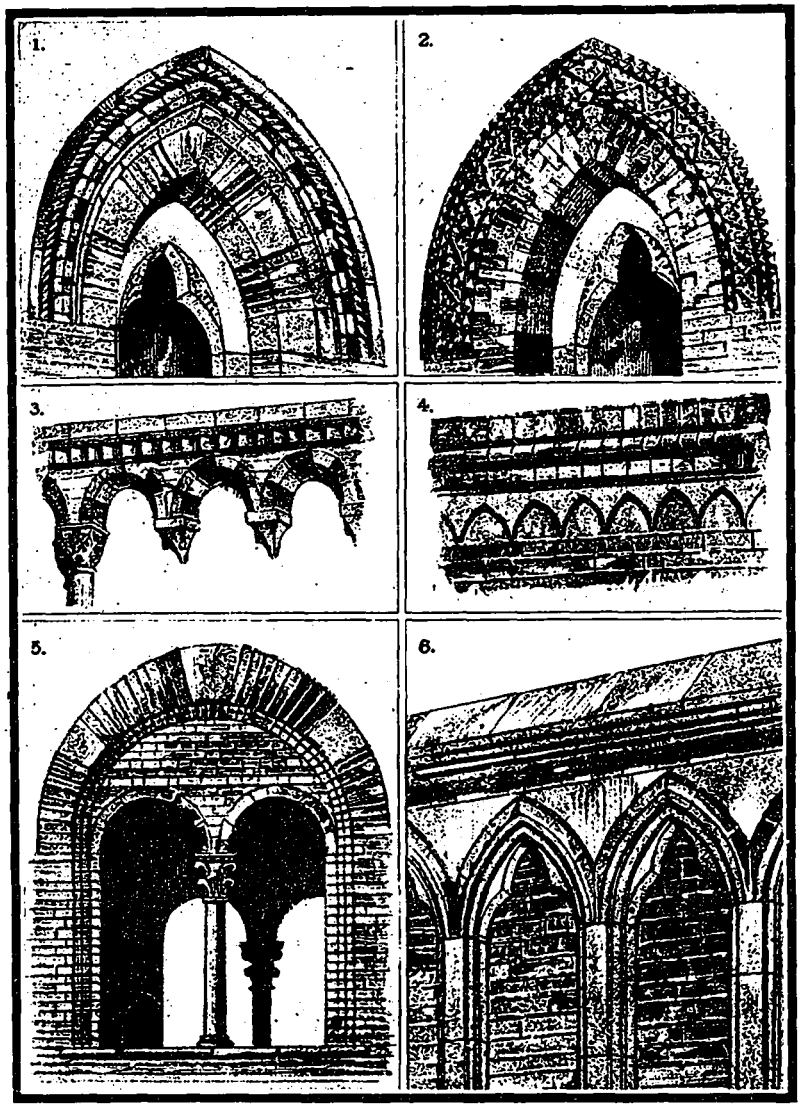
With the rise of Christianity, brick work became even

Ed. Note.—The drawing of brick details of old Italian buildings used to illustrate this article are reproductions from Mr. Street's book on "Brick and Marble Architecture of the Middle Ages in Northern Italy."

more prevalent than ever. The followers of Christ when they threw off the yoke of paganism, discarded with it the forms, arts, and customs of the people who had oppressed them. Constantine and his Christian advisers—who in their campaigns through Persia and the east, had become impressed and fascinated with the charms and beauty of its arts, the architecture of its buildings, the material and knowledge of statics displayed in their construction, the perfection of form and correct balance between structure and ornament—employed in the main men trained in the Orient, if not Orientals themselves, in the upbuilding of the world's new capital at Byzantium, 328 A.D. The Byzantine architects made but little use of concrete, and stone as a basic building material practically ceased to be used throughout Hellanic lands by the Seventh Century. Brick was their principal material and by its use they were enabled to decrease the thickness of their walls without in any way sacrificing the strength or structural character of the building. For their domes they used hollow conical bricks of light clay, which fitted into each other and which gave a minimum of weight and a maximum of cohesion. Of the many splendid structures erected by the Byzantines, St. Sophia, Constantinople, the work of Anthemius and Isadore, two architects of Asia Minor, is the most notable. No other Byzantine church ever undertook to rival or imitate St. Sophia, even in plan, and for ages it has been the marvel of all who appreciate and admire the beauties of good architecture. It is the Byzantines to whom we are indebted for the first examples of decorative brick work. They soon sought to vary their surfaces, and the exterior instead of being of plain bricks, had alternate courses of brick and stone or marble, and were diversified by inset panels and patterns of relief, as well as by pilasters and arcades. Churches thus constructed became numerous in the Ninth and Tenth centuries.

In the west, however, owing to the decline of Rome and the universal decadence which followed, little or no progress was made in the use of brick. True, the architecture of the Byzantines, pervaded certain parts of Italy as early as the Sixth century, but it was not until the good traditions maintained in the east—not only by the Byzantines, but by the Mohammedans of Persia, Syria, Egypt and other countries—passed into the Romanesque art of Italy in the early part of the Eleventh Century, that any good brickwork appears.

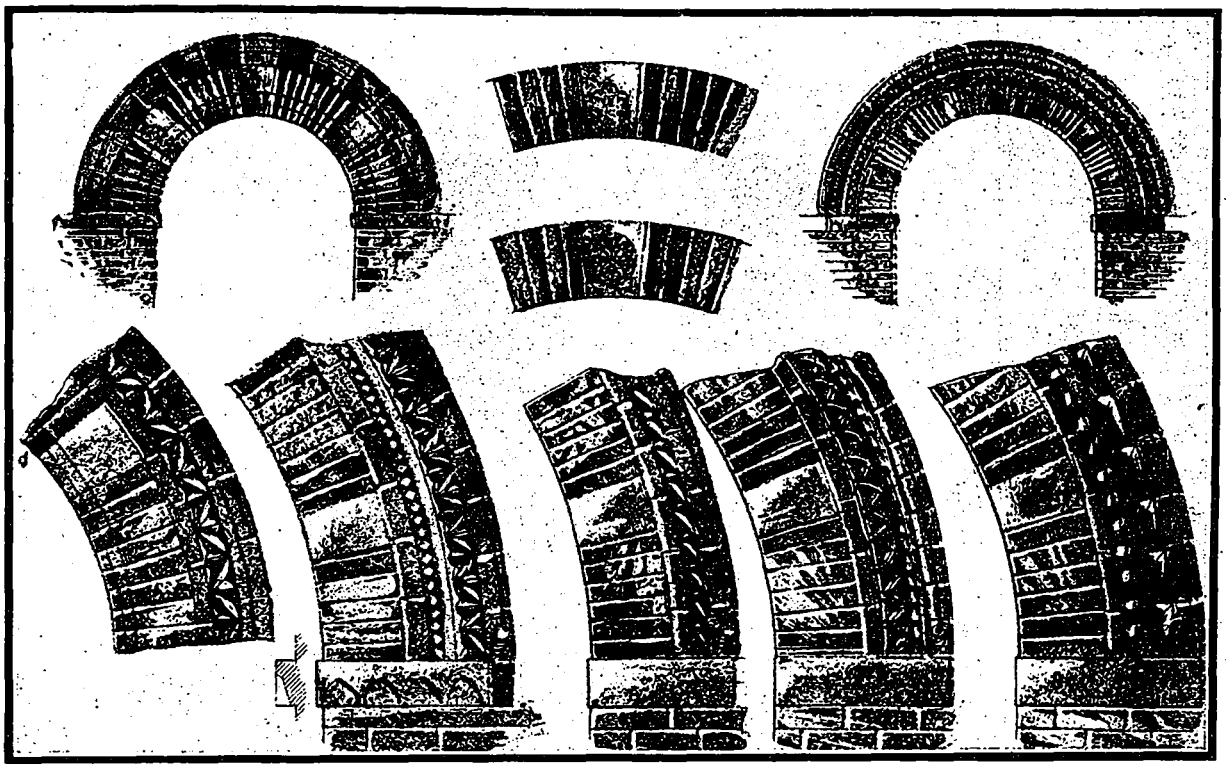
When, however, it had taken a firm foothold, rapid progress was made in its use and development. There arose, at the time the one really decorative school of brick architecture in two main branches, the first and finer in northern Italy, the second in northern Germany. In the southern portion of France, the builders also gave expression to their ideas in considerable good brickwork, and it was here that wall patterns were sometimes obtained by bricks of different colors, or a mixture of stone and brick, especially during the Renaissance. Its largest monument, St. Termin, at Toulouse, is partly of brick, and the convent of the Jacobins, also situated there, is a most artistic brick structure.



Italian Brickwork of the Middle Ages.—1 and 2.—Windows at Verona. 3.—Cornice work, S. Ambrogio, Milan. 4.—Cornice work of Bretlotto, Brescia. 5.—Window in Broletto, Monza. 6.—Wall Arcade, S. Fermo Maggiore.

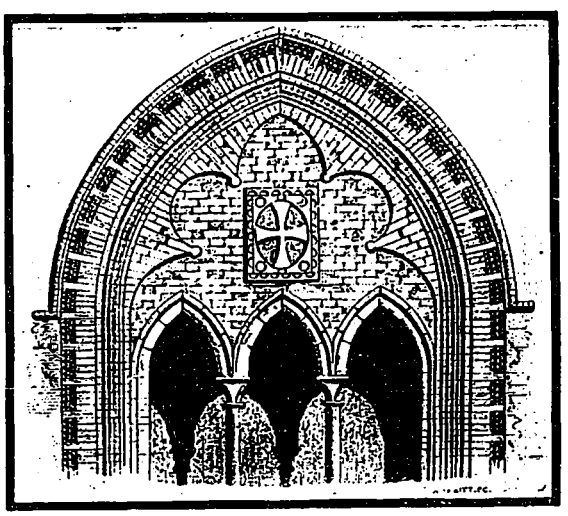
But Italy remained pre-eminently the home of brick construction, and the Lombard School solved the problem of effectively combining it with details in marble and terra cotta, and by inventing a wonderful variety of molded bricks which have served down to the present day as models for ornamental brickwork. Pavia, Bologna, Cremona, Milan, Bergamo, Brescia, Verona, and many more cities, are full of churches and town halls—splendid examples of brickwork—built between the Eleventh and Sixteenth Centuries. Mr. Street's book, BRICK AND MARBLE ARCHITECTURE OF THE MIDDLE AGES IN NORTHERN ITALY, published in 1855—in which he gives the results of his studies and observations through that picturesque country—came as a revelation of its constructive and artistic uses.

To wander through the pages of this book is to journey through the most delightful and fascinating realm



Details of archivolts of the Broletta or Town Hall, Brescia, Italy, erected in the 13th century and still standing. Note the variety of exquisitely moulded bricks to be seen in this one building.

of brick architecture. At Brescia, one sees the Broletta or town hall—built in the 13th century—with its perfect west front characterized by beautiful detailed doors, rose window and cornice, all executed in finely moulded brick; and the brick church of San Francisco, with its

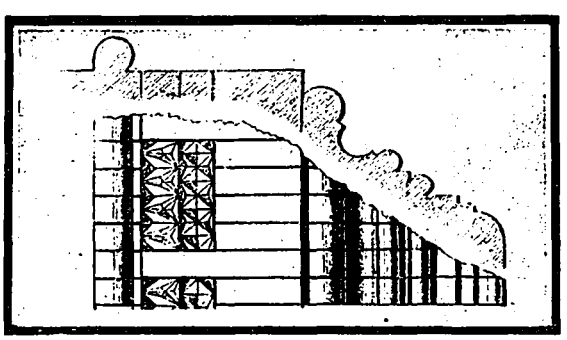


Brick window in north transept of Cathedral, at Cremona, Italy.

circular window, exquisite moulding and arched eaves cornice.

In Verona there is the campanile, a magnificent, lofty, simple, unbroken piece of brick work; the church of Sta. Anastasia, the noblest distinctly Italian church in Northern Italy; S. Pietro Maitre, a small church, with its windows marked by wide outside brick splays and arches built of alternate voussoirs of brick and stone; and the basilica of S. Zonona, a beautifully proportioned grand old church, with perfect details, breadth and simplicity, built of ordinary brick with red brick arch work. A particularly excellent example at this place, which the author describes, is an old house near the Palazzo Scaligeri, characterized by rounded and pointed arches, most of which have alternate voussoirs of brick and stone. Beyond the outside line of the arch is a line of very thin brick delicately defining, without pretending to strengthen the arch, while at the top, the house is finished with a quaint and swallowed-tailed battlement.

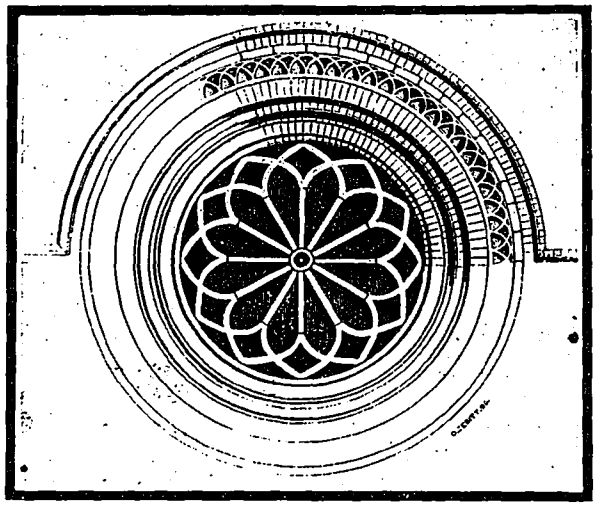
Another notable example is found at the extreme edge of the city of Verona, in the Ponte Pietri, a grand bridge spanning the rushing Adiga, built entirely of brick with parapets of the regular Veronese type. The pier between the arches are rather large and angular and finished with battlement rather above those of the bridge. The main arch, according to Murray, measures 160 feet.



Detail of window-jamb, Cremona, Italy.

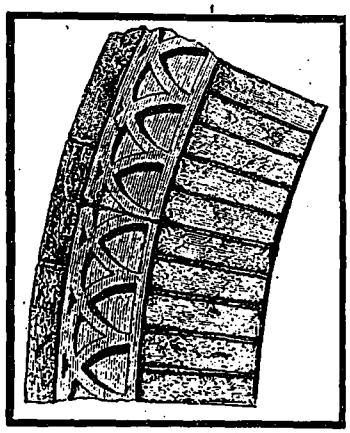
These and many other structures—such as the Church of St. Antony, built at Padua in 1231 by Nicolli Pisano, then one of the most eminent men of his day; the Ducal Palace at Mantua; the Palace of Jurist Consults, Cremona, and the bold use of brickwork as seen in Sta. Marie Glorisora Dei Frari and SS. Giovanna e Pavlo Madonna

dell' Orto in Vienna—serve to give an adequate idea as to the enduring qualities of brick and how readily it lends itself to architectural expression.



Detail of rose window, executed in brick, Cathedral, Cremona, Italy.

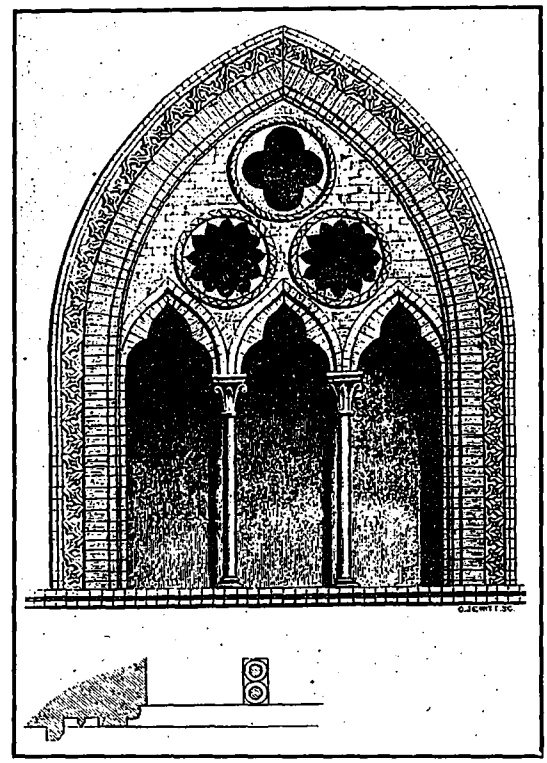
While in England, kilns were established as far back as the days of the Romans, the rise of Gothic architecture brought about a general decline in the use of brick and it was not until the Elizabethan period that their popularity again took hold. Then brick buildings rapidly multiplied and great progress was made, especially in the domestic architecture of the country. During the reign of Queen Anne a further impetus was given to its use and numerous buildings in which the artistic possibilities of brick was strikingly demonstrated, sprang up in all sections of the land. Thus we see the progress of the material in the early and middle ages, and how well the builders of those times found it adapted to meet their constructive and architectural requirements.



Specimen of brick arch mould, seen in one of the old buildings at Cremona, Italy.

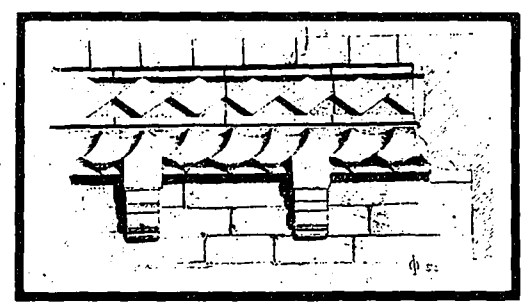
On this continent bricks were first made in the Colony of Virginia in the year 1612. Prior to that time small quantities had been imported from England and some fine examples of colonial architecture in brick work of the early days are still extant. However owing to the great cost of brick at that period and the large tracts of timber available, wood became the principal material employed, and it was not until after the revolutionary war that the manufacture and use of brick became general thing. Then followed a period of prosperity in which the people developed a taste for stonework, and brick for a while was regarded as being a secondary or inferior material; and again came the time when in the rapid growth of various sections, the builders utilized chiefly the materials native to their community. Field stone, quarried stone, brick or wood, was adopted according to the degree of their availability.

But in the past twenty-five or thirty years brick has become more of a general building product, until within the last few years its use perhaps over-reaches by far any other element related to building construction. The increasing fire hazards in our towns and cities, more stringent building by-laws, and the desire for a better and more substantial type of structures, have all tended to greatly increase its demand. Aside from this both the



Detail of brick window of St. Andrea, Mantua, Italy.

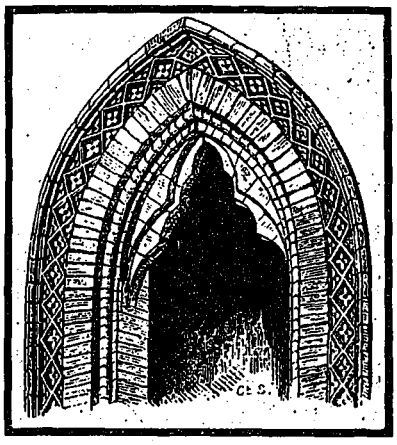
architects and the owners are seemingly more fully recognizing in it, qualities which are peculiarly its own. In our steel framed commercial buildings where light and lightness are both to be desired, no material offers greater architectural, protective or economical advantages. In manufacturing plants it also has a decidedly permanent structural value, while in domestic architecture brick has done much to improve our residential districts.



String Course of Brickwork, Palace of Jurist-Consults, Cremona, Italy.

Schools, libraries, churches, depots and public and semi-public institutions are other buildings for which brick construction is particularly well adapted, and the many structures of these various classes erected within the past few years, have no apology to make for their existence. While some of them are not up to the desired

standard of design, nevertheless they indicate a steady architectural progress, and it is extremely doubtful if equally as good results could have been obtained by the use of any other material.

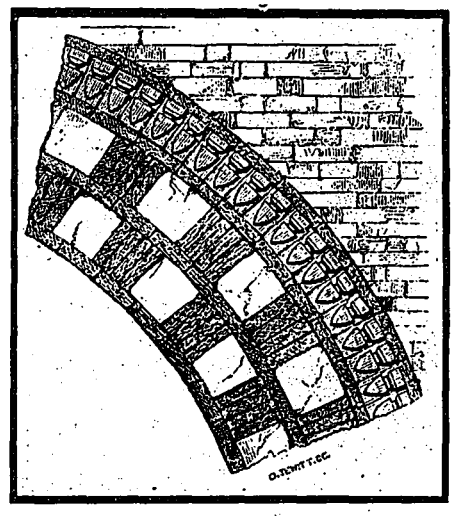


Detail of brick window of St. Andrea, Mantua, Italy.

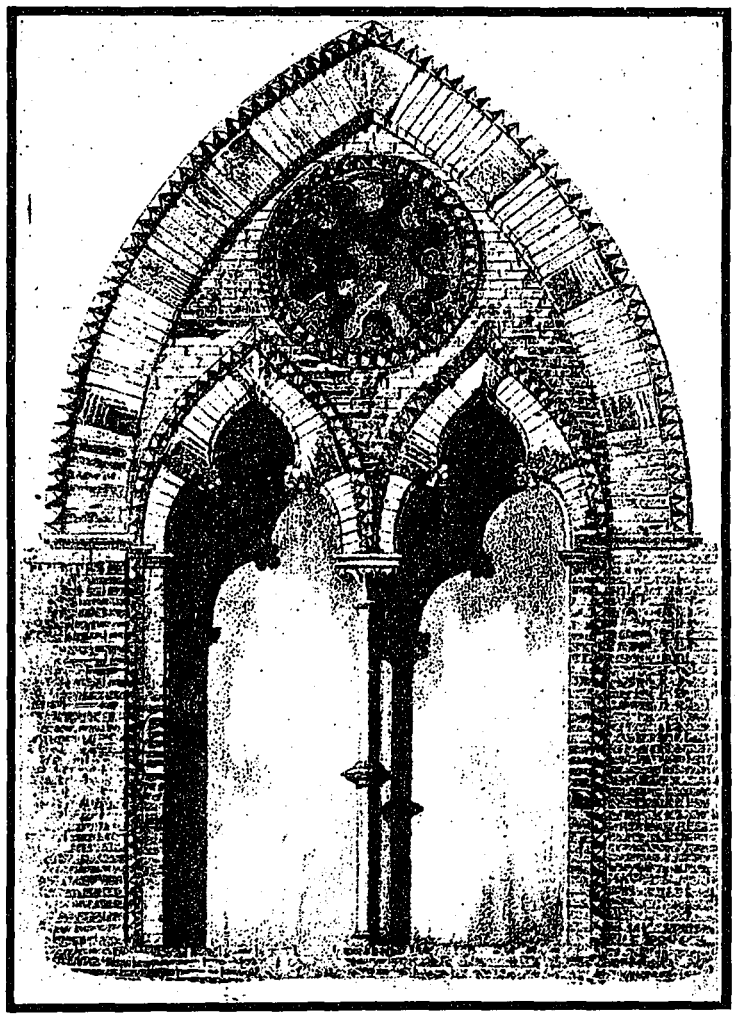
As regards architectural expression there is no other product in which the possibilities are as great. Even in the simplest wall treatment well proportioned pilasters and the predominance of straight lines of the panels have a peculiar charm which place brick in a class distinctly by itself. In interior work also we are beginning to witness a more extensive use of brick in wall surfaces and arching. Especially is this feature being developed in many of our modern railway stations and in some of our recent commercial buildings are to be seen splendid examples of counters and screen work carried out in this material.

Brick also has a peculiarly combining quality which gives it a special advantage in that it can be used effectively in conjunction with all other building materials. With wood or granite, stone or stucco, concrete or steel, it fits readily into place, and this can hardly be said of any other structural product.

Modern appliances and modern methods of manufacture are enabling architects to meet their every requirement. Moulded bricks are produced in every variety of design from simple sections like those of cornice, plinth and string course bricks up to the most elaborately decorated blocks of different forms such as voussoirs for arches, diaper patterns for walls, panels, and mouldings for entablature work.



Brick archivolt, Vescovato, at Mantua, Italy.



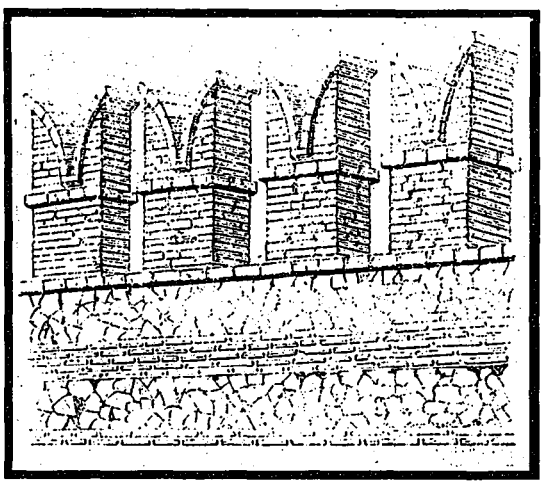
Window in Ducal Palace, Mantua. A fine example of early Italian brickwork.

In Canada, the manufacturers of brick are turning out a product of a superior kind as regards color and texture, quality and design, and there is no need of our architects or builders going further than the borders of their own country in order to meet their requirements in this respect. The Dominion offers the very best that is to be obtained anywhere, and the large beds of suitable clay—as recent exploitations show—found in various parts of the country, make plain that brick is one of our best and most available materials. The specifying of foreign made bricks by Canadian architects is rendered ridiculous in view of the excellent materials we have at hand.

BRICKWORK, ANCIENT AND MODERN.

By F. W. FITZPATRICK

PRIMARILY, or perhaps we should say fundamentally, the brick manufacturer is interested in his material as a purely commercial proposition. He has invested a certain amount in a plant and it is up to

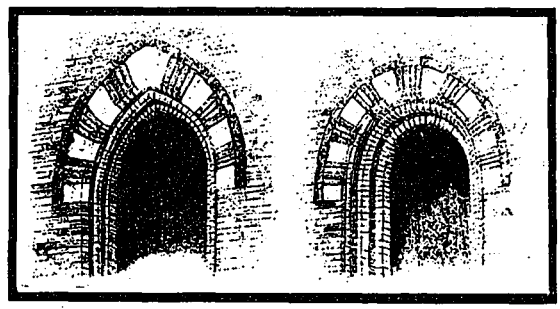


Brick Battlement of the Viccolo Cavaletto, Verona, Italy.—A characteristic style of parapet found in many of the old buildings of that city.

him to keep that plant at its full capacity in order to get therefrom the greatest return upon his investment. We, the architects, are interested in brick as simply a unit, one of many, used in the expression of our ideas, in the materialization of our designs. In those two basic viewpoints our interests are dissimilar but immediately thereafter they draw closer together. We want the very best thing we can get and it is to the manufacturer's interest to come as near supplying that demand as he possibly can. Some would have us believe that there is inborn antagonism there, a sort of distrust of each other, the one ever criticising and demanding something better and the other yielding just as little as he possibly can. This is the wrong view. The closer the architect and the manufacturer get together and train themselves to think with each other, so to speak, the better it is for them both and for the buildings, the art, that yields them both not only their bread but the opportunity to develop, to attain eminence.

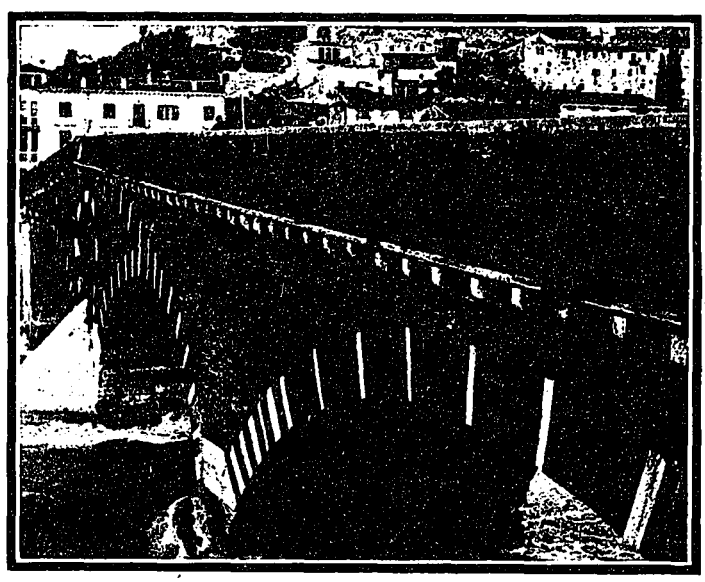
There were makers of brick at a very remote period in the history of man, perhaps even before there was any need for architects. The monuments of stone and of marble have decayed, the story they tell us in their hieroglyphics and pictured carvings is well-nigh obliterated, but the work of the potter, the maker of tile and of brick, has been preserved to us in almost perfect condition. The buildings may have crumbled, on account of the disintegration of the mortar used in the joints of such brickwork, but the claywork itself is unworn, intact. See what has been unearthed at Babylon, at Nineveh and at Hebes, and look at the splendid work in tile and in brick still standing in all its pristine perfection in Persia, Assyria, India, and in the early Christian examples of architecture at Byzantium and the other Roman dependencies. Surely we have precedent enough not only as to how to make brick that will last, but how we may put those brick together to form architectural masterpieces.

In ancient times there were rather sharply drawn lines in the use of materials. Geography and geology had much to do with the establishment of these demar-



Detail of pointed and rounded arch windows, old brick house, Verona, Italy.

cations. In places where stone was found and was easily quarried, stone, of course, was the most used material; in the neighborhood of great forests wood came easiest to the hand of man, to be fashioned into habitations and shelters, and then in regions in which neither timber nor stone was plentiful, man quickly learned to make for himself a building material from the clay of the soil, molding it with his hands and letting the sun harden it into permanent form or burning it with the straw and refuse of his cultivated fields.



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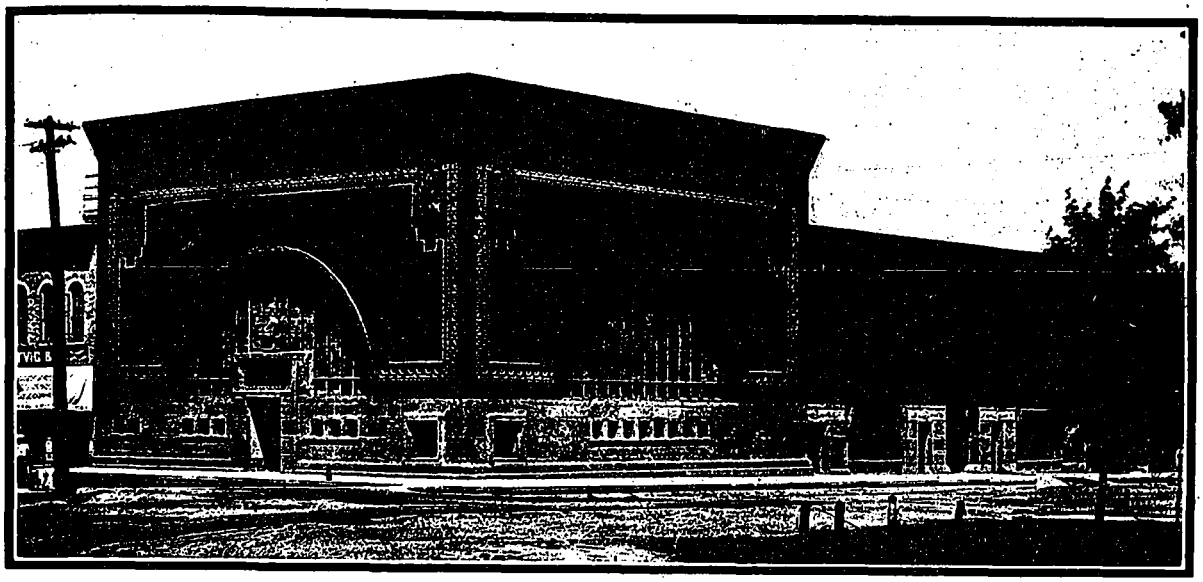
Old Roman brick bridge "Ponti Pietra," spanning the Adige, at the extreme edge of the city of Verona, Italy. Its main arch is 160 feet. Note the large and angular spring of the arches.

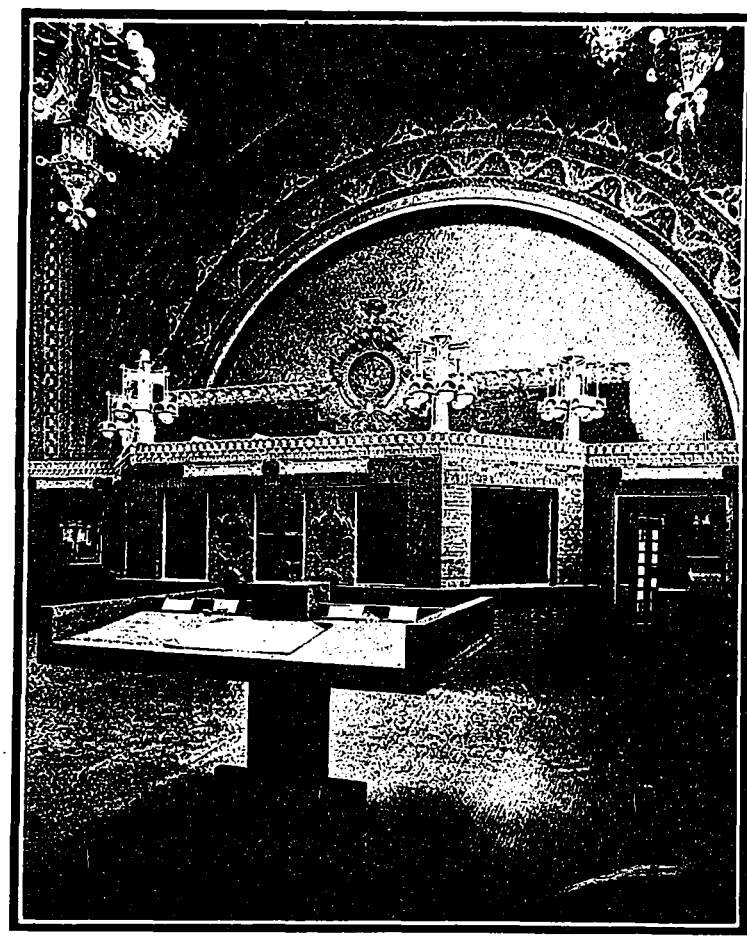
In our own time and land, the history of brick has been most interesting. Its career may be said to have been checked, but it has succeeded in making a place for itself that is unassailable and most deserving of respect. In the early days, it was a luxury and brought here from the mother country at great cost. Then each brick was as precious as a drop of its owner's blood and as carefully guarded. The theft of brick was a very serious offence indeed and punishable with the severest penalty. Then our fathers began to make brick themselves, rather a crude affair, but, laid up with a wide joint, the effect was quite artistic. Later, for awhile, everything had to be of stone. A man must indeed be of common



National Farmers' Bank of Owatonna, Minnesota.—A notable example of the use of brick in modern bank building work Note the perfect contour of the arches and the rich detail of the cornice and panelling, all of which strikingly demonstrates the advantages of this material as a medium of architectural expression. Louis H. Sullivan, Architect.

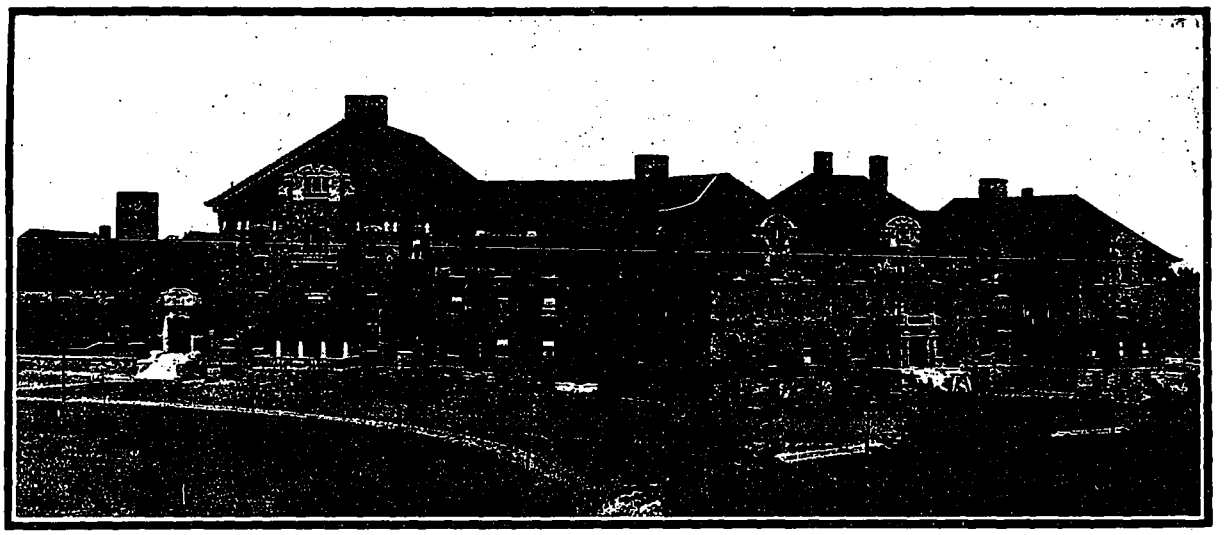
clay if he abided in but a brick house. Stone and marble were the proper materials, and if he could not afford them, why he stuccoed his brick and jointed it up in beautiful ashlar, or he built of wood. It was fashioned to imitate stone with joints, however, and everything most painfully copied.

In our own times brick was revived; there was a species of Renaissance, but it was only used for secondary buildings, as we might call them, the really monumental affairs having to be of granite, stone or marble. Those secondary or commercial buildings, nevertheless, were of more or less importance, and though we could not afford to make them of marble, stone or granite, we craved something better than ordinary brick and so pressed brick came into vogue. Kilns were carefully picked over and each building presented a most uniform appearance. The brick were all of an exact size with the narrowest imaginable joint, and of precisely the same shade in color—you can still get exactly the same effect by whitewashing or kalsomining a wall surface. It was distressingly beautiful. Some thought that galvanized iron and similar ornamentation was not quite the right thing, and so the brickwork was ornamented per se. Bands of black brick were introduced, little spots of other colors were injected, and dog-tooth effects were everywhere. Then we had molded brick, but the desire was always to get something that looked as nearly like stone as possible. We seemed to realize and properly appreciate that brick was only used as a substitute, something cheaper than what we would like to use, and it was for us to make it look as much like the real thing as we could. We always apologized for a brick building.



Interior of Farmers' National Bank, Owatonna, Minn., showing the possibilities of brick for interior work, as is seen in the counter and screen. Louis H. Sullivan, Architect.

It has only been within the last ten years that brick has really come into its own and taken its proper place among the available media architectural. Our architects have

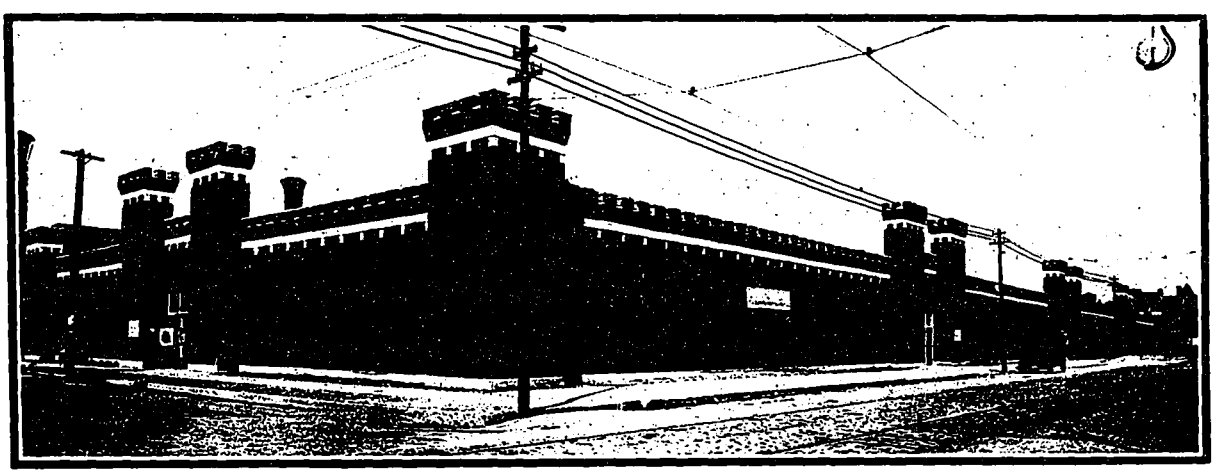


One of the several handsome brick buildings which comprise St. Anne's College, near Montreal. Hutchinson and Wood, Architects.

found that granite, stone and marble buildings, where at all exposed to fire, have been cruelly spalled and damaged. They realize that in our highly combustible cities nearly every building they erect is exposed to a greater or lesser fire hazzard on account of its neighbors, and they have found that brick best withstands fire. It has also dawned upon them that much expression can be obtained with brick, and latterly they have used the material from preference, selecting it regardless of price, instead of granite, marble or stone. The old notion of uniformity of color and great exactness as to shape has given way to the saner adaptation of rougher forms and varying tints. It is surprising to note the beautiful effects that can be obtained in brickwork today. In a stone building, elaboration of ornament and paneling and moldings are necessary, or the mass of a building becomes brutally heavy and uninteresting. An architect generally fights shy of much plain wall surface in stone. In brickwork just as great an architectural variation can be obtained. There can be produced seeming elaboration, plays of light and shadow, and at infinitely less cost than the carvings and moldings in the stonework. At the same time, also, a plain wall surface is sought for by the artistic designer. If there is no occasion or reason for his diversifying that wall in the flat by diaper work and artistic jointings, the crude, plain wall surface itself is most effective and prettier far than an equal surface of any other building medium. There are finer gradations of tint in it than in any other material, save possibly some of the very expensive foreign marbles, and these in large masses weary the eye.

Usually it has been the architect who created the demand for certain kinds or forms of material, but in the case of artistic brick the manufacturers have taken the initiative and produced the material first and offered it to the architect. This has been much to the latter's pleasant surprise and it has taxed him to apply that brick in one-half of its possibilities of artistic effect.

There is a rather unfortunate tendency toward ultra-specialization in materials. The concrete enthusiast wants his house entirely of concrete. If he could only get it transparent enough he would have it in his windows. The glass people have had in mind a building entirely of glass, with fittings and furnishings of glass, everything of glass whether it would best suit the purpose or not, and so it goes. I believe in a judicious combination of materials, each one in the place for which it is best suited, therefore I am not clamoring for a brick roof, brick downspouts and brick window sash; but I do believe that there are yet endless, almost unthought of possibilities in brick construction that for the best interests of architecture, let alone the brick manufacture, we should seek to discover, to develop, or to perfect.

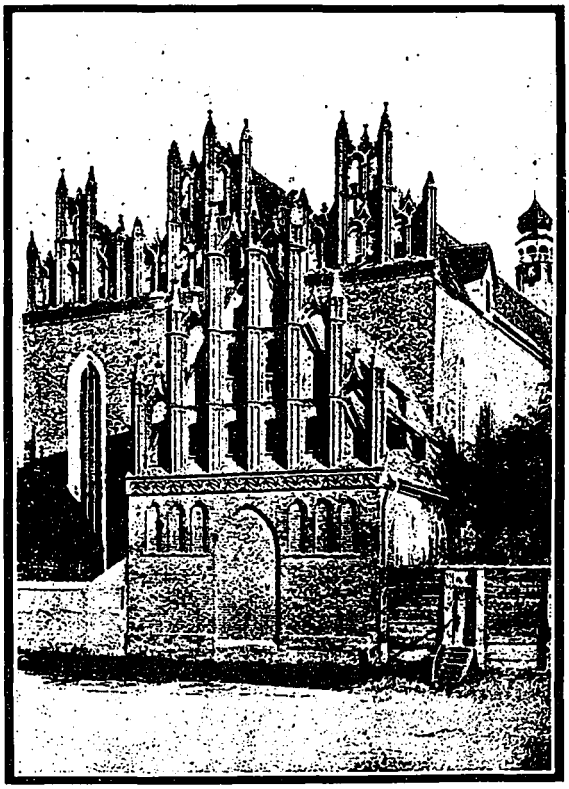


Central Market, located in the West Side District, Chicago. A simple, but effective treatment of brick work in wall, tower, and parapet design.

FROM THE BRICKMASON'S VIEWPOINT

By T. B. KIDNER.

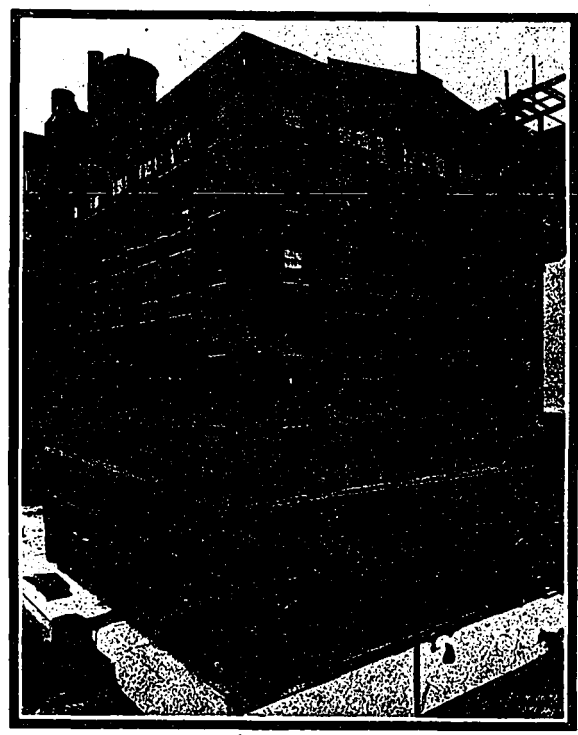
IN LOOKING BACK over the progress in architectural matters during the past twenty-five or thirty years, there is perhaps no feature more remarkable than the increasing attention which has been given to brick construction. Of the many reasons which may be adduced for this, probably the most weighty one is the undoubted fact that of all materials used in building construction, brick is preeminent in durability and strength. Of course, this has been recognized from the earliest times, but the increasing dimensions of modern buildings has emphasized the necessity for strength of materials, and the size of the cities of to-day, the importance of their durability, the herding together in vast cities such as New York and London, which one sarcastic writer recently characterized as "diseased growths, not cities," has rendered the air full of noxious vapors which attack the majority of building stones more or less. Hence a media like brick, which is absolutely impervious to atmospheric corrosion and decay, is par excellence the material for urban buildings.



Franciscan Monastery of the Trinity, Dantsic, Germany.—A splendid example of Gothic architecture, 300 years old, in which the wall construction, including the arching, cornice and panel work, is entirely executed in brick.

The present generation has also seen the birth and phenomenal growth of brick-incased steel construction, where again brick is preeminently adapted for the purpose. Mention must be made of the increased demand for fireproof construction, which has been such a marked feature of architectural practice during the past few decades, and for which there is no better material available than brick.

But there is another quality of brick which has been slower to be recognized, and that is its possibilities for artistic and decorative architectural effects. There is, of course, in the plainest of brick buildings, if properly carried out with good materials, the beauty of "line upon line," which is always attractive. For a long period,



Light manufacturing and office building, showing the satisfactory and unpretentious brick exterior of a steel frame structure.

however, it seemed to be a settled conviction of architects that brick required dressings or trimmings of stone for

Residence of John M. Bowman, Toronto, an example of clinker brickwork in domestic architecture.

quoins, windows, doorways, cornices and similar features of construction, which are usually chosen for embellish-

ment, and only in recent years has it again been recognized that brick in itself offers a material entirely suitable for the decoration and embellishment of any part of a

Main entrance of Blow School, St. Louis, Mo.—A rendering in simple brickwork, which is rich in its general effect.

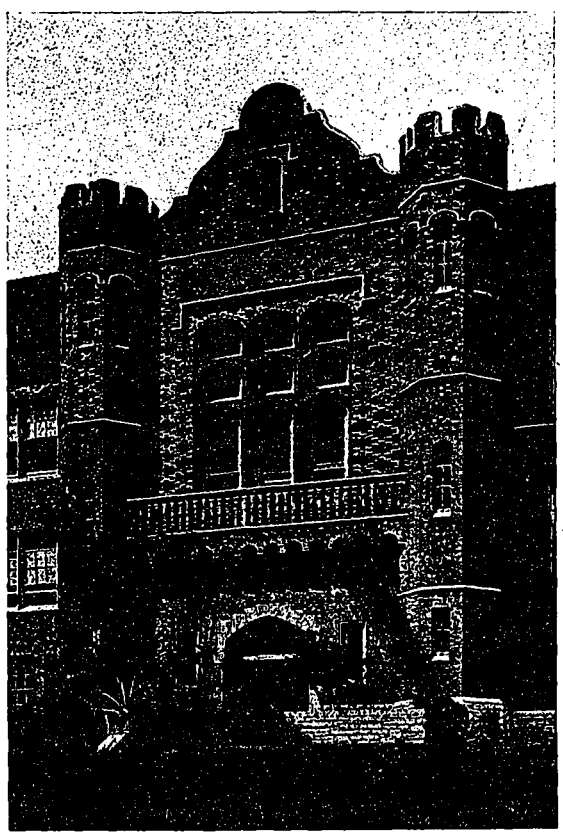
building, as well as for the plainer, solid portions to which it had for too long been almost wholly relegated.

In saying that its decorative possibilities have "again" been recognized, one has in mind that great period of artistic brick buildings, the reign of Queen Anne. In Great Britain, dotted up and down the land, are numerous examples of Queen Anne brick houses which, for thoroughly satisfying architectural effects, are hard to beat. Whether in the form of an old manor house, embowered amid the trees and lawns and hedges of some sleepy village, or of a town house in some old city square, with severe and formal outlines and surroundings, a Queen Anne brick house is alike a delight to the eyes and a monument to the honest old craftsmen who built them.

Branch Library Building, Queen St. West, Toronto.—A treatment in brick and stone work.

The revival of the Queen Anne style in Great Britain some thirty years ago, while primarily concerned with furniture and interior decorations, caused architects to turn their attention once more to the possibilities in the use of brick and undoubtedly led to the great modern development of artistic brickwork in that country.

On this side of the Atlantic, also, we have a good many fine examples of brick houses which have come down to us from Colonial days, and the interest taken in late years in the Colonial styles of architecture and the widespread adoption of many of its characteristic features, have undoubtedly given a great impetus to the art of brickmaking in North America. While, perhaps, for some years to come the complete brick house in Colonial style will be a luxury for the comparative few, the possibilities of brick in interior decorations have opened a large field for its use in houses of all classes. To name one feature—the



Main Entrance of Edward Wyman School, St. Louis, Mo.—A commendable architectural treatment expressed in hard and red brick, mixed as to color, and laid in up with a Flemish bond. Note the simple details of the towers and the arcading under balcony over doorway.

"Colonial" brick chimney-piece—there are hundreds of thousands of houses in this land whose "ain fireside" is furnished with one of these substantial and artistic specimens of the modern brickmaking art.

For this, some thanks are surely due to the numerous magazines devoted to homemaking in whole or in part, whose wealth of illustrations and suggestions in the direction of honest, substantial furnishings and decorations are in opposition to the gimcracks and gilt of a generation ago. Most of all, however, must the credit be given to the enterprise of our manufacturers of artistic brick who

have "produced the goods," not so much in response to a general demand, but who have largely created that demand by the excellence of their wares.

We cannot, however, pride ourselves yet in this country that the fullest recognition has been accorded to brick in its capabilities of application for exterior constructional decoration, though a great deal has been done in that direction.

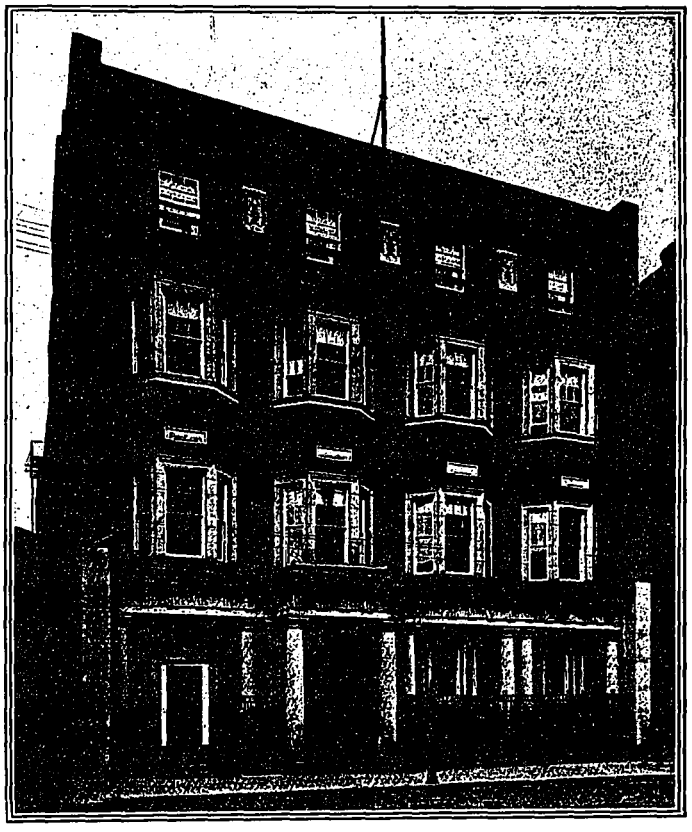
The demands for brick masonry, on account of its sterling utilitarian qualities referred to above, have been so great that very few of our architects have given much attention to the question of decorative exterior planning of brick details, and we are considerably behind some European countries in that respect.

Two avenues are open to the architect designing brick decorations and architectural features. One, offering by far the largest scope, depends on the carrying out of the architect's details by the brickmaker, who will mold and burn ornaments, moldings, pilasters cornices, dentils, arch members and similar pieces, ready for laying in place in the job by the brick-setter.

This involves on the part of the brickmaker not only a high degree of ability to interpret architects' drawings and details, but also the most careful attention to matters of bond, etc., which cannot be decided on the job by the skill of the man who is setting the brick, but must all be carefully worked out by the brickmaker's own draftsmen before a single mold is prepared.

The second method of decoration available for the architect is scarcely practised at all in this country and consists in the use of soft brick which can be cut with a sheet tin or wire saw, and worked into various ornamental details, just as soft sandstone is wrought by the mason at his bench; or can be laid in place in the building and molded or carved with mallet and chisel while in position. These soft brick are widely used in Great Britain under the name of "red rubbers," being so called from their being rubbed to form fine joints in gaged brick arches, etc., which are usually specified "to be gaged, rubbed and set in fine lime putty with joints of 1-32 of an inch." Although exceedingly soft when new, exposure to the weather renders these brick hard and impervious to the action of rain or frost, without any further treatment. For brick arches with orders or moldings worked on the several rings; in simple molded window openings or doorways for paneled pilasters, or sunk panels with name or date of building cut in, red rubbers are particularly suitable, being susceptible of the finest ornamentation, and chaste but rich in appearance when so treated. As intimated above, however, the field in this direction is limited in comparison with that offered by brick molded and burnt to pattern by the makers; the cost of cutting and laying red rubbers being high, in fact, prohibitive for all but the highest class of buildings.

We must look mainly, then, to the manufacturers of brick goods if artistic brick masonry is to come fully into its rightful place in the architecture of this continent, but architects must first be satisfied of its possibilities, and to that end every means available should be employed to bring before them and also before the general public as many examples of good structures as possible. To reach the former there are, of course, the splendid photographic illustrations, which are such a feature of professional magazines and architectural journals to-day, but better still the manufacturers themselves must bring constantly before the designers of buildings the splendid field open to them in this direction.



National Club Building, Toronto.—A most acceptable structure of Georgian design, in which the principal material used is brick. S. G. Curry and Sproatt & Rolph, Associate Architects.

To reach the general public, new buildings themselves will largely appeal, but here also advantage should be taken of the numerous magazines which publish views of domestic architecture especially, and by means of suitable illustrations and articles, create a taste and a demand for this best of all building materials. As an instance of the value of this kind of campaign, one has but to point to the case of the concrete-block makers, who have been in evidence in practically every magazine, professional and general, during the past three or four years.

To sum up then, while brick has an undoubted supremacy for strength, durability, sanitary qualities, and general structural value, it may be shown that as an artistic medium it has values equally high. In fact, there is no class of building, from the suburban residence to the Gothic cathedral, where brick masonry will not lend itself to the best and highest artistic effects.

IDEALS IN BRICKMAKING.

By A. BERG

OF ALL THE ARTS practised by man during his period of existence on this earth, that of building is the most ancient and most enduring. The love of architectural beauty has been a predominating feature of the greatest and most progressive periods of history. The art of brickmaking has preserved for us the pyramids of the almost prehistoric Paroahs and has left us the vestiges which display the grandeur of the ancient classical civilization.

Such an art has lasted from time immemorial, deserves therefore all our respect and admiration, not only on account of its age, but also on account of what it has accomplished for the progress of humanity. But in the present age we are sorry to state the ideals of this art have often been sacrificed for the material glory of making money from nothing. The feverish desire, so prevalent in recent times, of putting out products to pay a handsome return on capital invested, the insane craze of sweating every available cent of profit at the expense of other

Large Modern Apartment House.—A type of building for which brick, more than any other material, is particularly well adapted.

considerations—has caused a great degeneracy in even the ancient art of building. As a result, a great many buildings are put up, which, although fair to look at, are rotten at the core. The materials used are often of the most flimsy kind, and the structures built of these materials are permanent sources of danger to both life and property.

It is up to us to combat this modern tendency. We must try with all our might to oppose the use of all bad building materials, and we can do this by stirring up the municipalities to pass stringent regulations to this effect. There are already in existence regulations and specifications for deciding between good and bad cements, but no such step has ever been taken for brick in this country, at least. The various Canadian municipalities from whom some united action in this direction ought to have been expected, have so far neglected to standardize a material which they are daily inspecting and for which they must assume the responsibility. The city of New York has seen the need of such safeguards against the indiscriminate use of all kinds of building materials, and in 1905 it adopted certain conditions that a standard brick ought to fulfill.

Without going into the complete details of the methods specified by them, it will suffice to quote some of the conditions required of any new material before permitting of its use in buildings: "The ultimate crushing strength of such material must average 3,000 lbs. per sq. inch, and must not fall below 2,500 lbs. in any case. The percentage of absorption by weight must not exceed 15 per cent. on the average, and must not be greater than 20 per cent. in any case. The reduction in compressive strength must not be more than 33⅓ per cent. The freezing and thawing process must not cause a loss in weight greater than 10 per cent. nor a loss in strength of more than one-third. The fire test must not cause the material to disintegrate."

We must conclude from this that any brick which cannot stand a crushing load of 2,000 lbs. per sq. inch ought not to be used in any building, and a brick which stands no more than 1,000 is certainly deserving of being condemned; and yet a great many of our light colored common brick have a crushing strength below 1,000 and even down to 300.

With the small means at our own command, we have long fought against the use of all bad building materials; but how much more may be accomplished if only we all unite in this? A nation may be judged by its names, its public buildings. It ought to be our ideal to make our country proud of these things. We can do so by doing the very best that is in our power; and with the success in accomplishing this aim will come an even greater prosperity in our trade and the greatest reward of all—the satisfaction of having accomplished something for the progress of our country.

CLAY PRODUCTS IN THE UNITED STATES

TAKING UP THE QUESTION of clay products in the United States and the capital invested in the industry there, the SCIENTIFIC AMERICAN touches on a subject which may be of interest to Canadians in that it probably furnished a basis from which a relative idea can be obtained as to the amount invested in the manufacture of, and the use of these materials in the Dominion. That journal says:

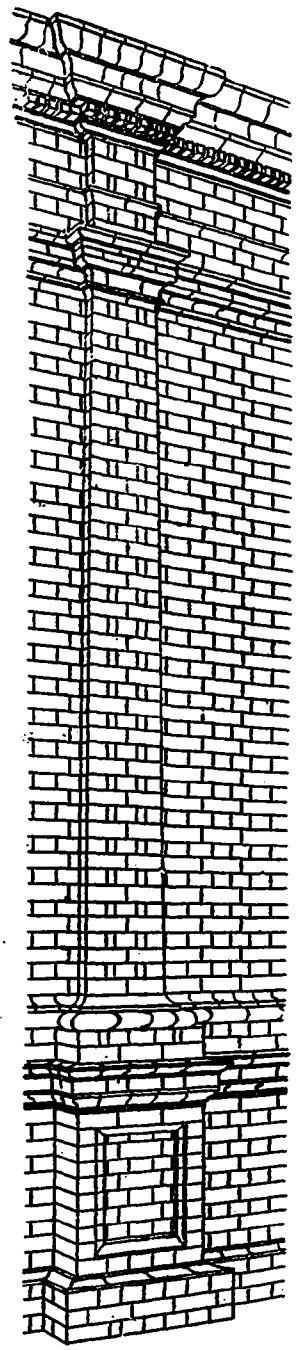
In this country brick were probably first burned in the colony of Virginia as early as 1612, says Charles E. Hall in an interesting Bulletin of the Bureau of the Census. In New England brick and tile making seems to have been followed as an independent calling about the year 1647. Though the product was of good quality the industry did not thrive as money was scarce and timber plentiful, and it was not until after the revolutionary war that home-made bricks came into general use. With increasing prosperity the desire and necessity for more substantial structures arose. The growth of the industry from year to year naturally provided a stimulus for the invention of machinery that would produce better brick, new shapes, and different sizes; and in turn these new inventions contributed to further the growth of the industry. The

Detail of Bronx Church House, New York City.

earliest record of a patent issued by the United States Patent Office for brickmaking is dated May 15, 1800, and was for a brick and tile machine invented by G. Hadfield, residence not recorded. Other patents issued about that time were one to E. Miller, July 17, 1802, for a brick machine; one to N. and P. W. Miller, January 5, 1804, for a brick and tile machine; one to W. Hodgson, Richmond, Va., May 22, 1805, for an apparatus for making

tile, brick, etc.; and one to J. F. Gould, Newburyport, Mass., March 1, 1806, for a brick machine. The first patent granted for a brick-kiln was issued to H. Read, of Kensington, Pa., June 17, 1840; and the first for a brick dryer, to S. M. Parish, of Baldwinsville, N.Y., August 16, 1864.

Although much the same process for making brick and tile has been used for ages, the evolution of the industry through the use of improved methods and machinery has brought about a great change in the character of the product. It is a long stride from the use of hand pick and shovel to steam shovel in uncovering the clay bed; from the old-fashioned ring pit to the machine that grinds, tempers, and molds; from the use of a hand mold to the machine with a capacity of 100,000 bricks per day; from the open air system, or a weather beaten drying shed, to the utilization of artificial heat for drying; from the temporary to the patented continuous kilns; and from the poorly made product of years ago to the firm, straight-edged, and otherwise well finished product of to-day. Of the $119,956,959 capital invested in this industry, the machinery, tools, and implements represent $33,295,324, or 27.8 per cent., an increase in five years of $16,045,486, or 93 per cent.



An artistic brick pilaster and entablature.

In the production of red front brick great care is exercised in the selection of raw materials and in the process of manufacture. The clay must be well tempered; the brick molded free from flaws or sand cracks; the method or drying be more complete than for common brick; and the repressing and subsequent drying, setting in kiln, and burning, skillfully and systematically managed.

Fancy colored and ornamental brick are primarily pressed brick. The different shades of color in the former are produced by the addition of artificial materials or by the manipulation of the kiln fires, while the distinguishing feature of ornamental bricks are the designs in relief or in intaglio upon the surface to be exposed

As the name implies, fire brick are used where intense heat must be withstood as in cupolas, blast and glass furnaces, coke ovens, locomotive fire boxes, etc. The utility of the appliances just mentioned depends largely, if not altogether, on construction out of materials which will stand intense heat without fusing, cracking, or yielding in any way.

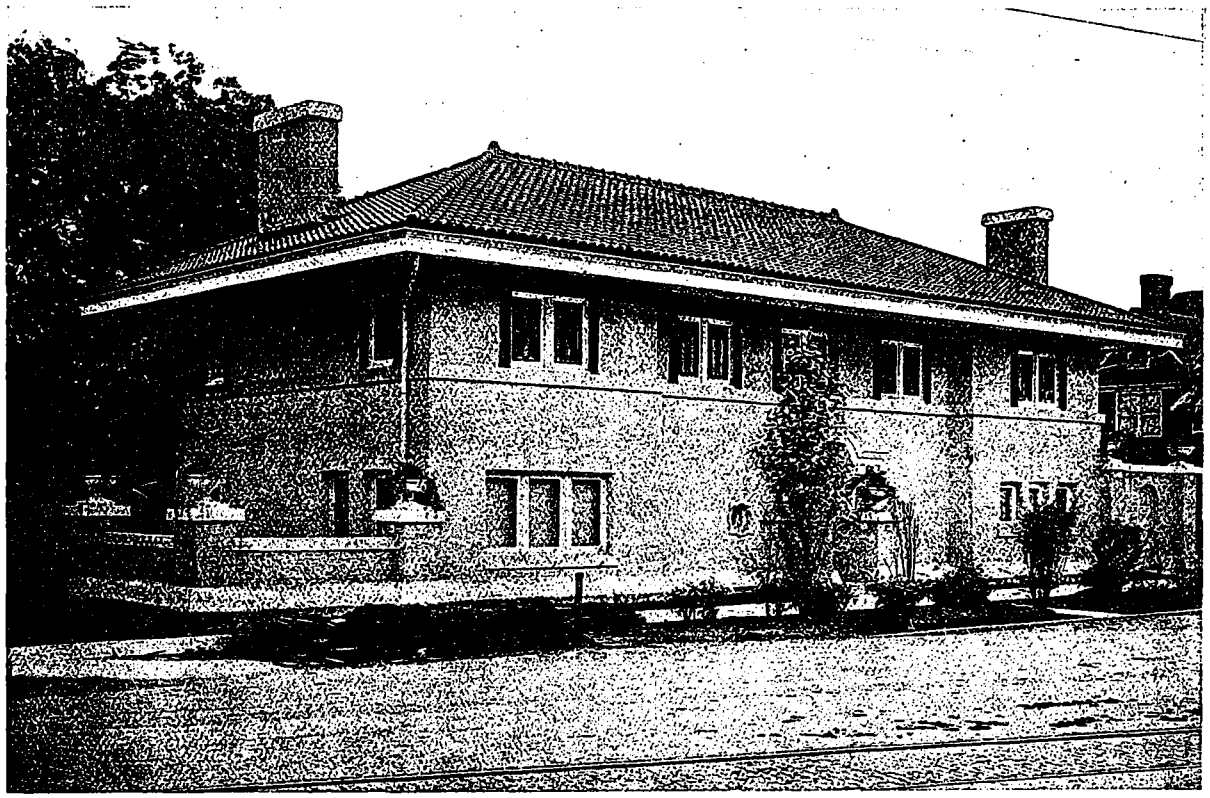
Possibly nothing has contributed more to the demand for burnt clay products, and brought more clearly to the attention of the public their value as a fire retardent, than the recent great fires in Baltimore, Rochester, and San Francisco. Without considering, however, these occasional catastrophies, it is estimated that the United States yearly sustains a fire loss of $250,000,000, a sum almost double the combined value of all clay products manufactured in this country during the same time and nearly three times the total value of all the brick, fireproofing, terra cotta, lumber, hollow building blocks or tile, and roofing, floor, and encaustic tile. With such an enormous annual property loss, and with the thinning out of the forests of the country, it is reasonable to believe that a change in building methods is imminent, and that the new era of construction will be of immeasurable benefit to

Pyramid, 4,294 feet high, giving a graphical comparison of the various burned clay products used in the United States in one year. It represents a total value of $158,942,369. Reproduced from the Scientific American.

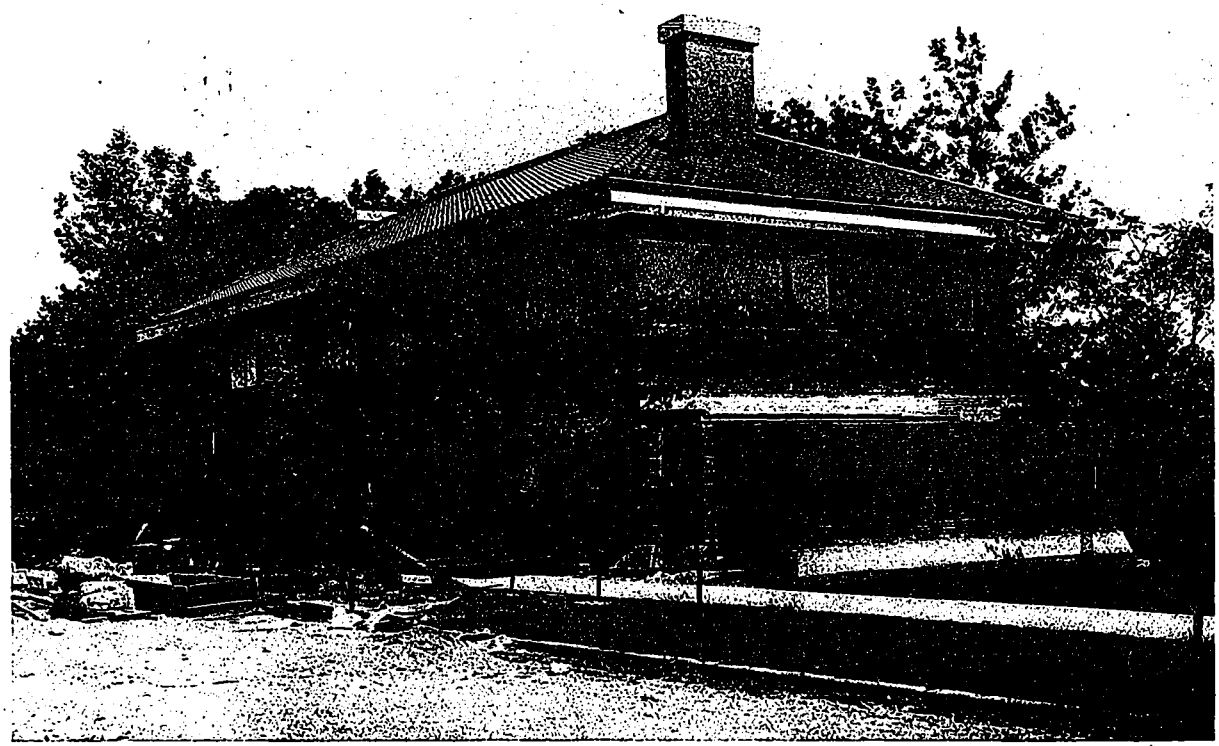
those engaged in the manufacture of burnt clay building materials.

It is claimed that the annual fire loss in this country during the past five years amounted to about $2.50 per capita, as against only 33 cents per capita in the larger European countries. This unsatisfactory showing for the United States has resulted in a growing demand for a fireproof brick that can be used in the construction of moderate-priced dwellings, and several large plants are now making a specialty of such an article.

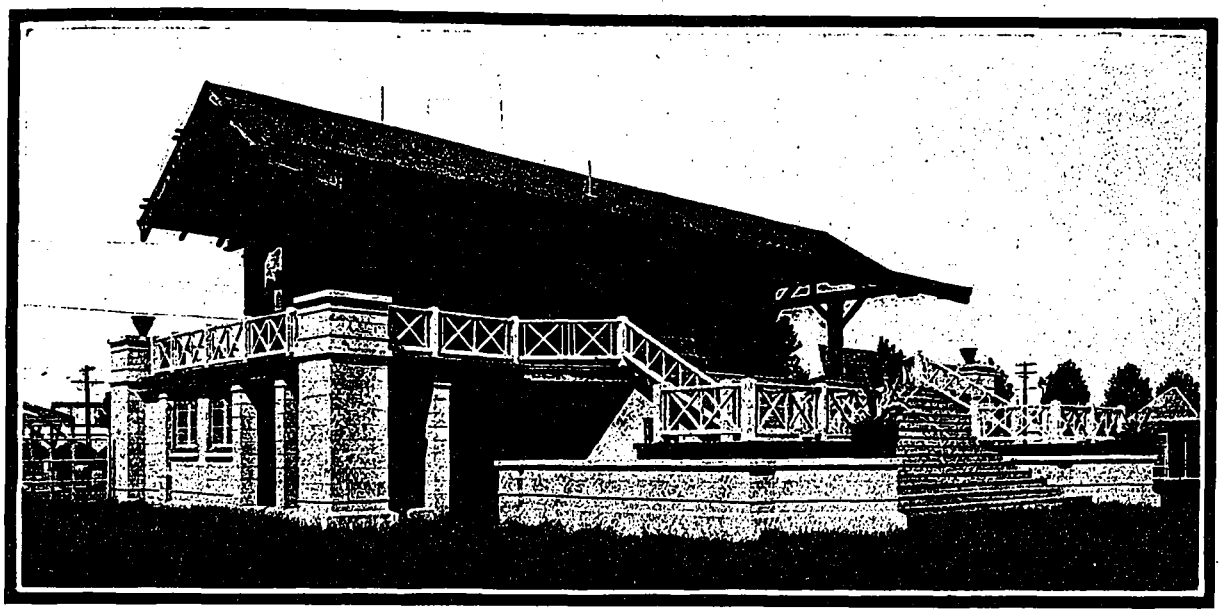
The accompanying engraving shows a graphical comparison of the magnitude of clay products for one year. The pyramid would be 4,294 feet high and looms well up toward the summit of Mount Washington.



Fireproof residence of Dr. George E. Harter, Elkhart, Indiana. An adaptation of the Mission stylle of architecture, built of concrete blocks with cement stucco exterior.



View of residence of Dr. George E. Harter, Elkhart, Ind., in process of construction, showing the concrete block walls before the cement stucco was applied.



Club House, Dallas Driving Association, Dallas, Texas. An attractive structure of concrete block, cement stucco, and half-timber construction.

CONCRETE BLOCKS.---Their Present and Future.---Availability* and Cost.---Color, Texture and Design.---Careful Selection of Aggregates and Proper Mixing Essential to Obtain Best Results.---Designs Now Produced to Meet Every Requirement of the Architect.

By J. AUGUSTINE SMITH

J. Augustine Smith.

CONCRETE BLOCKS are destined to play an important part in all forms of construction work in the future. Concrete construction is here to stay. It has every virtue possessed by any other building material and possesses some not possessed by any other. When we look back and see the development of the concrete block; note the difficulties through which it has passed; consider the mistakes that have been made both in its manufacture and exploitation; it is a wonder it has survived, and it would not have survived had it not inherently the virtues it possesses.

I need not touch upon the history of this material; how it was first molded in sand, then in wood forms, then in iron forms, and then when the demand for their more rapid manufacture became apparent, machines were invented for producing them. Machines were devised with the idea of supplying a concrete block, with ventilated chambers, which would secure greater resistance to moisture, heat and cold in the constructed wall. These first machines were regarded as a remarkable development in the art of manufacturing concrete blocks, and they were a long step in advance of the prior art.

With the invention and discovery of these machines, there followed a period of strong effort to have the blocks used in construction work generally, but with indifferent success. Then followed a period of constant pioneering, and finally came the invention of a simpler machine, of more perfect type, that opened the way for a large increase in the number of those manufacturing concrete blocks.

Unfortunately, with the great development in the use and manufacture of blocks, there entered into the business many incompetents, whose strongest desire was, in many cases, to produce blocks without regard to their worth or stability from a structural standpoint; just so they could be sold for a profitable price. Furthermore, many of these people lacked business training and business instinct, and they were satisfied to turn out blocks that were porous, imperfectly made, and an eyesore and detriment to the business.

It has been said, and truly, that "bad news travels fast." Never was this truism so aptly illustrated as in the case of concrete blocks. One poor, badly constructed building, of porous, poorly made, concrete stone, has done more harm to the industry than fifty well made, well built houses that were constructed of good, high class, concrete blocks could offset.

The manufacturers of machinery, too, must bear their share of the blame for furnishing designs of the rankest artificiality. I refer particularly to the rock faced pattern, which has received the condemnation of architects and builders, everywhere. Furthermore, many machines were produced of rude, crude type, which turned out

*Paper read at Toronto before the first convention of the Canadian Cement & Concrete Ass'n.

blocks which were untrue in measurement, preposterous so far as the ventilation of the block was concerned, and of designs that were, to say the least, extremely inartistic.

In every great business we find a first period of enthusiastic effort, then a re-action ensues, and then comes the conservative painstaking, upbuilding era, which means the development of the business on fundamentally correct lines.

Since the unpromising beginning, which I have just related, perhaps it is necessary to show the development of concrete blocks from that beginning. In the first place, as I have said, many machines fell into the hands of incompetent people, people who had no experience whatever with concrete, knew nothing whatever of the selection of aggregates, mixing of material, or curing of the stone and they, therefore, found the easiest way to turn out blocks was to make them with the least possible water. They added too little water to properly crystallize the cement.

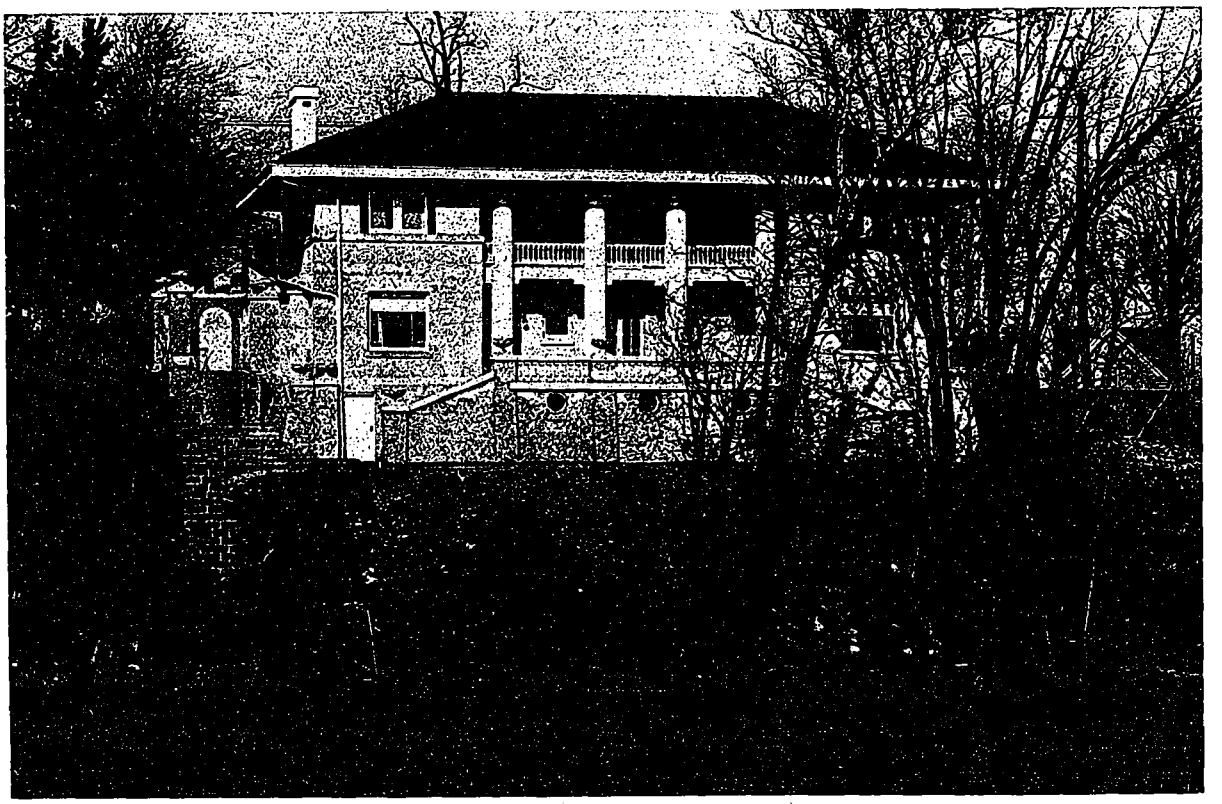
The development of the manufacture of good concrete blocks in this regard has been marked and pleasing until now, instead of dry tamped blocks, they are tamped wet, just as much water being added as will permit the block to be removed from the machine without sagging or sticking. I desire to say that it is essentially necessary for the proper manufacture of good cement blocks, to select your aggregates with great care. That proportion of sand and gravel should be used which will secure the least possible voids.

Proper mixing is essential. If hand mixed the mass should be turned over at least three times in a dry state, and at least three times in a wet state after the water has been added. You will find also, if you use an ordinary rake as a last means of mixing your concrete, both in a dry and in a wet state, this will help the mixing of the materials very much. I need not say this should be done after the mass has been turned at least twice with a shovel.

I want to lay particular stress upon the use of the proper kind of water and the necessity for measuring the amount of water used in making concrete block. It has come under my observation in several cases, where blocks of different colors and shades were produced, using identically the same material, the same cement, and the same water, it was found that the cause of this change of color was due to the water used. Tanks were erected for settling purposes, the cleared water used in the manufacture of the blocks, with the result that this discoloration, or change disappeared entirely.

With regard to the use of the proper amount of water to be used—the question as to which is the better, the wet or the dry mixing of concrete, I have recently seen an editorial in one of the trade papers which purported to give the result of extended experiments covering some four years recently made in Germany. From these reports the conclusion is drawn that the smallest amount of water which produces a mixture suitable for ramming, gives the strongest concrete. It is, of course, conceded that this amount of water must be sufficient to properly crystallize all the cement used. At the same time the concrete worker who attempts to use the smallest amount of water will produce a mixture suitable for ramming, will find many difficulties. There is, therefore, but one thing to do, viz., measure the water as well as the other aggregates, for each batch mixed. There should be no guess work about it.

The proper curing of blocks after they are made, is, of course, essential, indeed it is very essential, but it only plays its part in the whole process of manufacture. It is just as necessary that the aggregates should be selected carefully, and the materials mixed properly with sufficient water, as it is to thoroughly cure the stone afterwards. Furthermore, blocks should be properly tamped, and I strongly urge, wherever machines of good type can be secured that the mixing of the materials and the tamping of the blocks should be done mechanically.



Residence of Dr. George E. Harter, Elkhart, Indiana, as viewed from the river front.

MATERIALS.

The materials most commonly used in concrete block manufacture are sand, gravel, crushed stone and Portland cement. Much could be written on sands alone, so I will touch upon this subject very briefly. The term is confused by a great majority of concrete block manufacturers. In concrete work sand is that material which will pass a quarter-inch screen, and a good sand should be graded from coarse to fine, with the coarser grains predominating. A sand which is well graded from coarse to fine will make strong concrete. It will also make dense concrete. The strength of concrete varies directly with its density. Let me lay down one fact, however, and call your particular attention to it, viz., that no concrete can be stronger than the materials from which it is made.

Many block manufacturers insist on using for facing a very fine sand, mixed in the proportions of one part of cement to two parts of sand, not realizing that a coarse, well graded sand will give as strong a facing with a one to three mixture and a block of as good appearance as well. They seem to think they must use a fine sand in order to get a smooth block.

When the tamping is directly against the face, as in most machines, the finer particles work themselves through the coarser ones into the face, and thus the surface is just as smooth as though a fine sand were used.

As good a surface can be obtained by using coarse, well graded sand, and it will be far stronger and more waterproof. The reason for this is, that in a fine sand the grains are nearly all uniform in size, and the percentage of voids will be between 40 and 50 per cent, whereas, in a well graded sand, the voids may be as low as 25 per cent. Consequently, when using the same amount of cement with both sands, the coarser sand will make a coarser, denser, more waterproof concrete.

The fine sand also has a greater number of particules and consequently there is more surface to be coated with the cement mortar. This means that more cement is required.

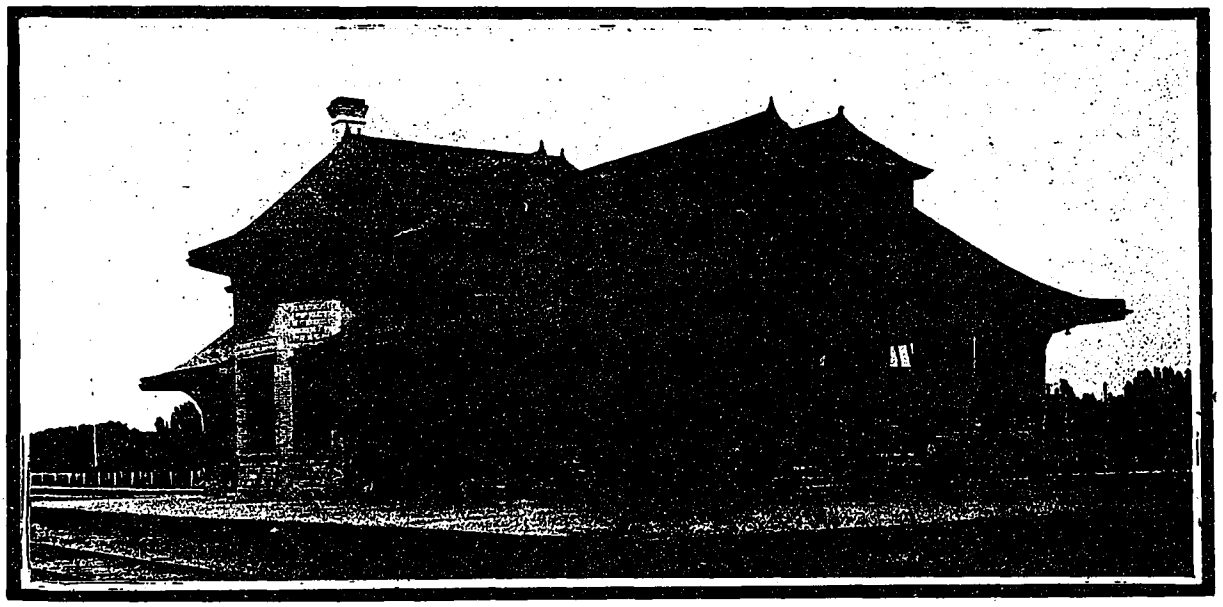
FACING OF CONCRETE BLOCKS.

The subject of facing concrete blocks is one that well deserves attention. Blocks are usually sold because of their good appearance and satisfactory qualities. The manufacturer who faces his blocks with materials which give them life, is the one who gets the business.

One of the most serious objections to concrete blocks in the past, is their dark gray appearance. This can be overcome by using light colored sand or crushed stone, with a white Portland cement, which will give a light gray effect. If a pure white effect is desired, then white cement should be used with white sand or crushed stone, mixed with a little marble dust. It is very difficult to obtain a coarse, white sand, although I have seen a few samples which were quite coarse.

I find white sand used alone with cement will not make a thoroughly dense, waterproof facing. In order to make such facing waterproof, I have found it necessary to use a proportion of marble dust, or crushed stone, with the sand. Care should be taken not to use too much marble dust, for if too much of this is used, the facing will check and show unsightly cracks. For this reason marble dust should never be used alone with cement. Usually the checks and hair cracks referred to will not show until the blocks have aged several weeks, or even months, but eventually they are bound to come.

The amount of marble dust to be used should not be more than 1½ parts to 4 parts of white sand. If the facing is too rich in cement, checks and hair cracks are liable to appear as when marble dust is alone used with cement.



Passenger Depot, O. S. L. Railway, Payette, Idaho. A highly acceptable design carried out in concrete blocks with buff brick trimmings.

Very good results can be obtained by using limestone screenings from coarse to fine, which will pass a quarter-inch screen, but usually it is advantageous to use a little white sand with this as well, in order to obtain a smooth, dense surface.

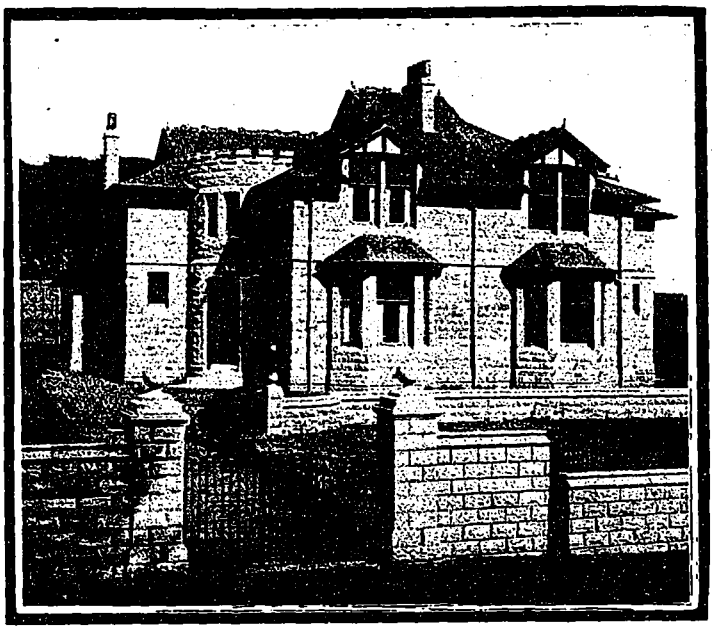
PROPORTIONS TO BE USED.

The proportions which should be used to produce maximum strength in concrete blocks, is one which has received much thought and consideration. The specifications of the American Association of Cement Users require proportions which will insure a minimum crushing strength of 1,000 lbs. per square inch of superficial area at the age of 28 days. They call for proportions of 1 part cement, 3 parts sand, 4 parts gravel.

Where a good coarse sand is obtainable it is sometimes more economical to use sand only in the proportions of one part of cement to four parts of sand, pit run. If the sand is coarse and well graded, blocks made with these proportions will develop over 1,000 lbs. per square inch in 28 days. It should, therefore, be the aim of your

association to insist upon such proportions as will secure an adequate minimum crushing strength within a given specified time.

It has always seemed to me that it is most important to get the requisite strength regardless of proportions, and if a 1 to 4 sand concrete will give these results, I unhesitatingly say this should be permitted. The same



A concrete two-family block villa, designed and erected by the owner, David Brown, Jr., at Paisley (near Glasgow), Scotland. The total cost of this building was $3,360.

holds true of a 1-3-6 mixture, provided it will give the required strength. Proportions of 1-2-4, 1-3-4, 1-2½-5, and 1-2-5, should all prove rich enough in cement to make blocks which will develop a crushing strength of 1,000 lbs. per square inch in 28 days, provided, of course, the aggregates used are of good quality and free from extraneous material.

CURING.

Wet tamped blocks should be sprinkled two or three times daily for a period of from 14 to 21 days. They should be sprinkled after molding as soon as the concrete has obtained its initial set, which it will do in from 12 to 24 hours.

The temperature of the curing room should never be lower than the freezing point of water, for if carried below this point the blocks will freeze, the setting of the cement will be delayed, and even if the blocks are not injured, they will be no stronger when they thaw out than when they first froze, for the process of hardening or crystallization stops at the time of freezing and does not resume until the blocks are thawed out.

Many manufacturers supply blocks for use a few days after they are made. This is a great mistake and should never be done, as blocks cured by the sprinkled method for a few days are not strong enough to use in structural work, and it is errors of this kind that discredit the use of this material. Every now and then one can see blocks in buildings that are so soft and crumbly that the surface can be cut away and this almost invariably is caused by insufficient water in the mixture or insufficient curing. It is sometimes caused by not using enough cement, but the former reasons are more often the cause.

Another point I want to emphasize strongly is the fact that no amount of subsequent sprinkling during the curing process will make up for an inadequate amount of water in the mixing of the concrete; that is to say, if a man uses but half as much water in his concrete as he ought to, no amount of subsequent sprinkling will make that block what it should be.

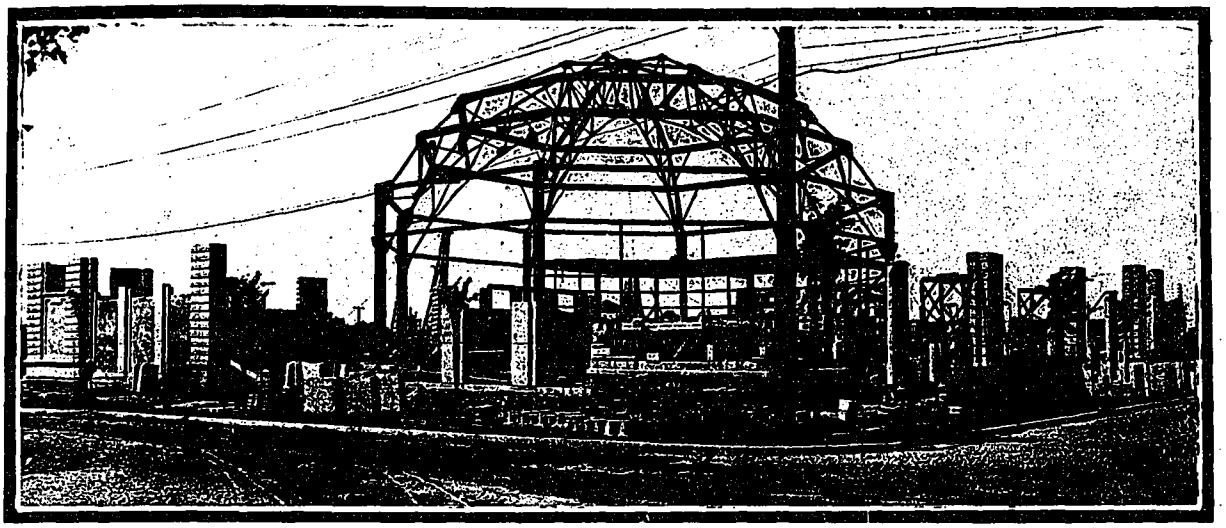
WATERPROOFING.

This is a subject that has had the earnest attention of many people. As I have before stated, good, dense concrete, absolutely waterproof and impervious to moisture, can be made by the proper selection of aggregates, the proper mixing of the materials, the addition of a sufficient amount of water and a proper curing of the stone. This is particularly true where you use a rich facing mixture for the block. To make assurance doubly sure, and to reduce the human equation to the lowest possible point, there have been devised waterproofing compounds and waterproofing fillers to make the blocks dense and impervious to moisture. Most of these compounds are water repellants. The use of them seems to me to be illogical, in view of the fact the desired end in making concrete is to secure perfect crystallization *by the use of water.*

A new development in this regard was shown at the Cleveland Exhibition of the National Cement Users, and the annual cement show in Chicago, recently held. This is a process by which perfect crystallization is secured without the use of waterproofing compounds or fillers as described.

Summer residence of Beyer Bros., at Winona Lake, Indiana, erected at a cost of $13,000. *The first story consists of alternating courses of 8-inch and 4-inch rock face blocks, while the second story and towers are built of plain blocks.*

It is to be regretted that the attitude of the insurance



Ladies' Art and Textile Building, State Fair Grounds, Dallas, Texas, in process of construction, showing the use of concrete blocks in conjunction with structural steel work.

underwriters is at present so unfavorable to concrete block construction. They fail to give credit where credit should be given; that is to say, where good concrete blocks are well made and well laid, and unfortunately, as I have before pointed out, bad practice in concrete block construction has counted infinitely more than good practice, and one poor example where failure under fire stress has occurred, has weighed infinitely more with insurance underwriters than evidences of good fire-resisting concrete block construction

In this regard I desire to call your attention specifically to the tests made by the United States Government at the Structural Materials Laboratories at St. Louis. It was conclusively proven there that of all building materials, concrete blocks stood the test of fire better than any other material. Tests were made of granite, limestone, marble, Bedford stone, sandstone, hollow tile, and brick, as well as concrete blocks, these materials being subjected to 1,700 degrees Fahr. for two hours, followed by application of water.

The hollow tile showed a fracture of the web and a falling away of the protective surface following the application of water. Extreme disintegration was shown in the case of the granite material. The limestone, marble, Bedford stone and sandstone, all went to pieces under stress of fire and water, and even such an excellent fireproof material as St. Louis brick was partially destroyed under conditions of these tests. Dry tamped cement blocks showed a remarkable resistance, merely surface disintegration following the application of water. Tests were made of gravel concrete in the form of short beams assembled as blocks, granite concrete beams or blocks, as well as cinder concrete blocks, and in each case they showed low thermal conductivity, paper labels on the backs of some of the specimens not even being scorched. The damage to these blocks was entirely confined to the surface.

In view of these tests, as well as other evidence of the remarkable resistance of concrete blocks to fire, it is astonishing that insurance companies should not seek to promote the use of this material rather than take the unfavorable stand they have taken in many cases, by exacting inequitable, unfair and absolutely exorbitant rates of insurance where this material is used.

I wish to record the fact, however, that many insurance people are awakening to the remarkable character of this material, and I feel safe in saying it will not be long before a change in this regard has come about

The possibilities of the concrete block business have been too greatly underestimated until the last few years, and even now prospective builders and the public at large are just beginning to understand their remarkable utility and availability. A few years ago concrete blocks were used for little less than foundations and cellars. The

Concluded on page 67.

Concrete block machine shop erected for the Wolverine Motor Works, Bridgeport, Connecticut. According to the statement of the owners, who made the blocks themselves, the complete cost of this building (120 ft. by 240 ft., and 24 ft. to top of saw-tooth roof) was $2,800, the cost of blocks being six cents each.

THE SOUTHAM PRESS BUILDING.—New Structure Recently Erected at Toronto.—Floor System and Columns of Reinforced Concrete.—Plan and Elevation Simple and Direct.—Fireproof Throughout.—Time Required in Construction and Cost of Work.

By W. N. MOORHOUSE

IN A BUILDING designed for the purpose of a large industrial company, the chief consideration should be "directness." If properly designed and carried out, this attribute, with its synonym "simplicity," will represent structural efficiency, satisfaction in the subsequent conduct of business, and a pleasing sense of harmony in the elevations. The figure that represents industry is not that of a king decked with gold and jewels, but of a young man, his only beauty that of natural strength and dignity, his only ornament the tools that represent his office of toil. So it is with the inanimate representative of industry, whose lines should spring boldly in conformity with its purpose, which its mass and proportions should express in no uncertain language.

This has been the aim in the design of the Southam Press Building, successors to the Mail Job Printing Company. Its motto is "directness." Simple in plan and elevation, the lines and proportions of which are its ornament, it represents "efficiency."

CONSTRUCTION.

The system of floor and columns construction adopted was that of concrete reinforced with ordinary mild steel bars and expanded metal. Before such a decision was arrived at, tenders were taken for various types of construction, including steel and concrete, and steel and tile. The closest tender to that accepted, represented an increase in cost of $8,700. The basis of tenders placed on the same footing all approved systems of fireproof construction, cost alone ruling the selection. The type of construction adopted produces a strictly fireproof building of a monolithic character, free from vibration.

TIME REQUIRED IN CONSTRUCTION.

In rapidity of construction it cannot be surpassed, as the following statement will show. Mill construction is generally considered to be the type that may be erected with the greatest ease and rapidity. A general comparison might be of interest. In a building of the mill construction type recently completed here, within a close time limit, the average rate of placing each floor of 5,400 square feet area, was ten days. In this building, herein described, the time taken to lay each floor of 10,000 square feet are, including setting up of forms, placing of reinforcement and such pipes, leads, etc., as were fixtures in the slab, and pouring of columns, beams and slabs, was two weeks. This does not include the finished wood floor, but a cement grout could have been put on in three days extra per floor. While on the question of time of construction, it might be of interest to give a short progress chart:

Ground floor Aug. 31 Sept. 4. 12 days behind Sept. 22

	Start	Finish.	Days per floor	Progress of contract.	Forms removed.	
	—1908—					
Foundations	Aug. 7	Aug. 28				
Ground floor	Aug. 31	Sept. 4		12 days behind	Sept. 22	Con.
1st floor	Sept. 2	Sept. 17				Brick
	Sept. 17	Sept. 21	15	7 days behind	Oct. 7	Con.
2nd floor	Sept. 21	Sept. 28				Brick
	Sept. 30	Oct. 3	10	On time	Oct. 20	Con.
3rd floor	Oct. 2	Oct. 10				Brick
	Oct. 13	Oct. 16	11	8 days ahead	Nov. 4	Con.
4th floor	Oct. 16	Oct. 26				Brick
	Oct. 27	Oct. 30	13	15 days ahead	Nov. 17	Con.
Roof	Oct. 31	Nov. 10				Brick
	Nov. 13	Nov. 18	16	17 days ahead	Dec. 4	Con.

This shows a total time of construction of the foundations, walls, columns, floors and roof, that is the main body of the building, of three months and four days.

New Southam Press Building, recently erected at Toronto. A simple designed, well proportioned, reinforced concrete structure with brick curtain walls. Messrs. Sproatt & Rolph, Architects.

COST OF WORK.

The cost of this building was 11¼c. per cubic foot, allowing for everything including plumbing for three floors and offsets, for rest building, office fixtures on the fourth floor, and electric light and power conduit work (the latter not generally included in such estimate). As a comparison, it might be said that the cost of the building of mill construction type herein before mentioned, was 10¾c. per cubic foot.

A few of the patent advantages of a type such as the Mail Job Printing Company's building, are:

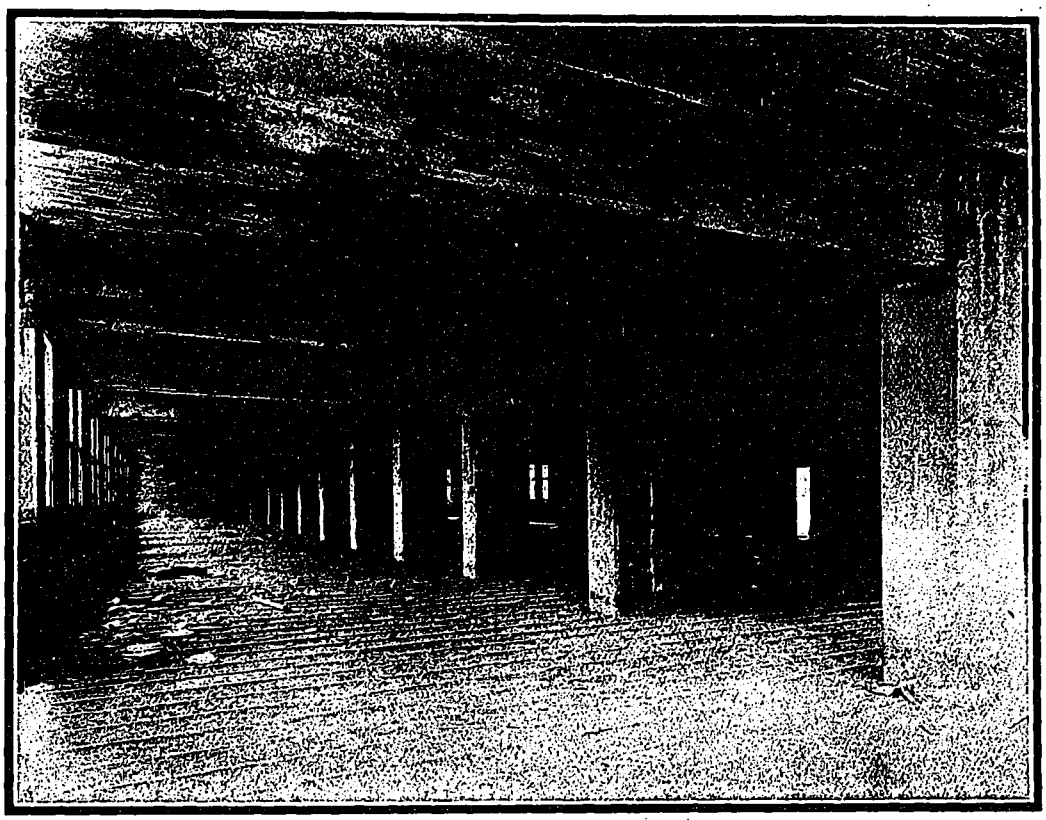
(a) A smaller percentage to be reckoned per annum as depreciation.

(b) A saving in insurance rates.

(c) Fireproof quality in reference to value of rents

if the proprietor wishes to let the building in whole or in part.

In reference to item (b), it might be said that the rating of a building of this kind, however perfectly fireproofed, depends largely on the report of the inspectors as to the environment. This building, however, gets the lowest possible rating, viz., 15c. per hundred per annum, which effects a saving of 5c. to 15c. per hundred per annum over types of fireproof buildings where structural steel is used.

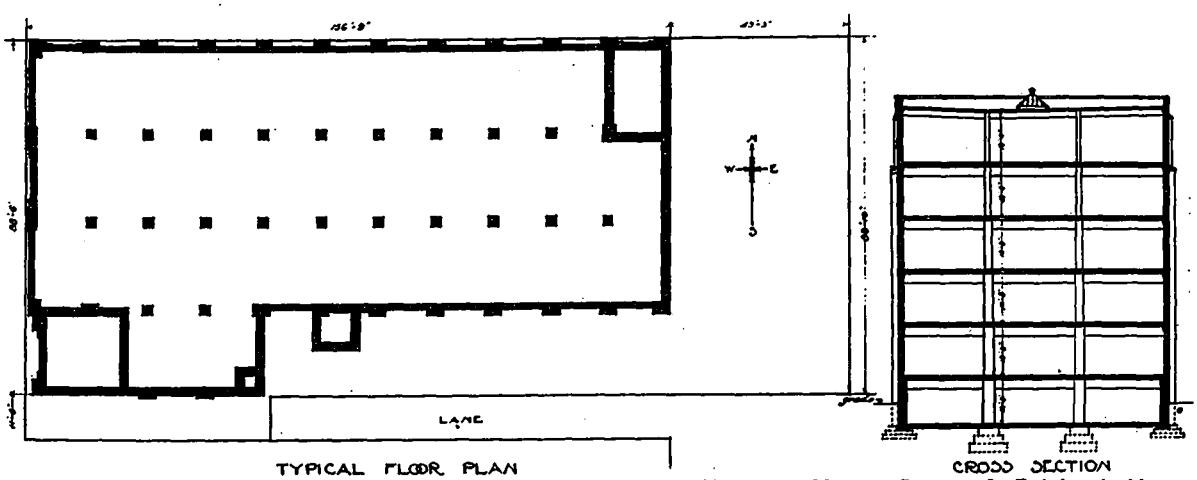


View of one of the floors, new Southam Building, Toronto, prior to applying the finishing coat or laying the hardwood super-floor. Messrs. Sproatt & Rolph, Architects.

DESCRIPTION OF THE BUILDING.

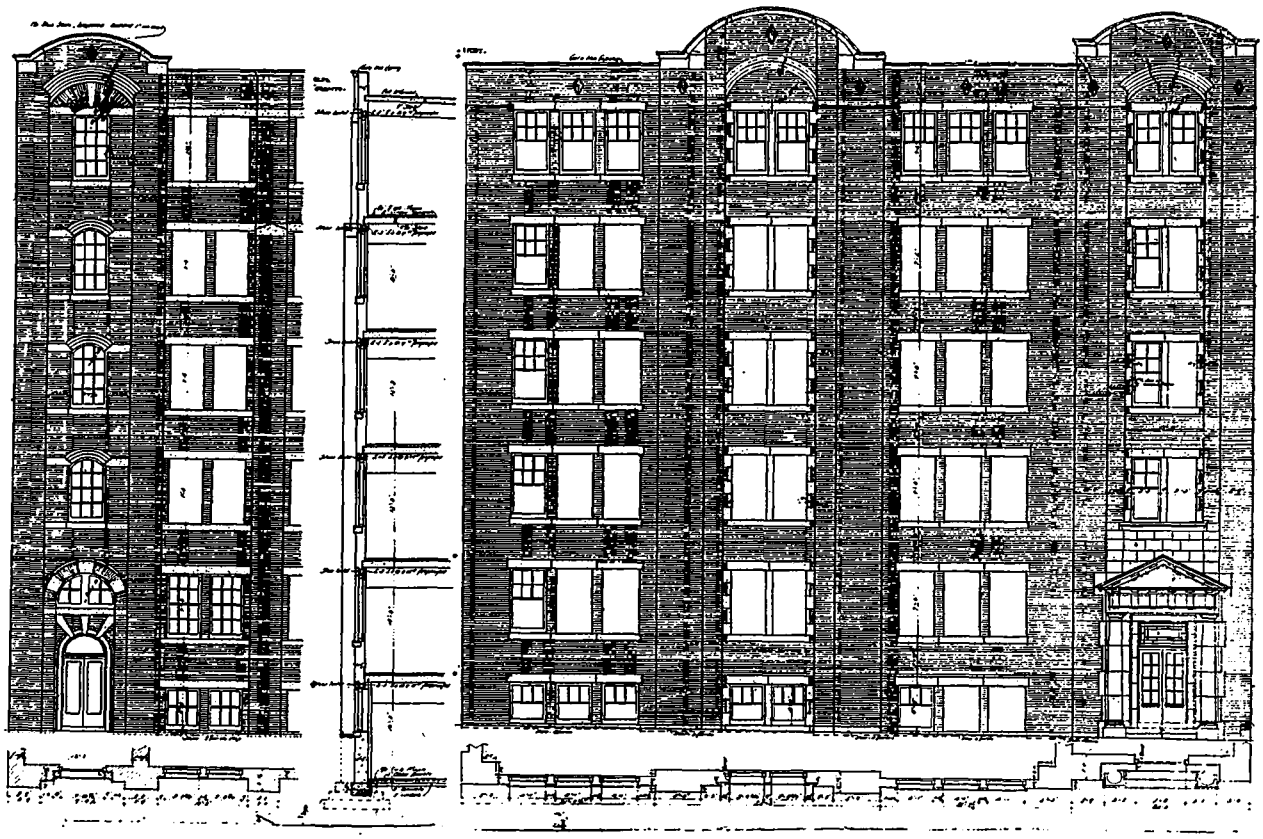
The columns and beams are not figured on the plans shown with this article, as these are the original tendering plans before the method, of columns, beam and slab construction, were decided on. The types adopted consists of girders covering the 22 ft. spans between the columns across the building and a 9-in. slab reinforced with expanded metal and ⅜-in. bars at 7.8/ centres spanning 14 ft. lengthways of the building. This does away with intermediate beams, giving free passage of light and doing away with concentrated loads on girders. The columns in basement are 32 by 32 inches, reinforced with six 1 11-16 in. square bars and hooped with iron straps placed at centres equal to the diameter of the column. The floor girders are 20 by 28 inches, reinforced with three 1¼ in. and three 1-in. square bars, three of these being straight and three trussed.

The depth of the floor slab provided an efficient method of disposal of light and power leads and also sprinkler hangers, all of which were well covered with



Typical Floor Plan and Cross Section, new Southam Press Building, Toronto. Messrs. Sproatt & Rolph, Architects.

asphalt paint before placing. The finished floor was composed of bevelled sleepers with 2-in. fill of cinder concrete and covered with ⅞-in. maple matched and dressed pany. The sprinkler hangers used were such that after being placed in the bottom of the floor slab, they allowed play of one inch each way for centering, which is a diffi-



Main and Sectional Elevations, new Southam Press Building, Toronto. Messrs. Sproatt & Rolph, Architects.

flooring. This gave a convenient method of disposal of pipes for plumbing and heating. By leaving out a 12-in. section of cinder fill and carrying heating pipes under finished flooring close to the wall, the difficult alternative of carrying the pipes under the girders below and providing two sleeves for delivery and return at each radiator, was avoided. The position of the freight elevator shaft, nearly central with the building, gave a convenient method of carrying up the heating mains, etc.

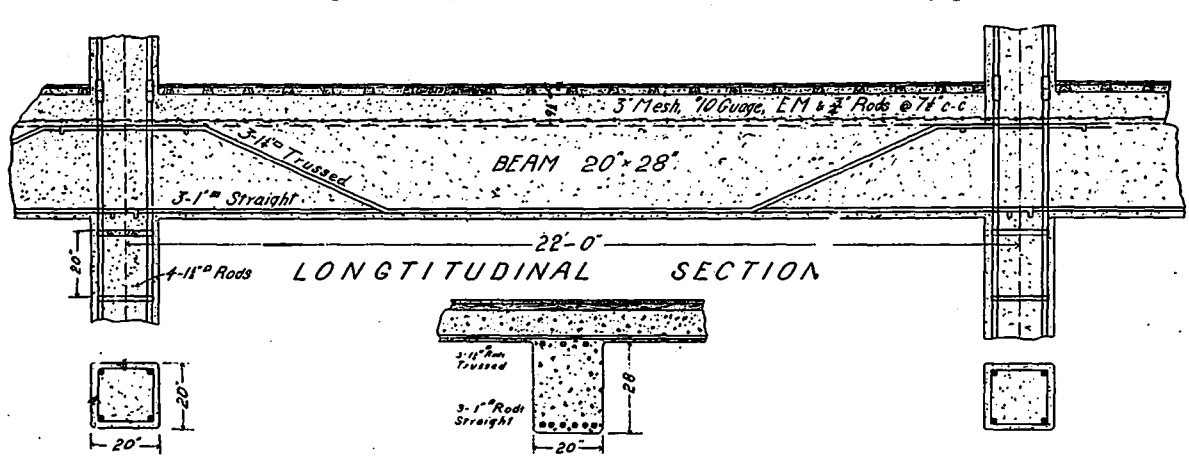
The sprinkler system is according to requirements of the underwriters, with automatic electric alarm system connected with Dominion Messenger and Signal Com-

cult matter when the pipes are carried through sleeves in the girders.

On the south and east sides of the building, metal frames and sash with wired glass, were used. The windows are as large as possible, steel lintels enclosed in concrete being used in place of reinforced concrete beams to gain window height.

The building is served by a main stairway with passenger elevator on the west from the Duncan street entrance. The employees' stair is situated in the north-east

Continued on page 70.



Details of reinforced concrete construction, new Southam Press Building, Toronto. Messrs. Sproatt & Rolph, Architects.

CONSTRUCTION

A Journal for the Architectural, Engineering and Contracting Interests of Canada.

H. GAGNIER, LIMITED, PUBLISHERS
Saturday Night Building
TORONTO - - - - CANADA

Ivan S. Macdonald, Editor and Manager

Address all correspondence to "CONSTRUCTION," Saturday Night Building, Toronto, Canada.

Telephone { Private Branch Exchange connects with all Departments } Main 6640 6641

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SUBSCRIPTIONS.—Canada and Great Britain, $2.00 per annum. United States, the Continent and all Postal Union Countries, $3.00 per annum in advance.
ADVERTISEMENTS.—Changes of, or new, advertisements must reach the Head Office not later than the first of each month to ensure insertion. Advertising rates on application.
CORRESPONDENCE.—The Editor will be pleased to receive communications upon subjects of interest to the readers of this journal.

Vol. 2 Toronto, May, 1909 No. 7

Current Topics

WATER TANKS of white pine used on railroad work have in the past had a maximum life of 20 years, while the maximum life of cypress is 25 years.

* * *

ASBESTOS IS USED in large quantities in and about Birmingham, England, according to a recent report of Acting Canadian Trade Commissioner J. E. Ray, who adds that numerous inquiries regarding Canadian manufacturers are being continually received at his office.

* * *

THE MESSINA EARTHQUAKE had no effect on the reinforced concrete buildings at Favelloni, in Calabria, although other structures in their vicinity were injured. These buildings were constructed after the earthquake of 1905, which also had destructive results in that neighborhood.

* * *

A NEW CORPORATION at New Westminster, B.C., is the Pitt Lake Brick Company, which has been organized to exploit the extensive clay bed discovered at Pitt Lake. It is understood that samples of brick made from deposit are rich in texture and of a highly durable character. The company has made arrangement for the installation of a modern brick plant and soon expect to have their product on the market.

* * *

THE FIRST PASSENGER ELEVATOR to be installed in a Hamilton church and possibly the first in the entire Dominion, has just been placed in the house of worship of the Centenary Methodist congregation. The car is of sufficient size to carry three or four persons and it is provided for the benefit of those who find it a difficult matter to climb up the large number of steps from the entrance on Main street to the auditorium.

A THIRTY-ONE STOREY HOTEL BUILDING is to be erected in New York city, if plans recently submitted to the bureau of buildings are favorably passed upon. The site of the proposed structure is at the southwest corner of Madison avenue and 42nd street, a stone's throw from the Grand Central Station, and from curb to roof the building will be 376 feet high. It will be the highest hostelry in the world and overtop by ten storeys any hotel structure in the city. A local real estate company is behind the project and will expend $2,000,000 to complete the building.

* * *

PLANS FOR THE QUEBEC BRIDGE are well underway and it is expected that they will be completed early next fall. According to the present intentions of the government, as soon as the drawings have been finished and approved of, the task of supervising the erection of the structure will be placed in the hands of Mr. Vautelet, the Canadian member of the board of engineers who now have charge of the work, while Mr. Fitzmaurice and Mr. Modjeska will be retained only in a consulting capacity. It is reported that the Grand Trunk has made a proposition to the government to take over the construction of the bridge.

* * *

VARIOUS METHODS of applying preservatives to railroad ties and telegraph poles have been in practical use in Europe for more than thirty years; and it would be difficult to find in any advanced continental country a single railroad, telegraph, or telephone company which has not adopted some means in this respect with highly gratifying results. In recent years the most usual preservative agents in use have been chloride of zinc, creosote, and bichloride of mercury, applied by imbibition, or by impregnation by injection forced by the pressure of the air. This second method of treatment generally consists in placing the wood in closed metallic recipients from which the air is pumped, and the liquid then introduced under high pressure.

* * *

ONE OF THE SUMMER ATTRACTIONS at Vancouver hereafter will be a concrete bathing pavilion, 276 feet long, which is to be erected on Beach avenue, overlooking English Bay. The roof of the structure is designated so as to be used as a promenade from which a splendid view of the harbor can be obtained. In the centre of the pavilion a large office will separate the men and women departments. Each wing will contain fifty-four well lighted and ventilated dressing rooms with convenient show bath facilities, and the doors, grating and seats will be so arranged as to allow all room to be easily cleaned and drained. The beach is to be approached by a flight of steps from each side, and a broad terrace will run the full length of the building.

* * *

RICH DEPOSITS OF GYPSUM have been discovered at East Bay, about fifteen miles from Sydney, Nova Scotia. The whole extent of a local railway company's present holdings and a large section of contiguous country appear to fairly abound with the material. Explorations are now being made by the present owners, with the assistance of government experts, and calyz drill operated at the base of the hill has been driven down through the plaster to a depth of about eighty feet without any break being found in the deposit. The analysis, straight through, shows nearly 99 per cent. of purity. Some 20 tests have been made, and it is claimed that in every instance the pure gypsum has been found at an average of 10 to 12 feet beneath the surface.

A 2,000,000 BUSHEL ELEVATOR, together with wharves and other facilities for handling this vast quantity of grain, is to be built at Flat Point, Victoria Harbor, Georgian Bay by the Canadian Pacific Railway at a cost of $1,000,000. The closing of this contract, it is said, assures the construction of a line from this point through Orillia and Lindsay to Peterborough, a distance of 100 miles, where it will connect with the company's main line to Montreal and Quebec.

* * *

NEGOTIATIONS ARE NOW UNDERWAY between the Dominion Government and the Equitable Engineering Company, of New York, for the removal of the debris of the fallen Quebec bridge. The New York company controls the Oxy-Acetylene process by which a bar of iron five inches thick can be cut through in a few seconds. If satisfactory arrangements are brought about the work will begin during the summer and all the steel and iron work now clinging to the piers will be detached within a few weeks by this new process, which, it is said, will save considerable time and involve an expense much smaller than would be necessary by the ordinary processes.

* * *

ACCORDING TO THE REPORT of the engineer in charge of the Hudson Bay railway survey, as transmitted to the Department of Railways and Canals, a canal could be built to the Hudson Bay which would enable ocean vessels to take cargo at Winnipeg, and thus establish a direct waterway route from the West to Liverpool and other Atlantic ports. From a glance at the map such a route is not only feasible but practical. However, it is still a question as to whether it will offer any advantage over the present means of transportation, and in the opinion of the Hon. Mr. Graham it will need a good deal of further investigation before the work would actually be entered upon.

* * *

A CLAMSHELL DREDGER BUCKET, which had been damaged by cracking one of the arms says the ENGINEERING RECORD, was recently repaired at Stockton, Cal., by welding with Thermit, and at the same time a cast-steel bumper plate was welded between the arms, which were of 2 x 11 1-2 in. forged steel. The bumper plate was about 2 in. thick and 12 in. wide, and had legs turned at right angles for bolting to the arms. The crack was about one inch wide, and extended through one of the bolt holes. Reinforcing strips were placed on each side of the crack and on each side of the bumper plate. Double gates and risers were used, and 137 lbs. of Thermit, 10 1-4 lbs. of steel punchings, 10 1-4 lbs. of cast-iron borings and 2 3-4 lbs. of ferro-manganese were required. A second operation was necessary to weld the bumper plate to the other leg, requiring, however, somewhat less welding material.

* * *

UPWARD OF 12,000 FEET above the level of the sea is to be the elevation of the railway which will shortly be built across the Andes from Arica in Chili to La Paz in Bolivia by Messrs. Sir John Jackson, Limited, a well known firm of English engineers and contractors, who have just been awarded the contract for its construction. This line which will extend a little over 300 miles, will undoubtedly be the highest railway route in the world. The first fifty to sixty miles will be across a desert, and the contractors will be required to provide a complete system of water supply over the entire distance. From this point on for fifty miles the road will pass through the Andes, while the last two hundred miles will be over the high tableland upon which La Paz, the highest city in the world, is situated. At present the only means of transit from coast to coast is by mule trains, in which two mules have to carry fodder and water for every baggage-carrying mule.

THE HIGH LEVEL TANK at the top of Rockland Avenue, Victoria, B.C., erected as an auxiliary unit to the city's water supply system, is now ready for service connections with the water main having recently been made. Both from an architectural and constructive standpoint the structure is said to be very acceptable. Buttresses ornament the sides and about seventy to eighty feet from the ground where the base of the tank proper commences, a small balcony extends around the outside wall. The structure is further rendered attractive by a pleasingly detailed roof. From its lowest point to the roof the structure towers one hundred and twenty feet. The tank itself is forty feet high and twenty-two feet in diameter, having a capacity of one hundred thousand gallons. Its entire construction, including the foundation, is of reinforced concrete, and the cost of the structure complete is figured to be about $12,000.

* * *

THE FOLLOWING FIGURES AND FACTS are furnished in regards to the mammoth apartment building which is now being built in New York City on a site covering the entire block bounded by Eighty-sixth and Eighty-seventh streets and Broadway and Amsterdam avenue. It will house a community as large as that of many a town, as it will contain 175 apartments, with 2 080 rooms, and the number of occupants including servants will be 1,225, it is estimated. The outside dimensions of the building are 350 x 200 feet. Its twelve floors and a mezzanine floor contain 50,000 square feet apiece, one and one-eighth acre to the floor, and thirteen and one-half acres in all, after deducting the space occupied by the open court, which will be 25 x 100 feet. Figures given as to the material which will be used in its construction are: Bricks, 7,000,000; steel, 6 000 tons; steel beams, 74 miles; plaster, 6,400 tons, covering 2,500,000 square feet; plumbing pipe, 20 miles; limestone facings, 30,000 cubic feet; moulding wiring, 189 miles; electric light bulbs, 16 000; steam pipe, 86,000 feet; radiators, 1,600.

* * *

SOME INTERESTING DATA which enables one to intellectually grasp the magnitude of the new C.P.R. bridge which is now in process of construction, over Belly River, near Lethbridge, Alta., was recently given out by a prominent official of the company. According to the statement made, the structure will be more than double the height of the ill-fated Quebec bridge. The latter bridge was to have been 150 feet above the level of high water while the C.P.R.'s new bridge will be 307 feet above the water level, and combining both its height and length it will be the largest bridge in the world. Its length will be 5,327 feet, or some twelve yards over a mile, and the cost of the structure will amount to $1,500,000. Comparison with other great bridges of the world show that the Lethbridge structure surpasses in length the bridge over the Dnieper at Jakaterinoslaw, Russia, which is 4,557 feet in length; the Alexandrowski bridge over the Volga, near Syzran, 4,871 feet; the Severn bridge 4,162 feet and the Empress bridge over the River Sutlej, on the Indus Valley railway. Of the bridges which approach it in height, the Kentucky bridge is important, having a height of 275 feet 6 inches above low water; while the C.P.R.'s own bridge over the Fraser river is 125 feet high. The structure which spans the Victoria falls of the Zambesi river has the advantage of the new C.P.R. bridge in height, but fails in comparison in length. The Lethbridge bridge will also be twice as high as the famous Forth bridge, and nearly five times as high as the Victoria bridge at Montreal, although both of these bridges are of greater length, the latter being nearly two miles long. The concrete foundation of the structure at Lethbridge goes down to 24 feet below low water, and stands on hard shale. Twelve thousand tons of steel, 18,000 cubic yards of concrete, 20,000 barrels of cement, and 15,041 piles are being used in its construction.

ORNAMENTAL CONCRETE STONE.*---Methods of Treating Surfaces to Produce Satisfactory Results as to Color, Texture and Detail. ---Selection and Intelligent Manipulation of Aggregates Important.--- Some Examples of Decorative Concrete Work.

By FRED. A. NORRIS, C.E.

IT IS NOW a generally accepted fact that properly made concrete possesses all qualities of the best natural quarried stone that would make it desirable as a building material, with the exception of a pleasing appearance, which it generally lacks.

For massive masonry construction, concrete has taken the place of old fashion stone masonry to an enormous extent, because of its comparative cheapness; and it might almost be said that natural stone is practically confined in use to facings and ornamental trim on pretentious buildings, where moulded courses, cornices, capitals, columns, and other ornamental features are employed. It is used in these cases nearly always purely on account of its superior appearance. Its principal function is to ornament, not to support loads.

It is well known that concrete can be moulded or cast into any desired form, but then, its appearance, especially in color and texture, unless this is done by careful, intelligent men, trained in this special work, is usually so undesirable that it cannot be used successfully on buildings of the first class.

In view of these facts, it is apparent that if we could make its color and texture pleasing to the eye and its form accurate in every detail, so that it would not appear moulded or cast, but have sharp arises and true lines, it might largely take the place of quarried stone, even where now used.

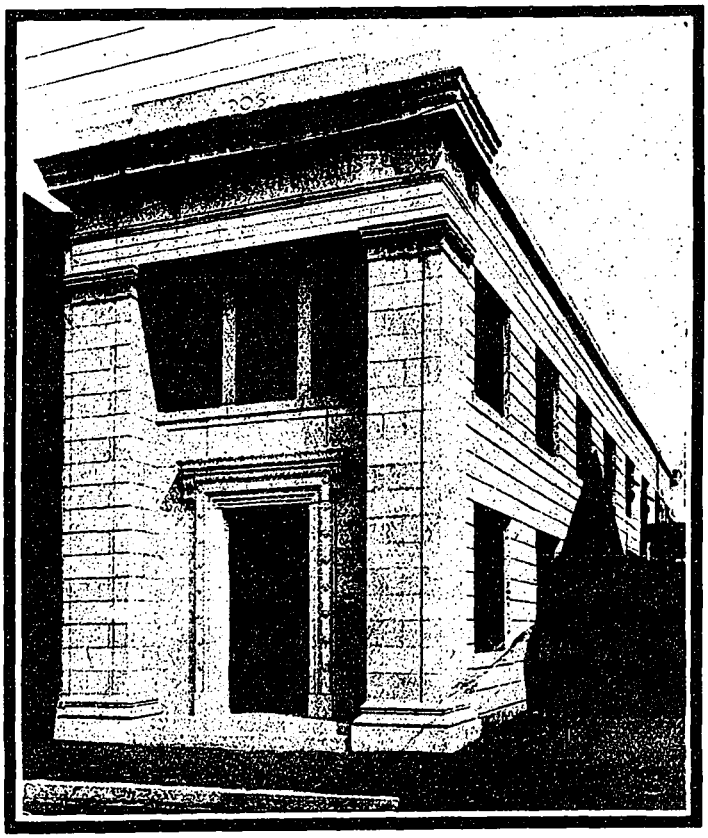
As our creterion of appearance, fixed habit, is that of quarried stone, and as concrete is really itself stone, we naturally try to approach in color and texture the article made by nature, not necessarily because we wish to imitate it for the purpose of deception—although in practice this is unfortunately often the case—but because in our imaginations we have no better standard of looks.

Therefore, the nearer this material comes to looking like quarried stone in color, shade, texture, and accidental tone, the better it is. I am confining my discussion now to its use on structures as a substitute for quarried cut stone But it need not even then deceive or be known as anything but what it is, because the jointing can be arranged to conform to the possibilities of the material and be unlike what would be possible or practicable of accomplishment with natural stone.

There are two methods of surface treatment usually employed in making concrete stone of this character.

One, and to my mind the most important and satisfactory method, is to reveal selected aggregates by tooling the surface after the concrete has thoroughly set.

In order to attain good results by revealing aggregates, the aggregates must be worth revealing and be pleasing in themselves; furthermore, they must be placed in the forms and be manipulated after being placed, in such manner as to be uniform in distribution, and show no markings of the form or demarcations between successive layers installed at different periods of the work. They must also be properly selected as to size and must possess a number of other qualities, such, for instance, as the ability to reflect light well, and be distinctive and different from each other in shade or color, or both.

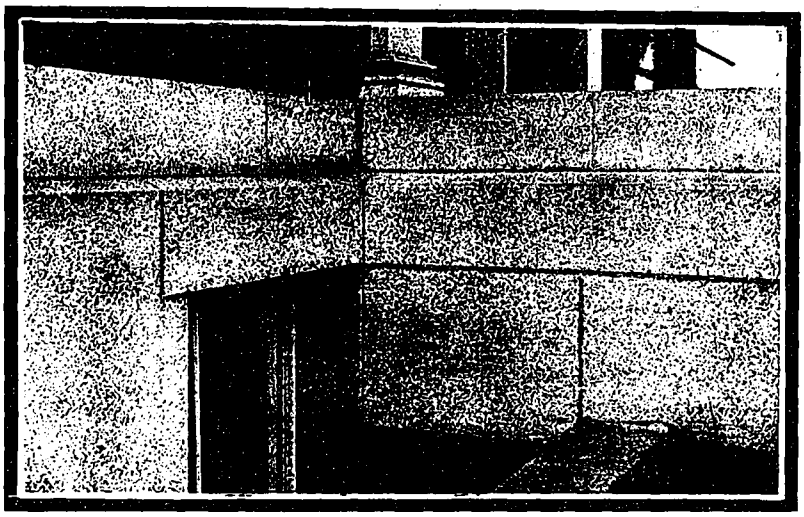


Office building, Boston. An example of artificial stone construction in which the texture of the material and the simplicity of design combine to produce a highly satisfactory and effective exterior.

We have been very successful in employment of a selected material of different sizes of black and white marble; and concrete made of this aggregate instead of becoming dull with age, weathers better and retains distinctive textural advantages over even most granites. Some kinds of crushed granite serve very well, but require in nearly every case a small portion of aggregate of a different kind, distinctive in color, and also brilliant in order to give the desired "life."

It is nearly impossible to proportion the aggregates of a given stone so that there shall be a minimum of voids, thereby making it possible to use the least possible amount of cement and then reveal the aggregate and obtain the appearance of the stone from which the aggregates were taken. In other words, it is nearly impossible to crush up granite, mix it with cement, reveal the aggregate and get a product that will look like the original granite, and this applies to nearly every other stone. Besides, even if it were possible in a laboratory; in actual work carried out on a large scale in the field, the variations in the operation would make the results anything

*Paper read at Toronto before the first annual convention of the Canadian Cement and Concrete Association.

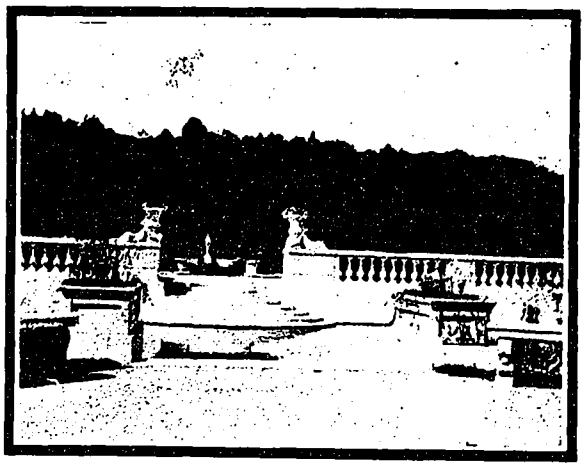


The above illustration shows the remarkable similarity to natural stone produced in concrete work, in that the stone on the left and over basement window is Medford pink quarried granite, while that on the right is a concrete monolith, built in position, with marked off joints.

but uniform, even with the most careful superintendence.

While we are on the subject of aggregate, I should like to call attention to the fact that if sharp arises and fine ornamental detail are required aggregates of small size must be used. It is a common error of design to select a concrete of too coarse texture for the detail.

On account of the cost, it is often desirable to form only the surface of selected materials, placing them in position at the same time that the backing of coarser concrete is installed. If this be properly done a perfect bond between the fact and backing can be made.



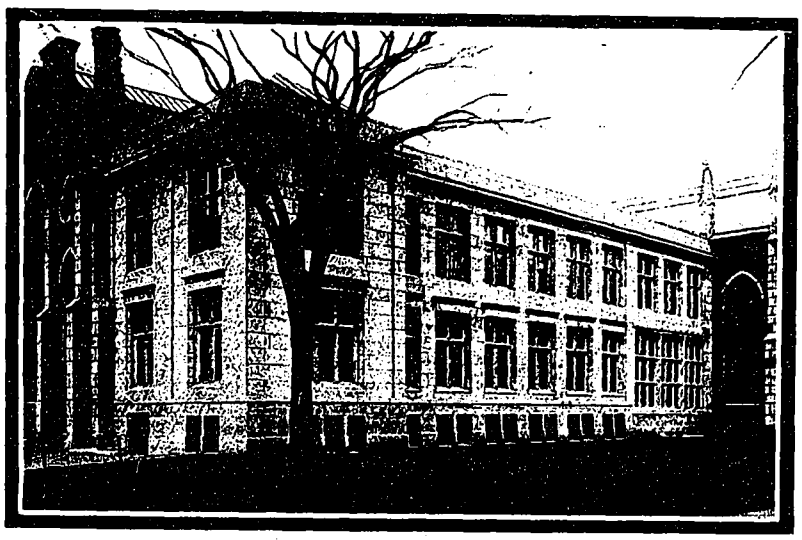
Ornamental concrete work, private Estate, Massachusetts.

The second method is to make the concrete surface take on its color and texture from different substances placed in contact with the wet mix in the moulds or forms. If concrete is poured quite wet into a mould made of a porous substance, such as sand or a mixture of sand and other desired material, the surface of the concrete which comes in contact with the mold, will take on the texture and color of the material of which the inside surface of the mold is composed. When concrete is of this wet consistency the surplus water it contains naturally carries with it the very finest particles which are composed largely of neat cement. This comes to the surface, percolates through the porous substances on the inside face of the mold, leaving behind it on the surface a sufficient quantity of neat cement to adhere to the particles forming this surface of the mold, taking them up and making them an integral part of the body of the concrete, thereby forming the surface of the same color and texture of the material with which the mold is lined. There are many possibilities in this direction still undeveloped.

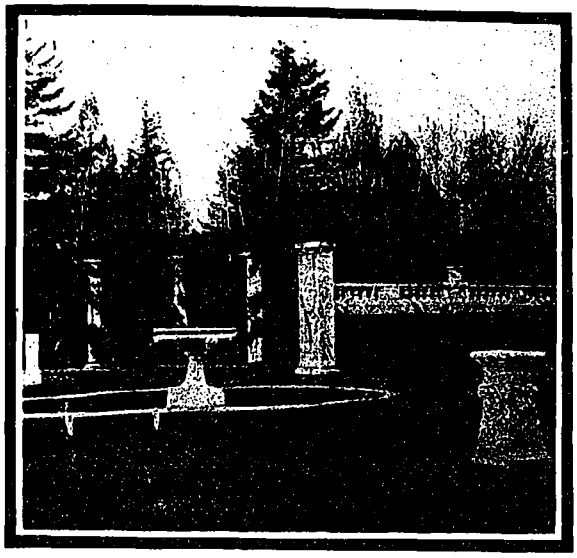
When concrete is used structurally in large masses it should not resemble stone, but its surface should either be treated to give a pleasing appearance and at the same time look like concrete, and nothing else, or it should be covered either with a paint of some kind, such as lime and water or cement and water, or it may be plastered with a Portland cement and sand plaster.

Many authorities disapprove of plastering concrete surfaces, claiming that a proper bond cannot be secured between the backing and the surface and, therefore, in a short time the plaster will come off. It is possible to make a durable job in this manner, however, and we do it and have done it regularly for some years. I shall not take up your time by going into details as to methods, but in a general way state that the surface must be well roughened, preferably by tooling, and then it should be thoroughly wet, in fact, it should be soaked in water. The first rough coat must then be thrown on with force and allowed to harden before the second coat is applied. The second coat should then be thrown on the roughened, wet, hard first coat in the same manner. This requires experienced men, and on top of that careful supervision and failures are either due to ignorance or attempts at labor economy.

There is another method of treating concrete surfaces



Gore Hall (Library Building) Harvard University, showing concrete addition in the foreground. The surface of the concrete in which the selected aggregates are revealed, has the appearance of Quincey Granite and strongly simulates the natural stone used in the original building.



Garden in an estate at Bar Harbor, Maine. An example of concrete in decorative landscape work.

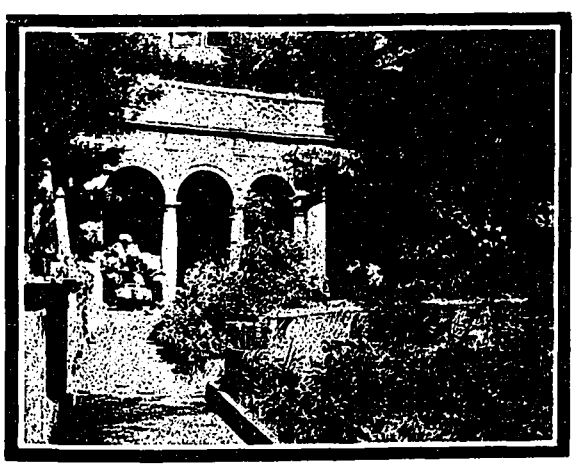
by embellishing them with colored substances in design, such as terra cotta, colored glass, mosaic, brick, and similar substances, but I shall not dwell on this.

We have all heard recently much talk to the effect that concrete should always appear as concrete, and never have its identity concealed, or be used as an imitation material, but I think it perfectly proper to paint it or plaster it just as we do wood or iron, and if we wish to use it for fine ornamental work and we can simulate natural stone in appearance and at the same time produce a better article in some respects, why not? It can be made fireproof without strata or bed, and reinforced with steel. It has qualities which quarried stone does not possess.

CONCRETE BLOCKS.---Their Present and Future. ---Continued from Page 59.

blocks of those days were usually of rock design, and, as I have pointed out, the very worst rock effect at that.

It seems strange, upon consideration of this part of the business, that that design was chosen for the general exploitation of cement blocks, which represented to the highest degree the artificial character of the product and at the same time the most difficult to closely imitate.



English Garden, private Estate, Massachusetts, another example of the decorative possibilities of concrete.

There is no dressed stone design that varies so greatly as the rock, or quarry face stone, and there is no dressed natural stone so cheap as this design. Therefore, in selecting this one for exploitation of cement blocks the extraordinary and peculiar fact was brought home to us all, that it required a greater variety of face plates, and also required greater care in the manufacture and use of this design to produce a pleasing effect than with any other that could be secured.

All this has been, and is, in process of being changed, however. Good plain designs are now being urged upon every manufacturer of blocks, designs that can be produced with natural and telling effect, and the future I believe will show the elimination entirely of the rock face concrete block.

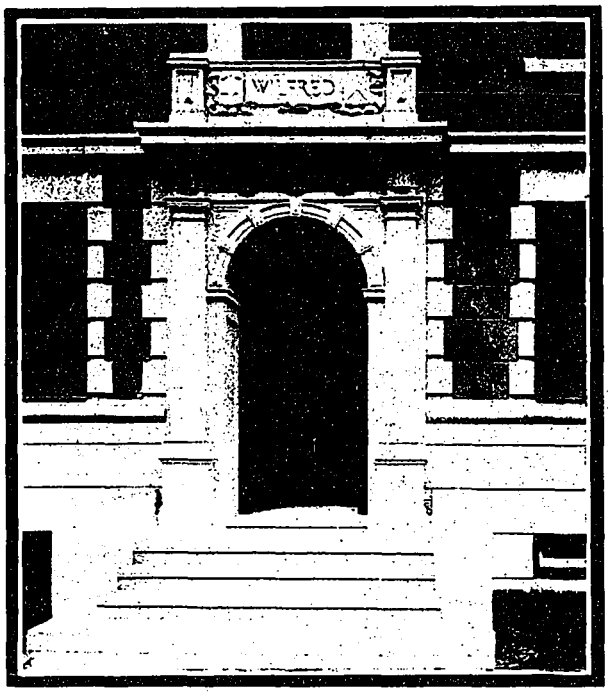
The present is showing, and the future will still more show, the extraordinary development of this remarkable material. Wherever you go, east, west, north or south, particularly in the United States, everywhere, you will find evidences that concrete blocks are receiving more and more favorable consideration. You will find foundations,

Temple in formal garden, private Estate, Massachusetts, built entirely of ornamental concrete stone.

houses, schools, churches, public buildings, factories, and even complete manufacturing plants constructed with cement blocks. Good concrete blocks are now being sold in the United States at a figure where they compete with common brick, and where pressed brick or cut stone was formerly used, concrete blocks have now an ever enlarging field. This is as it should be, for as I have pointed out, there is no virtue in any other building material not possessed by concrete blocks, to which may be added the fact that they can be produced in as high a grade as any other building material from an architectural and structural point of view, and at a cost lower than any other building material except lumber. Lumber is becoming scarcer and more expensive, and as a consequence, people everywhere are looking for another building material, and right here the concrete block steps in and claims its own. Its plastic character makes it possible to produce it in any desirable design. Its remarkable resistance to fire has been thoroughly attested, and in a few more years

we will see concrete blocks used as commonly as brick is now, and that means that blocks will be used in the construction of the great majority of buildings.

Of all forms in which concrete can be used, I desire to specifically state that the cement block represents the most approved method. You ask why? Because it elimi-



Entrance, Ivanhoe Apartments, Alston, Massachusetts. Note the excellent texture, detailed effect, and granitic appearance of the concrete.

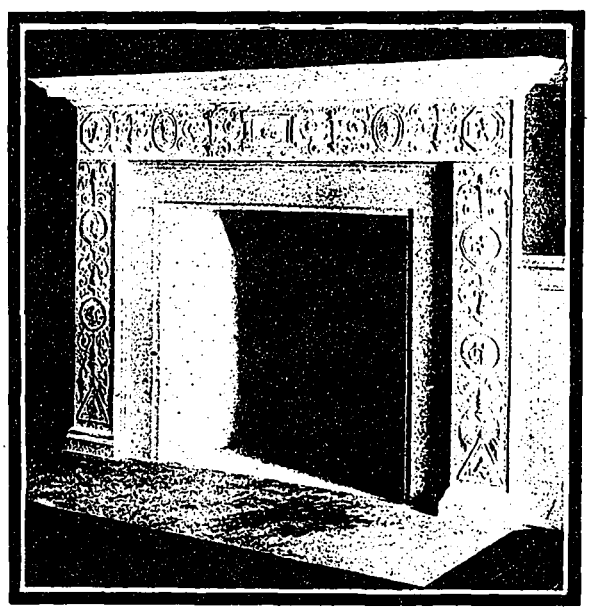
nates to the largest extent possible, the human equation in making concrete; because a cement block is a unit that can be inspected before it goes in the building; therefore, its stability and perfection can be assured: because it secures the use of a ventilated wall, and this fact is a distinct advantage in construction. Furthermore, this ventilation saves material and permits the installation of wires and pipes within the walls of the building itself, and, the block when delivered on the job is finished in design and needs no further dressing of the exterior surfaces. In factory and other general construction work it is possible to dress both the exterior and interior surfaces, as has been shown in recent samples exhibited.

Designs are now produced for cement blocks which makes it possible to meet every demand of the architect for beauty of design. One of the most promising developments in the use of cement blocks has been shown lately in their use in conjunction with reinforced concrete columns, beams and girders. Many buildings have lately been constructed of reinforced interior, with concrete blocks for the exterior walls and partitions.

PITTSBURGH'S UNIQUE CHURCH-OFFICE BUILDING.

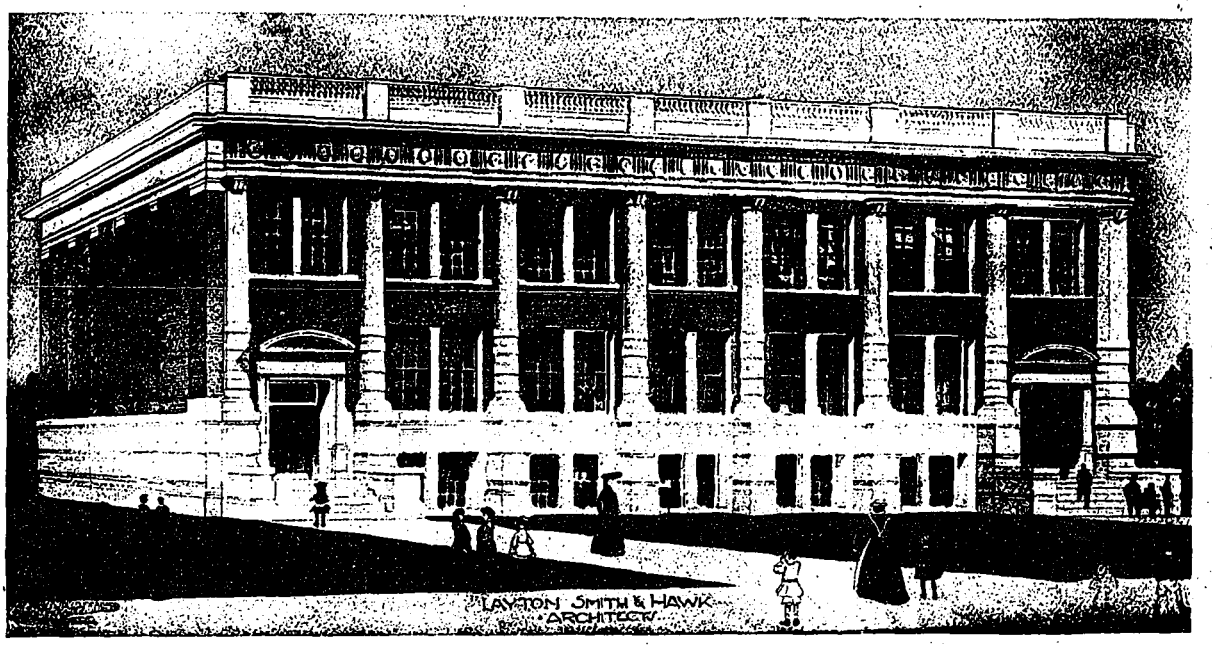
SHOULD THE PRESENT PLANS be carried to a successful conclusion there will soon be erected upon the historic site of the oldest religious congregation in the city of Pittsburg a church and office structure which will be unique among the country's examples of imposing architecture. The combination building will rise on the block now occupied in part by the church of the first German Evangelical Protestant congregation, which traces its origin back to the year 1782. The site upon which the church and adjoining buildings now stand is regarded as one of the most valuable in the congested business district, and while the property is too spacious for church purposes alone, measuring as it does 240 x 110 ft., at the same time the business buildings are wholly inadequate. The structure, which has been designed by Architect E. C. F. Ernst, consists of a solid block in one street front of which is the church edifice flanked and surmounted as it were by a business building 14 stories in height. The right and left wings unite with the trunk of the business building above the sixth floor, so that the entire space from the seventh to the top floors may be devoted to offices, of which each floor will have 58. The business sections of the right and left wings may be occupied by two separate establishments if desired, or they can be devoted to one enterprise if necessary, as the rear entrance forms a connecting passage. On the upper floor is a large assembly hall 240 x 110 ft. in area with a pilaster facade built around the light court. The church auditorium is 80 ft. wide amply lighted by 10 large windows opening on the street, as well as by a 24 x 48 ft. skylight and several windows 20 ft. wide bordering on the light court. The height is 48 ft. to the cove and 62 ft. to the crown of the dome. The main floor has a seating capacity of 860 and with one gallery will seat 1,150 people. On the sixth floor are the social rooms of the congregation and at this level is also placed the church clock, which has a face of 10 ft. in diameter. The architecture of the church is pure Gothic, while the rest of the structure is of the Renaissance type. Three large portals admit to the vestibule 43 ft. wide, where on both sides staircases 8 ft. wide lead to the main floor of the church auditorium. The architect's design shows at the peak of the front gable, a distance of 128 ft. from the street level, an eagle holding in its talons the American and German flags.

IN THE SOUTH OF FRANCE is a concrete arch bridge, known as the Pont du Gard, which was erected



Concrete Mantel, private house, Boston. Both in design and texture of material this mantel is especially worthy of note.

56 B.C. It is regarded as an excellent example of the early use of concrete. The composition of the bridge differs from the concrete of crushed stone, sand and Portland cement now employed in work of this kind, in that it consists of alternate layers of large and small stones, gravel and other cementitious materials



New eight-room fireproof school building now being erected at Oklahoma City, Okla., in which a number of innovations of a structural character are introduced.

AN EIGHT-ROOM FIREPROOF SCHOOL BUILDING.---New Type of Structure Now Being Erected at Oklahoma City, Okla.---Structural Economies Effected by the Use of Reinforced Concrete and Metallic Lath and Stud Partitions.---Cost Compares Most Favorably with Wooden Structure of Same Cubical Contents.

THE LACK of fireproof school buildings in most of our communities is not due to the want of architects to design them; nor can it be ascribed, as a rule, to the failure of the authorities in charge to realize the need for such structures. There are both, numerous architects capable of planning buildings of this type, and a strong desire on the part of public to have them; but the impediment which usually precludes their erection, has been the increased cost which such construction involves. For this reason, school boards have been inclined to adhere to the older methods of construction, and to rely upon the proximity of the class-rooms to the exits, in the event of an emergency.

In view of this fact, the new eight room school illustrated herewith, now being erected at Oklahoma City, Okla., will undoubtedly prove of interest in that, it is claimed, the building is a successful solution of fireproof construction in which the cost has been reduced to a minimum.

This building while introducing a number of new innovations of a structural character, makes no variation in the arrangement of the rooms. The plan is direct, and simply consists of corridors on both floors extending through the centre of the building to stairways at each end, and having two class rooms on either side.

The distinctive feature of the construction lies in the abandonment of the interior brick walls and the substitution for them of metallic lath and metal stud partitions. The partitions are not designed to sustain any weight, as the reinforced concrete floor and roof are carried on reinforced concrete beams, which in turn are supported on reinforced concrete columns placed along the line of corridor partitions.

The framing, which is not shown in the plan presented herewith, consists merely of reinforced concrete beams set parallel with each other and running from the columns to the piers of the outside walls. This divides the floor into panels, approximately 13 feet in width which are spanned with concrete floor slabs. The roof is constructed in the same manner, the necessary slope being given by a fill of cinders which in turn is finished with a coat of cement and sand and covered with a tar and gravel protective coating.

While the cost of the concrete floors is more than the cost of wood floors, it is said that the difference in cost is practically offset, owing to the economical proportion of the concrete floor slabs, and also to the saving made at various points by the use of reinforced concrete and metal lath and studs for partitions. Usually where wood floors are employed, the thickness from the bottom of the plaster line to the top of the finished floor is 19 inches, while in this case the concrete floors, including the wood superfloors, are only eight inches thick. This has effected a saving of 11 inches per story, which together with 10 inches economized in the roof, gives a total saving of 32 inches in the height of the building, without any decrease in the available spaces.

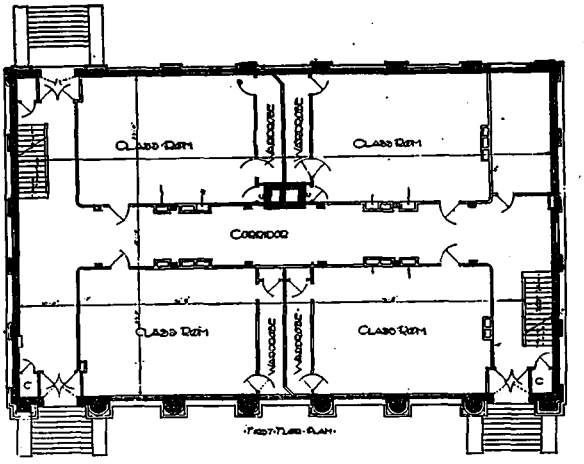
The metallic lath and metal stud partitions, in that they are but two inches thick after being plastered, also effect a big saving of space in the interior walls. The plaster work instead of two and three coat work, as usually applied to brick and where wood lath is used, consists of a skim white coat of plaster applied directly to the concrete.

The need of any deadening material between the wood screeds to which the hardwood superfloor is nailed is obviated owing to the type of floor construction employed. There is a filler of lean-cinder concrete, but this has been adopted mainly because of the difference in cost between lith and cinder concrete is much in favor of the latter,

and not because it is intended to act as an agent to retard the transmission of sound.

The interior foundations consist of isolated concrete piers, 4 feet 6 inches square and 18 inches deep; a character of foundation which is structurally perfect, and which it is said, contributes to the moderate cost of the building.

The result of the combined structural economies worked out in the school in question as regards cost, is shown in the comparative cost of this structure and a wood building of the same class. The contract price of this building complete, exclusive of plumbing and heating, was $25,145.00. After receiving tenders the school board decided to widen the corridor 2 feet, and consequently the contract was let on a plan 2 feet greater in one dimension than that of the plan shown. With this addi-



Ground floor plan of new eight-room fireproof school building, Oklahoma City, Okla. The framework is of reinforced concrete, while metallic lath and studs partitions are used for interior walls. Layton, Smith & Hawk, Architects.

tion, the cost of the building exclusive of heating and plumbing was 12.4 cents per cubic foot.

Figures were also taken on a building of the same dimensions in wood. The lowest tender in wood was 11.3 cents per cubic foot. In order to secure a structure of the same net area, however, the cubic contents of a building constructed of wood would have to be increased by 29,200 cubic feet. This was not considered in the alternate figures as the increased size of partitions in the wood building reduced the room dimensions. The rate per cubic foot established by the alternate tender multiplied by the cubic contents of a wood building with the same working space, gives an estimated cost for the combustible structure of $26,243, a figure actually greater than the cost of the fireproof building.

In order to enable a comparison of the cost of this building in Oklahoma with a similar building in Canada the prices of material and labor in Oklahoma will be of interest. Common brick there costs $8.00 per 1,000 on car, builders' sand costs $1.60 per cubic yard, crushed rock for reinforced concrete costs $2.05 per cubic yard, Portland cement costs $1.50 per barrel, and dimension lumber $25.00 per M. These prices are delivered on the building site. Ordinary labor costs $2.25 for nine hours, carpenter labor costs 45c. per hour, and brick layers and plasterers get $6.00 per day. It will be seen that these prices should result in a building of approximately the same cost as a similar structure in most portions of eastern Canada.

The use of reinforced concrete results in an arrangement of outside walls which readily permits of maximum window spaces. This is shown in the elevation of the building under construction. The spandal section as shown is built of metal lath and metal studs covered with galvanized iron. This construction is not suitable for Canadian climate, and this point is the only one which would require an increase in cost in Canada, as compared with Oklahoma.

A wood building of this class is subject to an annual depreciation of from three to five per cent. of its value. The type of school herein referred to is far more durable and its structural portions become stronger with age. It also has a further value which is not measured by dollars and cents, as there is no commercial criterion by which the value of the safety of children can be measured.

The reinforced concrete work was designed by C. W. Noble, 117 Home Life Building, Toronto, and the cost of the building included his fees. The reinforcing rods used are unpatented.

THE SOUTHAM PRESS BUILDING.---Continued from Page 62.

corner of the building, with entrance from Adelaide street. These stairways, of simple steel and cast iron construction, were built by McGregor & McIntyre, Ltd.

The building is equipped with a passenger elevator and a freight elevator, these being electrically operated by machinery installed at top of shaft. A hydraulic plunger hoist runs from the shipping floor on the south side of building to the basement. These elevators were supplied by the Turnbull Elevator Company. The structure is heated by the vacuum system of steam heating.

The brick throughout is Port Credit Brick Co. kiln-run, laid in cement mortar.

The cement throughout is Canadian Star Brand, from the Canadian Portland Cement Company's works at Port Colborne, Ont. The different carloads were fairly uniform in test, the following figures being average values:

Initial set, 260 m. Final set, 420 m

Tenstile strength--

Neat cement—24 hrs.	354 lbs. per sq. in.
7 dys.	601 lbs. per sq. in.
28 dys.	640 lbs. per sq. in.
3 to 1 7 dys.	230 lbs. per sq. in.
28 dys.	294 lbs. per sq. in.

The concrete, on placing in forms, was of a quaking jelly-like consistency for floor-slabs and slightly drier for beams and columns. The results on the removal of forms were highly satisfactory as regards finish of surface. A subsequent test of 700 pounds per square foot placed on floor showed no appreciable deflection.

The lintels, sills, coping, etc., are of Canadian art stone, while the entrance on Duncan street of Indiana limestone.

The reinforced concrete work throughout was executed according to the system of the Expanded Metal and Fireproofing Company, Toronto, who were the contractors for this branch of the work.

A feature of the building is the employment, in nearly all of the trades, of materials of Canadian production.

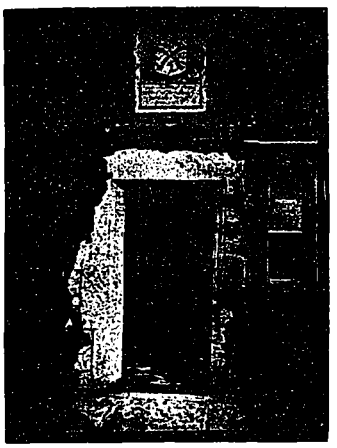
RED BRICK TOWERS, it is observed by Mr. T. M. Grose Lloyd, who writes the extremely interesting account of the "Ancient Churches of Essex," in "Memorials of Old Essex," are a unique characteristic of the county. These brick towers, and the timber towers and turrets, are the most characteristic features of its churches. The wood towers and turrets are often covered with shingles, a kind of roof-covering that nowadays is much more common in America than it is in this country. The porch of Feering is vaulted in brick; the tower of Sandon is donned over in brick and shingle, and Cignal Smealy is built entirely of brick, even to the font.

SOME OLD DOORWAYS.---Several Interesting Doorways of Quaint and Historic Places, Which Are Still to be Seen in England. ---Examples of Early Architecture Dating Back to the Time of Edward IV.

By HENRY WALTERS

WOOLSTHORPE MANOR HOUSE. This old homestead is situate on the outskirts of the village of Colsterworth, on the Great North Road, a few miles south of Grantham. It will ever be memorable as the birthplace of Sir Isaac Newton. The cross-bones which appear above the doorway are the arms of the Newtons, and the inscription immediately below reads as follows:

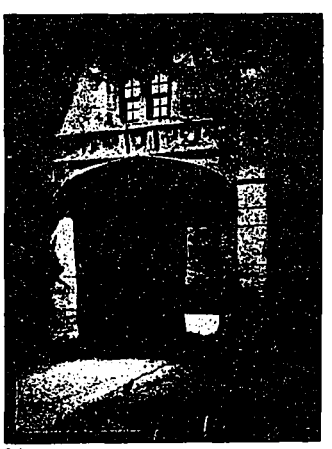
"In this Manor House Sir Isaac Newton, Knt., was born on 25th December, 1642."



Woolsthrope Manor House, the birthplace of Sir Isaac Newton.

OLD HOSTELRY AT FOTHERINGHAY. When Fotheringhay Castle was in its glory the accommodation within its walls was insufficient to accommodate the numerous visitors. King Edward the Fourth therefore built a hostelry in the village of Fotheringhay for the entertainment of those who were unable to find room in the castle. The hostelry is now occupied as a private house, but the old gateway remains, giving some idea of the beauty of the whole structure.

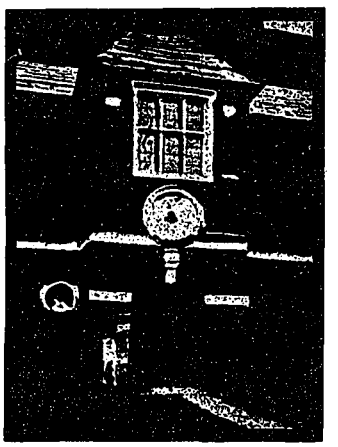
KERSAL CELL. This quaint, half-timbered building is situate on the outskirts of Manchester, in the vale of the Irwell. It is noteworthy as the birthplace of Dr. John Byrom, who wrote "Christians Awake" within its walls. That hymn was first sung around the old doorway, by the choristers from Manchester Parish Church, on Christmas Eve, 1750, under the direction of John Wainwright, the organist, who set the words to music.



Hostelry erected by Edward IV. at Fotheringhay.

NORTHBOROUGH MANOR HOUSE is situate about three miles east of Helpston station, a few miles to the north of Peterborough. It is a beautiful example of ancient domestic architecture, and is locally known as "Cromwell's Castle," because of the frequent visits thereto of Cromwell. His daughter lived within its walls, and Cromwell's widow died there, and was buried in Northborough Church. The Gate-house gives access to a quadrangle, on the south side of which is the manor house with crocketted gables and other architectural features in the Decorated Style.

"WELLBRIDGE" MANOR HOUSE is situate on the outskirts of Wool, in Dorset. It was formerly the home of the D'Urbervilles, and latterly has gained some notoriety from the fact that it is the place where "Tess of the D'Urbervilles" spent her ill-fated honeymoon with "Angel Clare," as depicted by Thomas Hardy in his realistic romance. The portraits on the staircase, which gave poor Tess such a fright are still dimly visible on the staircase. The house is now occupied as a farmhouse, but is still worthy the closest attention of the architectural student.



Wellbridge Manor House, Wool, Dorest. Where Tess of the D'Urbervilles spent her honeymoon with "Angel Clare."

ROCKINGHAM CASTLE. Access is gained to the Courtyard of Rockingham Castle through a ponderous Norman gateway. The doorway shown in our illustration is in the quadrangle and is surmounted by the shields of the Watson's. Rockingham Castle is noteworthy inasmuch as it is the "Chesney Wold" of *Bleak House*. The Castle and neighboring Church are full of interest from an architectural point of view. Rockingham Station on the Rugby to Peterborough branch of the L. & N.W. is within a couple of miles of the castle.

ELTON HALL, the seat of the Earl of Carysfort, is situate on rising ground overlooking the Vale of the Nene, a few miles north-east of Oundle. The principal feature of the hall is the great doorway with its ponderous battlements.

Rockingham Castle. The "Chesney Wold" of "Bleak House."

QUAINT DOORWAYS AT OUNDLE. Both these doorways are situate in the same street within a short distance of each other. The "bonnetted" doorway is an excellent one of its style, and as will be seen from the illustration, still has the doggate in situ. The other gateway, with its elongated pinnacles, gives access to a row of almshouses.

ADLINGTON HALL is situate a few miles north of Macclesfield in the county of Cheshire. It is the ancient home of the Legh's, and is one of the best examples of the magpie style still in existence. The old doorway shown in the illustration gives access to the house from the courtyard, which is still completely surrounded by buildings, and a portion of the moat is still to be seen. Handel was a frequent visitor here, and there is good ground for believing that he composed "The Harmonious Blacksmith" within its walls.—JOURNAL OF THE SOCIETY OF ARCHITECTS, LONDON.

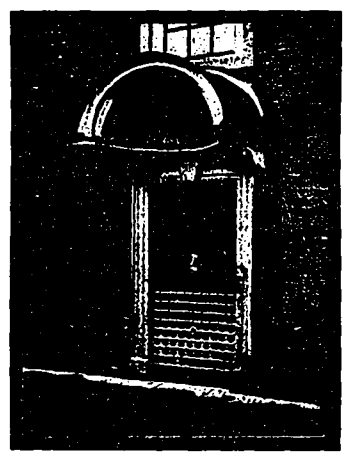
Elton Hall. The seat of the Earl of Carysfort.

MILL CONSTRUCTION AND CONCRETE CONSTRUCTION.---Their Comparative Merits.

THE RELATIVE VALUE of what is known as slow burning mill construction and of structural steel construction when reinforced with concrete, was very interestingly discussed in detail in an address by J. H. P. Perry, recently delivered before the Modern Science Club of Brooklyn, N.Y. In part, Mr. Perry said:

"In comparing the advantages of the two methods of construction (mill and structural steel) and calculating the annual charges of insurance, interest, depreciation, maintenance, additional repairs to machinery caused by vibration vermin losses, influence of maximum light on the effectiveness of the work of the employees and the waterproof and sanitary qualities of the two buildings, it is possible to show an annual saving of from 1 to 2 per cent. by the adoption of reinforced concrete in preference to mill construction. The question of insurance rates is not by any means settled in the way it ultimately will be, as in some sections there is a tendency on the part of the insurance interests not to give concrete the benefit of the low rates that it should receive. Where it is possible, however, to bring in competition in the form of the Boston Mutual Companies, the rates on concrete buildings drop to practically nothing. On a large paper manufacturing concern's factory in Brooklyn and also on a large color works in Staten Island, both of them dangerous risks and with bad exposure hazards or with lack of adequate protection, the rate on the building is 10 cents per $100 insurance. There is one instance where rates of 6 cents on a large Chicago building have been quoted. Compare these with rates on mill buildings under similar conditions of occupancy, contents, and protection of 21 cents and 30 cents and 50 cents and it is easily seen where some of the 2 per cent, annual saving above referred to comes from. Reinforced concrete factories practically eliminate vibration under rapidly moving machinery. One large paper manufacturer in Brooklyn states that his nine-storey concrete factory saves him 20 per cent. in the amount of power required to operate his machinery as compared to a six-storey first-class mill construction building used for the same purposes. Also this concrete building saves him about $5,000 a year in the amount of repairs on his machinery. Both of these savings are due to the stability of the concrete structure. Machines once set in place and shafting once lined up remain in position as there is no vibration to cause movement. It is easily appreciated that in a monolithic concrete building there is no place for vermin of any kind. With concerns which manufacture delicate materials or which have to store fruits or vegetables or other perishable goods the question of vermin loss is often a serious one.

Quaint Doorway at Oundle.



Doorway and Dog Gate, Oundle.

"With reference to structural steel, concrete can be put up at a saving of from 10 to 15 per cent. on the same plans. There are several cases which may be cited where bids have been received by architects for a building which could be constructed either in steel or concrete, and in every instance, for industrial purposes at least, the concrete figure has come under the structural steel figure by from thirty to forty thousand dollars on a quarter of a million dollar and larger propositions. This is owing to the expensive fireproofing of every structural member—beams, columns, girders, brackets, etc., with terra cotta, brick or concrete. The steel skeleton can be run up cheaply, but before the building is completed its cost goes over concrete most appreciably. The vibration in a steel building is liable to cause occasional trouble and there is always the question of rust and depreciation. With reinforced concrete structures, however, the steel used consists of small sized bars or wire, all of which is fully protected by concrete. Baltimore and San Francisco demonstrated beyond dispute the effectiveness of the concrete protection to steel under fire action. The Prussian Government and numerous other investigators have made futile further discussion of the rusting possibilities of steel bars imbedded in concrete. Tests of blocks under water, in steam baths, in sulphur vapor, and under pressure has proved the impermeability of concrete and its consequent prevention of rusting."

Adlington Hall, Cheshire. The home of the Legh family.

Suburban House of English Character. Designed by Architect Collier Stevenson.

A STUDY IN HOUSE DESIGN OF ENGLISH CHARACTER.—Planned for Suburban Life.—Construction Provided for Common Brick Walls with Rough Stucco Exterior.—Private Character of Porch a Feature.—Arrangement of Rooms Well-balanced and Compact.

AN INTERESTING STUDY of domestic architecture in which a number of splendid features have been developed both as to plan and design, is shown in the accompanying illustrations of a surburban house of English character, designed by Architect Collier Stevenson, of Hamilton.

The chief charm of this attractive little residence, and that which gives it such a strong individuality and homelike aspect, lies mainly in the exquisite treatment of the roof lines and simplicity of detail.

Its construction provides for walls of common brick, plastered in a very rough stucco finish, dull yellow in tone. The exterior woodwork is to be painted a warm brown with window sashes of cream, while the shingles are to be stained a silver grey. This pleasing combination of colors is to be further enhanced by the chimneys and underpining course, which are to be of red brick, laid up with white joints.

One of the pleasing features of the house is the private character of the verandah at the side, from which two doorways lead to the interior—one directly to the living room and the other to the hallway. The first floor throughout is admirable in its arrangement. But very small space is required for the hall, and only one stairway is provided, but that is equally easy of access from the living and service portions of the house.

The living room, which is of spacious dimensions, has a beamed ceiling and a large open fireplace, while in the dining room, in addition to the last named feature, is a sunny flower bay, and a built-in sideboard, having mullioned windows above it. Both of these rooms being continuous, practically open into one large space, thus affording ideal facilities for entertaining.

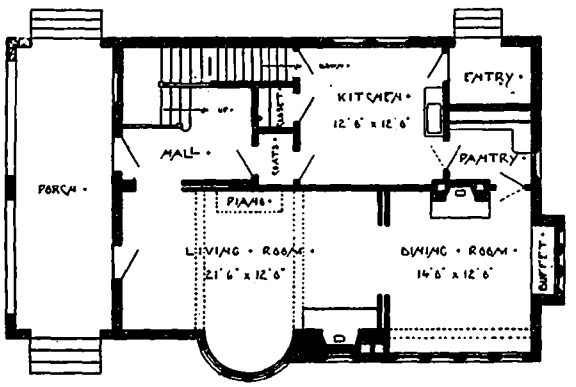
In planning the house the architect was governed at all times by the vistas to be obtained from one room to the other.

The complete isolation of the kitchen—so much to be desired in domestic work—is effected in a most simple and satisfactory manner, being separated on one side by the coat room connecting it with the entrance hall, and on the other by a large serving pantry which opens directly into the dining room. This arrangement results in a very compact and convenient grouping of the various rooms and the elimination of all waste space. Off the kitchen is a roomy closet for the storing of culinary utensils, while at the back is an entry opening onto the back of the lot.

As to interior finish, all walls on this floor are finished in grey-green stucco, with grey stucco ceilings, and the woodwork, with the exception of the kitchen and pantries, is of whitewood stained a dark brown.

Equally as pleasing a plan as that of the first floor is found on the second where the grouping of the various rooms shows a well balanced arrangement and the proper value of space. There is no unnecessary waste of room or unused corners, and the different chambers have been carefully placed so as to be in proper relation to each other.

As on the floor below, the hall, while of small proportions, is sufficiently large enough to adequately serve the various rooms. Something not usually provided in a



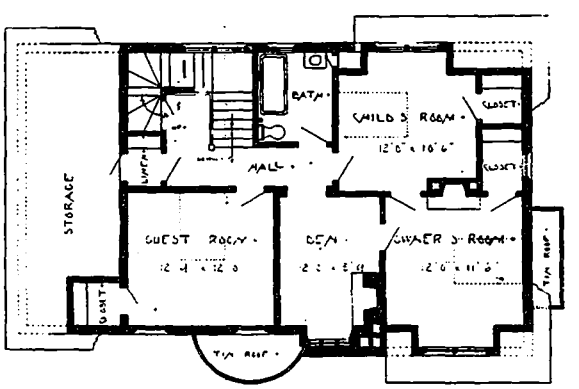
Ground floor plan, Suburban House of English character. Architect Collier Stevenson, Designer.

small house such as this one, is the owner's suite which consists of a den, overlooking the bay window, a master's room and a child's room.

In addition to these rooms there is a well lighted guest's chamber, and a bathroom which can be conveniently reached from all parts of the floors. Both the den and the master's room have open fireplaces, while all bed rooms are provided with commodious built-in clothes closets. Off the end of the hall is a large linen closet which in turn opens into a storage room utilizing the space over the verandah.

The entire woodwork on this floor is finished in white enamel with the exception of the doors which are mahogany-stained.

On the third or attic floor, the plans of which are



Second floor plan, Suburban House of English character. Architect Collier Stevenson, Designer.

not shown, are two maids' rooms finished in a similar manner to those just described. The estimated cost of this house complete according to the present market price of materials and labor is $4,500.

TEST OF REINFORCED TERRA COTTA COLUMN.

THERE WAS RECENTIY tested at Phoenixville, Pa., a reinforced terra cotta column, 21 ft. 7 1-2 in. long and 21 3-4 in. in diameter, which was subjected to a maximum load of 4,109 lb. per square inch, and, according to the report of Robert W. Hunt & Co., of Chicago, who made the test, was not injured. The column was built of special shaped, hard burned, terra cotta tile, composed by two concentric rings, the inner one of three and the outer seven tiles. The vertical reinforcement of six 3-8 in. twisted steel rods was placed in the circular joint between the inner and outer rings.

The column was built of 106 courses of tile, each approximately 2 1-4 in. thick and containing in the other ring a 1-in. circular groove, 1-4 in. deep, in which was placed a welded ring of 3-16 in. wire, 16 in. in diameter. Through the centre of the column was a 2 7-8 in. hole. The mortar in the horizontal joints was one part Owl Portland cement, one part torpedo sand and one part fine sand. In the first seven courses the mortar in the vertical joints was one part Portland cement and three parts torpedo sand. In the vertical joints of the remaining courses the mortar was of the same proportions as in the horizontal joints, with, however, the addition of 7 to 10 per cent. plaster of Paris in the outer ring, added to make a stiff and quick setting mortar. All joints were 1-4 in. thick. A cross section of the column is shown in a sketch reproduced herewith.

Samples of the materials entering the column were tested. The twisted steel samples showed elastic limits of 67,430 and 71, 390 lb. per square inch, respectively; the wire for the rings, elastic limit, 48,900 and 51,780 lb. per square inch; half tiles, crushing load, from 10,000 to 12,338 lb. per square inch; full-size tiles were tested to the capacity of the machine without crushing, amounting to 8,812 and 9,066 lb. for the two specimens.

The column was built in Chicago by the National Fire Proofing Co. and was finished Aug. 18, 1908. It was shipped to Phoenixville on an ordinary flat car in the early part of November, arrived in good condition, and was tested in a horizontal position on Nov. 10, 1908. The compression curves for loading and release are shown herewith.

THE WALLS OF JERICHO.---Masonry of Canaanite Builders Laid Bare by Excavation of German Society.

THE WALLS OF JERICHO have been partly laid bare by the excavations conducted under the direction of the German Orient Society, and it is clear from the remains that the taking of the city by the Israelites under Joshua must have been a feat of arms well meriting its prominence in history. The excavations at Troy and Jericho indicate considerable correspondence between the two fortifications. The Canaanite builders, who probably constructed the greater part of the famous walls of the city at least 1,500 years B. C., first leveled up the rock foundations with mud and rubble and then built a wall of blocks of stone nearly 18 ft. high, with a inclined outer face and vertical back. This was surmounted by a wall of mud brick about 7 1-2 ft. high. Some of the stone blocks contain considerably over a cubic yard, and some of the brick are much smaller. Within the wall at one place was a citadel having towers at the corners. It was built of mud brick with immense blocks at the corners and presents a number of features the uses of which are decidedly puzzling. The explorations show that even in those very remote days before the entrance of the Hebrews into Judaea, the art of masonry construction there had advanced to a creditable position, and we must recast our ideas concerning the nature of the cities of the Promised Land. In the report of the excavations thus far made, which is given in the "Builder," it is stated that but a very small part of the site of old Jericho, which is 1 1-2 miles from the present city, has been laid bare so the continuation of the work promises to yield as full knowledge of the old buildings of Palestine as we already possess of those of Babylon and Nineveh.—ENGINEERING RECORD.

BUDDHIST AND HINDU ARCHITECTURE OF INDIA.*—Their History, Development and Characteristic Features.—The Influence of the Former on the Latter.—Early Examples of the Dravidian and Indo-Aryan Styles.

By ARTHUR ANTHONY MACDONELL, M.A., Ph.D., F.B.A., Oxford University

THE HISTORY of Buddhist architecture in India extends over about nine centuries, and may be divided into three roughly equal periods. The earliest period reaches from 250 B.C. to 50 A.D. The monuments which survive from this period are almost exclusively the work of Buddhists, who introduced the use of stone in architecture at the commencement of this period. For some centuries before the beginning of this period, the architectural use of brick had been known, as is proved by the Stupa of Piprahwa, which probably dates from 450 B.C. But the ornamental buildings of the pre-Asokan age must have been built of wood, like the modern palaces of Burma, only the substructures being made of brick. The whole history of Indian architecture points to previous construction in wood, the stone monuments being, to a large extent, imitations of wooden models. The second, and as far as Buddhist sculpture is concerned, best period, extends roughly from 50 A.D. to 350 A.D., the third period from 350-650 A.D.

The remains of Buddhist art in India are almost entirely architectural and sculptural; sculpture practically always appears in connection with the architecture, and invariably in the service of religion.

Early Buddhist architecture may be divided into three main groups:—(1) "Stupas," or relic mounds; (2) "Chaityas," or places of worship, corresponding to our churches; and (3) "Viharas," or dwellings for the monks.

"STUPAS" OR RELIC MOUNDS.

The "Stupa" is a dome-shaped structure which was a development of the low sepulchral tumulus or mound of earth, in which baked bricks were substituted for earth with a view to durability. The purpose for which they were erected by the Buddhists was to serve as monuments enclosing relics of Buddha or of Buddhist saints, which were placed in a stone coffer, or to commemorate important events or miracles connected with the history of Buddha.

As representative of this from of structure, the large Stupa at Sanchi in Central India, which, dating in all probability from the third century B.C., is an example of the Asoka type. Upon a substructure consisting of a low circular drum a hemispherical dome was erected. This dome was surrounded by a procession path forming the upper rim of the drum. On the top of the dome was a box-like structure surmounted by an umbrella (the Indian emblem of sovereignty), and surrounded by a stone railing. This structure is usually called a tee (a Burmese word). The tee has disappeared from all the Indian Stupas, but its form can be seen from the Stupas surviving in Ceylon, as well as from stone models and sculptural representations preserved in great numbers in India.

The Stupa itself was surrounded by a massive stone railing, with gates on four sides enclosing a procession path and a sacred precinct. Both the rails and the gates were unmistakable imitations of wooden models. The gateways, which are usually called by the Sanskrit name of Torana, were introduced into China and Japan along with Buddhist architecture from India. In China, under the name of Pailoos, they are frequently still constructed in wood; when made of stone they retain down to the present day the forms and details of wooden construction (like the gateways of Sanchi). A very remarkable thing in the history of this architectural feature is that these Pailoos are still used in China as gateways to simulated tombs just as their prototypes, the Toranas, were used at Sanchi 2,000 years ago.

Buddhism was introduced into Japan by way of Korea about 600 A.D. It is probable that the Japanese Tori-i, gateways similar in form to the Indian Toranas, and always found at the entrance of Shinto temples, are descendants of the Indian Toranas. There are similar gateways in Korea.

The earliest Stupas were very low in porportion to their diameter, but as time went on the relative height increased, and later, the Stupa showed a tendency to assume the shape of a tower.

Concurrently with the elongation of the Stupa we can see an elongation taking place in the tee also. Finally, we come to the last development in China, where the tee is practically all that is left.

It would be difficult to find a more remarkable example of evolution in art. Here you have an Indian architectural ornament, consisting of a few superimposed umbrellas only a few feet high, finally transformed into a nine-roofed Chinese pagoda reaching the height of 200 feet. Fergusson, in his "History of Eastern Architecture," suggests that the Chinese pagoda is derived from the Stupa, but he nowhere tries to prove the connection, though some of the illustrations in his own work supply part of the evidence.

THE "CHAITYAS" OR PLACES OF WORSHIP.

The second class of Buddhist religious buildings, the so-called Chaityas, are the exact counterpart of Christian churches, not only in form, but inuse. The typical Chaitya consists of a naive and side aisles, terminating in an apse or semi-dome. The pillars separating the nave from the aisles are continued round the apse. Under the apse and in front of its pillars is the rock-cut Stupa, nearly in the same position as that occupied by the altar in a Christian church. The tee was doubtless usually surmounted by a wooden umbrella, but this has everywhere disappeared except at Karli, the finest Chaitya cave in India. The roof of the Chaitya is semi-circular. The door is opposite the Stupa. Over the doorway is a gallery. Above this is a large window shaped like a horse-shoe. This window is constantly repeated on the facade as an ornament.

All the most important examples of Chaityas occur at six places in Western India. As we pass from the earliest to the latest specimens, we can clearly trace progress towards stone construction on the one hand, and degeneracy of cult on the other. In the oldest of these Western caves the pillars of the nave slope inwards, as in wooden structures, to resist the thrust of a circular roof. The rafters here, as well as the screen, were made of wood, but these have long since disappeared. In later specimens, the pillars of the nave and the jambs of the door become straight, and the screen consists of rock.

The development of the Buddhist temples will show how important archaeological evidence is for the history of Indian religion as well as architecture and sculpture.

THE "VIHARAS" OR MONASTERIES.

Besides the structural Stupas or their substitutes, the rock-cut temples, there arose Viharas or monasteries, as residences for Buddhist monks. According to the rock-cut specimens, the Viharas consisted of a hall (sala), generally square, but sometimes oblong, surrounded by a number of cells or sleeping cubicles, and shaded by a verandah in front. The cubicles in the oldest caves usually contain a stone bed. There is generally only a single

*Summary of a paper read before the Indian Section of the Royal Society of Arts. From the Journal of the Society of Architects, London.

floor, but examples of two-storeyed Viharas are not wanting. The only examples of Viharas in Eastern India are found at Udayagiri, in Orissa.

All the rest are found in Western India. Probably about forty of these were excavated before the Christian era. The four most important of these occur, one each at Bhaja and Bedsa, and two at Ajanta. That at Bedsa is specially interesting because the Vihara here has an apse, which points to this being a first attempt to excavate a Vihara in rock, as it imitates the shape of a Chaitya. The interior of the Vihara at Ajanta, is adorned with seven horseshoe arches, four over the doorways of cells, while three are simply ornamental.

Nasik and Ajanta are the most interesting places for the study of Viharas, the groups of caves in both places being purely Buddhistic. One of the principal ones (No. 3) at Naisk has a verandah with Persepolitan pillars. It has a hall 40 feet square, without pillars, and contains 16 cells. In the middle of the back wall is added the new feature of a Stupa carved in relief.

There is at Nasik another and larger Vihara which has the still later addition, at the inner end, of a sanctuary with two richly carved pillars in front and containing within it a colossal seated Buddah with flying and standing attendants, doorkeepers, dwarfs and so forth, such as are not found till in the fifth century.

Ajanta has more Buddhist Viharas than any other place, the number being twenty-two. These are specially important as supplying a complete series of examples of Buddhist art, without any admixture from Hinduism or any other religion, extending from 200 B.C. to 600 A.D., and thus belonging to all three periods. As they contain many inscriptions the dates of the caves are fairly well known, and thus help to fix the chronology of other groups.

The caves of Ellora are, however, the historically most interesting with reference to the inter-relation of the three Indian religions, Buddhism, Brahmanism, and Jainism. For here we have side by side three groups of caves (altogether thirty-three), distinctly representnig those religions, while the transitions from one to the other can be clearly traced. Of the Buddhist group of twelve, eleven are Viharas. The sanctuaries of most of these contain figures of Buddha seated, but with the feet down and not folded under them. Thus, the Buddhist monastery is becoming a place of worship in which figures of Buddha are ousting the monks from their cells. These Viharas come down to about 700 A.D., at which point the earliest Brahman examples begin. There are here three two-storeyed caves which illustrate clearly the transition from Buddhism to Brahmanism. The first is entirely and unmistakably Buddhist. The second is similar in plan, and the sculptures are still all Buddhist, but these deviate sufficiently from the usual simplicity to have justified the Brahmans in appropriating this cave as belonging to their religion. The third is very similar in plan to the preceding one, but the sculptures are all unmistakably Brahman. It is evidently the earliest Brahman cave, being a close copy of the preceding Buddhist example.

HINDU ARCHITECTURE.

We have thus arrived at the beginning of the Hindu period of Indian architecture. We have seen that the Buddhists were the first builders and carvers in stone in India, beginning in the third century B.C. It is only on Buddhist monuments that we find the earliest representations of Hindu deities. Thus Lakshmi, the Hindu goddess of Fortune, worshipped by two elephants pouring water over her, appears on Buddhist sculptures from the second century B.C. onwards. But the oldest remains of independent Hindu art, either sculptural or architectural, only date from several centuries after the beginning of our era. These considerations in themselves justify the presumption that Hindu architecture is derived from the older art of the Buddhists.

The whole surface of India is covered with Hindu temples, the vast majority quite modern or comparatively modern. The number of ancient shrines is small, chiefly in consequence of the destructive religious fury of the Mohammedans, who invaded India from 1000 A.D. onwards. The oldest specimens date from about 600 A.D., and the best examples are to be found between that date and 1300 A.D. In surveying these ancient monuments we can clearly distinguish two styles, each of which shows a definite type from the beginning. The geographical distribution of these two types is, to begin with, rather interesting. For the Southern or Dravidian style of Hindu architecture is found only within the tropics, or south of the 23rd degree of northern latitude. The Northern or Indo-Aryan style, on the other hand, is found only north of the tropic of Cancer, excepting only the eastern and western extremities of its territory, which come down to the 20th degree. A historical study of these two, moreover, shows that the Hindu temples of both styles are developments of Buddhist prototypes. But the remarkable thing is that they are respectively the descendants of two entirely distinct classes of Buddhist building; for it can be shown that the Dravidian Hindu temple has been evolved from the Buddhist monastery, while the Indo-Aryan Hindu temple has been developed from one of the other two classes of Buddhist building.

The earliest representative of the Dravidian type is a temple at Mahabalipur, one of the Seven Pagodas, situated near the seashore, thirty-five miles south of Madras. It is a monolith, being hewn out of a single block of granite, and dates from about 600 A.D. It is clearly Brahmanic in origin, as is shown by the sculpture as well as the inscriptions. But it is evidently also a model of a Buddist monastry of four storeys. The plan is square the pyramidal tower representing the upper storeys containing the cells of the monks. The design of the regular structural Dravidian temple is a square base ornamented externally with pilasters, and containing the cell in which the image is kept. Over the shrine rises the sikhara, a pyramidal tower, which is always divided into storeys. This division never disappears in Dravidian temples. The tower is crowned with a small dome either circular or polygonal in shape.

The later Dravidian temples from about 1000 A.D. stand in a large court surrounded by an enclosed wall. A special feature here is the Gopuram, or great gateway, erected in front of the shrine in the wall which encloses the court around the temple. It has a storeyed tower, resembling that of the shrine itself. But it is oblong, not square, in shape, being twice as wide as it is deep. The prototype of these gateways is the oblong monolith temple at Mahabalipur, one of the Seven Pagodas. It is in storeys, with a wagon-headed top, the ridge being decorated with a row of ornamental vases. The best specimen of the structural temple in the Dravidian style is that at Tanjore, which was erected in 1025 A.D. The body of this temple is of two storeys, about 80 feet high, while the pyramidal tower rises in eleven storeys to a total height of 190 feet.

Many of the famous later temples of Southern India are architecturally a good deal spoilt by two main defects. In the first place, successive independent additions obscure the design of the original shrine, producing a sense of bewilderment in the observer, who is unable to discover any general plan or arrangement of parts. The second defect of these later temples is the fact that the gateways in the walls of the successive courts, which have subsequently been added, increase in size and height as you proceed outwards, thus entirely obscuring the tower of the central shrine.

To each of the great temples of Southern India is attached a large tank for the religious ablutions of the worshippers. Some of them are picturesque, such as that in the great temple at Srirangam, near Trichinopoly. Sacred tanks not within the precincts of a temple are also frequent in Southern India. These are called Teppa kulam, or raft tanks, with a small shrine in the centre,

to which at certain festivals the image of the god is taken across on a raft. There is a great Teppa kulam at Madura, in which the central island is adorned with a pyramidal Dravidian tower in the middle and four small pavilions at the corners.

One of the features of the Madura and other great South Indian temples are the colonnades which surround the tanks. Other South Indian temples have colonnades around their court. This is the case in the great Siva temple at Vellore, not far from Madras. It is one of the most remarkable shrines in South India. It has a Gopuram, seven-storeyed, and 100 feet high. The colonnade which runs round the enclosure, is supported by nearly 100 carved pillars. There is a remarkable stone pavilion in the left hand corner of the enclosure as you enter, the ceiling and the pillars being most exquisitely carved.

The most attractive of all the Chalukyan shrines is the great temple of Siva at Halebid, about twenty miles from Belur, delightfully situated on a terrace near the shores of a lake. It was left unfinished in the year 1270 A.D., the towers never having been added. It is one of the most remarkable monuments in India. One of the pavilions in front contain a huge image of the Bull of Siva. In the interior are some remarkable black stone pillars, which look as if they had been turned in a lathe. This temple is unmatched in the variety of its details and the exuberance of fancy shown in its ornamentation. There is, perhaps, no other temple in the world on the outside carving of which such a marvellous amount of labor has been spent. It will give some idea of the enormous amount of sculpture with which this temple is covered when it is stated that the lowest band of the frieze alone contains a procession of about 2,000 elephants, no two of which exactly resemble each other.

THE INDO-ARYAN STYLE.

There are extant side by side two of the earliest examples of the Dravidian and Indo-Aryan styles near a place called Badmai, in the Chalukyan territory. They date from the end of the sixth century A.D., and already show fully developed the characteristic features which the two styles clearly retain down to the present day. Both have a square base containing the cell, but while the Dravidian temple has a pyramidal tower, always divided horizontal storeys, the Northern tower is a curvilinear spire, not divided into horizontal storeys, but, on the contrary, having a vertical band running up each face. While the Dravidian tower is surmounted by a small round or polygonal dome, the Indo-Aryan tower is surmounted by a circular fluted ornament, somewhat flattened at the top. The Indo-Aryan, like the Dravidian shrine, has a porch nearly always added in front of the entrance to the cell, but it was evidently no essential, not being an integral part of the edifice. The shrine itself consists of two parts. The lower part containing the cell is square. It rises from a moulded plinth and ends in a cornice. There are never any pillars or pilasters (as in the lower part of the Dravidian shrine). Above this rises the spire, which is square in section, and the curve of which in the early specimens begins near the top. The central vertical band was carved, usually with a reticulated ornament composed of minute arches.

The Mandapam, or porch, is added in front of the doorway of the cell, and is square, being of the same height as the top of the shrine where the spire begins. In the earliest specimens there were no pillars, and the roofs consisted of long sloping slabs. Later, columns were introduced in groups of four, and courses of masonry were made outside to correspond to the carved conical roof inside.

The earliest representatives of the Indo-Aryan style are found in the group of deserted Hindu temples at Bhuvanesvar in Orissa, about 250 miles south of Calcutta. The older and finer specimens begin from about 600 A.D., the series coming down to about 1100 A.D. They show this style in its greatest purity, and probably furnish better material for the history of this form of Hindu art than any other temples in India.

The origin of he Indo-Aryan spire has always been a puzzle to Eastern archaeologists. Thus Fergusson, the great authority on the subject of Eastern architecture (p. 412) says:

"Neither the pyramid nor the tumulus affords any suggestion as to the origin of the form, nor the tower, either square or circular; nor does any form of civil or domestic architecture. It does not seem to be derived from any of these."

Here, then, we are faced with a fascinating problem. The Indo-Aryan Hindu spire appears fully developed in its earliest occurrence, about 600 A.D., besides the Dravidian Hindu pyramidal tower. It has clearly no connection with that tower. But it can still less be a development of the Buddhist Chaitya or church, with its wagon-headed roof and semi-circular apse at the end, which shows no suggestion of anything like a spire about it. Where then are we to look for its source? I believe the answer can be given with certainty, or at least a high degree of probability; and although I cannot here adduce all the evidence, I think I can supply enough to establish the correctness of the conclusion. I have shown how the Buddhist Stupa in the cave temples gradually developed from a plain solid dome into an elongated hollow cell containing an image of Buddha. The transition from the solid to the hollow Stupa is further illustrated by model Stupa at Bodh Gaya. Then we find near Badami an old structural Hindu temple of Vishnu dating from the seventh century A.D., containing a similar hollow cell for the image, the back of the cell being still semi-circular. In that neighborhood we find another old Hindu temple, the same in other respects, the only difference being that the cell has become square. Now, there are to be found in Northern India a number of simple Indo-Aryan shrines erected without porches. These evidently bear a strong resemblance to the transformed hollow Stupa. In place of the original round drum you have the square base, as more suitable in form for a cell. Above this rises the spire in place of the elongated dome, and still retaining the vertical curve of the latter, but modifying its circular shape by carrying the corners of the square base to the top, Thus the horizontal section of the spire becomes square also.

Finally comes the explanation of the ornament at the top of the spire. I think we may dismiss the theory that the fluting is an imitation of a certain small Indian fruit. In the earliest examples of Indo-Aryan temples there is a neck between the top of the spire and the ornament. One of the rock-cut Stupas at Ellora indicates that the neck represents the lowest part of the tee, and the ornament above represents the upper part, the fluting being a rounded modification of the vertical divisions in the tee. The curved flattened top probably represents a single umbrella. In one of the rock-cut Stupas at Ajanta, the three umbrellas carved in stone above the tee are themselves fluted. These in turn are surmounted by the vase-shaped finial which regularly appears at the top of the Indo-Aryan spire.

Thus we arrive at the remarkable conclusion that, while the Southern Hindu temple has been evolved from the Buddhist monastery, not only Buddhist temple architecture outside India, but also Hindu temple architecture throughout Northern India, is a development of the Buddhist Stupa. In the Northern Hindu temple the dome of the Stupa was elongated, while the umbrella ornament became attenuated. Outside India the dome was gradually attenuated till it finally disappeared, while the umbrella grew to such an extent that it finally became a tower 200 feet in height. With the red thread of historical study to guide us, we are thus enabled to understand clearly what otherwise presents itself as an inexplicable mass of disconnected phenomena in the domain of early Indian architecture.

MACHINERY AND TRADE

HAMILTON BRIDGE COMPANY.

A VERY HANDSOME BOOKLET—more a portfolio of interesting and instructive views of bridges and other types of structural steel work than a catalogue—has just been issued by the Hamilton Bridge Company, Limited, of Hamilton, Ont. In glancing through its pages, one is enabled to obtain a most comprehensive idea as to the many modernly designed steel bridges which have been provided within recent years to facilitate travel in every province of the Dominion.

A number of the illustrations show picturesque and rugged bits of country at points where some of these structures are located. One view in particular, in this respect, is seen in the illustration showing the large single arch bridge, built by the company, on the line of the Canadian Pacific Railway, over Stoney Creek, in the Selkirk range of the Rocky Mountains. This structure, it may be interesting to note, is one of the largest single span arch bridges in the world, being 483 feet in length, with an arch rise of 100 feet.

In addition to the large number of bridges shown, there are also a series of cuts illustrating buildings and other structures in which the company has executed the structural steel work. Among these are several mills and manufacturing plants, Drill Hall and Armouries, Hamilton; dome of St. Jean Baptiste Church, Montreal; Trader Bank Building, Toronto; Federal Life Insurance Building, Hamilton; grand stand, Toronto Exhibition grounds; and the inlet valves in use on the Welland Canal at Port Colborne.

Perhaps the best testimony as to the Hamilton Bridge Company's ability to carry out work of this kind, is the fact that up to the present time they have successfully completed over 4,000 miscellaneous contracts in the Dominion. A general view of the company's splendidly equipped plant, covering a site of eight acres, is shown in the fore part of the booklet, together with several interior views of their various departments.

The company is to be complimented on the general high tone of this admirable little publication, and it is one that will be greatly appreciated by both the architect and engineer. Over two-thirds of the booklet, which contains 150 pages, is taken up with half-tone illustrations, while the remaining portion is devoted to descriptive matter, together with data on estimates, sketches, plans, etc., which will prove to be of much benefit to anyone interested in structural steel work.

LAPRAIRIE BRICK

ONE OF THE MOST enterprising and successful firms of its kind in the Dominion, is the La Prairie Brick Company of Montreal, whose plant, located across the river from that city, both in general dimensions and equipment is second to none on the American continent.

It is claimed that this firm is the only concern in Canada which uses shale entirely, instead of common clay, in the manufacture of its products. Three grades of La Prairie bricks are manufactured, Roman, pressed, and plastic, all of which are meeting with the unqualified endorsement of architects, contractors and owners, owing to their superior strength, durability and appearance.

The plastic brick made by this company are suited to every purpose where brickwork is required, and they are especially employed to a great extent in foundation work. Owing to their impermeability, great crushing strength, and fire retardant qualities, these bricks are particularly well adapted to meet any requirement which the fire underwriter may impose.

Among the many fine buildings of recent erection in Montreal alone, in which La Prairie brick has been used for all work including the foundations, are the new Eastern Township bank, Windsor Hotel, Canadian Bank of Commerce and La Patrie Building.

The exceptionally enduring qualities of shale brick, it is said, are to be seen in the old Roman walls which have stood for centuries, and which show little or no indications of "scaling" or "disintegration."

LIME AND STONE.

THERE IS PROBABLY no firm in Canada dealing in lime and crushed stone that is better known to the trade than Christie, Henderson & Company, whose head offices are at 34 Yonge St., Toronto. Since engaging in the manufacture of grey lime stone twenty-five years ago, the business of this concern has been attended by a steady growth and an increasing patronage. In addition to the original plant, the company is now operating two white lime plants, one at Hespeler, and the other at Galt, Ont., both of which have been acquired within the past six years.

As regards crushed stone, this firm has been connected with this department of their business for the fifteen years back, and they are splendidly equipped to supply any quantity to contractors, corporations or municipalities on the shortest notice.

The facilities of the company for meeting the requirement of the trade are the very best. Direct yard services with the C.P.R. and Grand Trunk Railways enable them to make immediate shipments to all points.

Local and long distance phone orders, or written communications to their above address will receive prompt attention.

PRIVATE WATER SUPPLY.

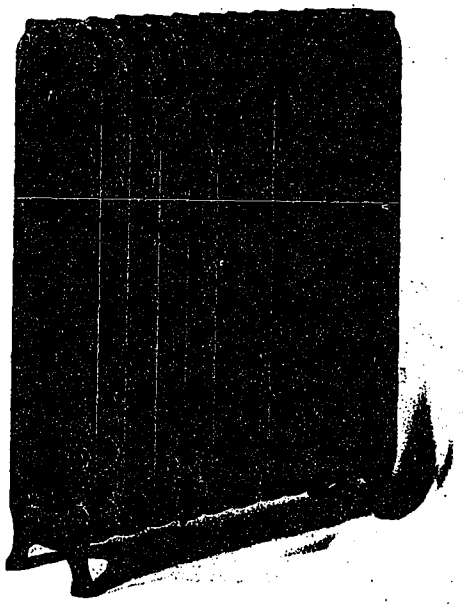
THE PROBLEM of providing a private water supply system is one with which the average architect, especially in designing a suburban or country home, is frequently called upon to deal. Up to ten years ago, while private lighting plants, heating plants and sewage disposal plants have been developed to a high state of perfection, such apparatus as was available for a private water supply system was at its best pitifully crude, unsanitary and very often unserviceable.

Since then, however, a series of experiments have resulted in the invention of the Kewanee Pneumatic Tank, which has attained complete success in this direction. This tank is equipped with an automatic valve and an operating pump attachment designed according to conditions with which it has to meet.

One of the main features of this pneumatic system is its compactness, and the simplicity and easy way with which it is operated. It dispenses with all uncertainty and complications, is absolutely automatic, requires no attention, and can be operated by any desired power. The air supply is so regulated that it delivers the necessary amount to the height resuired.

As to purity of supply, this system lays claim to a distinctive advantage in that the water, owing to the existing compression, after becoming impregnated with the air which oxidizes or burns out every particle of foreign

The Perfectly Heated Home is Equipped with "King" Radiators and a "Daisy" Hot Water Boiler



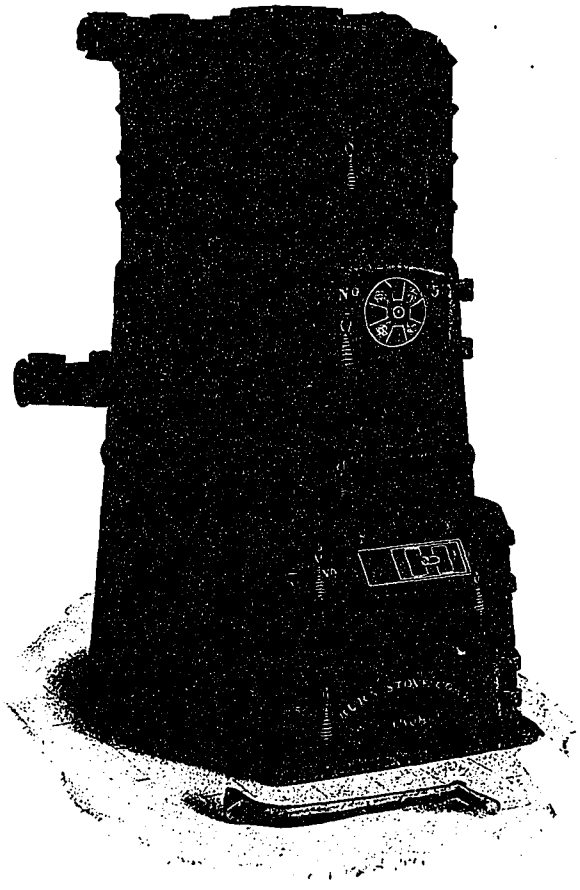
THERE is no room for doubt that a hot water system is the most hygienically and scientifically perfect method of heating houses.

To those who have investigated, there is less room for doubt that the most perfect system of hot water heating is that supplied by the "Daisy" Hot Water Boiler in conjunction with King Radiators.

It is the most simple and cleanly system to operate—distributes healthful warmth, evenly, throughout the house—is economical of fuel, and is the easiest controlled.

The "Daisy" Boiler is manufactured under the direct supervision of expert heating engineers in the most modernly and perfectly equipped plant in the country.

Over 50,000 "Daisy" Boilers are now in active service, and giving the utmost satisfaction. Into every one of these there has been put the best there is in material and expert workmanship. It is the easiest and most quickly erected boiler. The "Daisy" has won through sheer merit the position of standard of hot water boilers.



The King Radiator is made in a thoroughly modern and perfectly equipped plant that is devoted exclusively to their production.

They are designed to give the greatest possible radiating surface, yet are compact and artistic in appearance—lending themselves easily to the highest class of room decoration.

The sections are connected by a double screw nipple which makes an absolutely unleakable joint.

Every section of each King Radiator is tested to a cold water pressure of one hundred pounds. After assembling, each completed radiator is again submitted to this severe test; although, in actual use, the highest test they would be subjected to would not exceed ten pounds pressure.

Architects who are planning new houses, or remodelling old ones, have the services of our heating experts at their disposal at all times. Full information about King Radiators and Daisy Boilers cheerfully furnished by our heating salesmen. Taking advantage of this service does not obligate you in any way.

The KING Radiator Co., Limited

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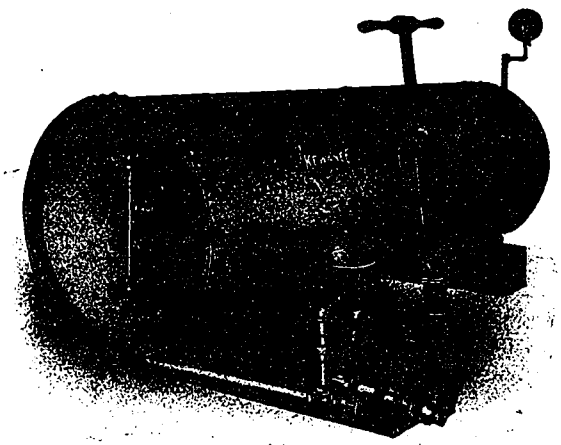
Showrooms and Sales Office:

21-27 Lombard St., TORONTO

matter, is filtered through stone, thus rendering it absolutely free from all impurities and disease-breeding germs.

While the Kewanee System was at first designed for the farms and country residence, it is gradually and systematically covering the field of public buildings, hospitals, asylums, country clubs, almshouses, apartments, manufacturing plants and tall office buildings, in which it is installed for both ordinary use and fire fighting purposes. With a pneumatic water supply system of this kind situated in the basement and acting directly upon an automatic sprinkler system extending throughout the building, the fire hazard is reduced to a minimum, and the big saving thus effected in insurance rates soon pays for the cost of its installation.

Kewanee tanks can be supplied in sizes to meet any requirement whatsoever, and at prices ranging from $90



Kewanee Tank (2 1-2 by 8 ft.) and hand force pump. The capacity of this tank is 200 gallons and the pump will deliver 100 gallons in 20 minutes.

upwards. As to their adaptability to climatic conditions, it may be said that there are a number of places where their ability to withstand the rigors of a northern winter has been amply demonstrated.

The Kewanee System is supplied and installed by the Record Foundry Company, Montreal, who will gladly furnish architects and owners, additional information regarding its merits upon request.

VULCAN CEMENT.

THE FRANK B. GILBRETH COMPANY has placed with the Vulcan Portland Cement Company, through its sales agent the Wm. G. Hartranft Cement Company, Limited, of Montreal, the contract for all the cement required for the immense power development of the Grand Falls Power Company, Grand Falls, New Brunswick. The quantity is estimated to be 100,000 barrels or over, which, it is said, is the largest contract for Portland cement ever placed with a Canadian company, for a single piece of work.

BUILDING SUPPLIES.

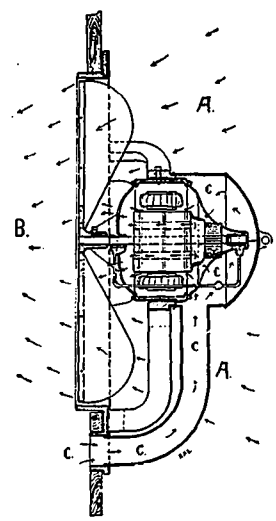
ON A RECENT VISIT to Montreal we had occasion to call on Mr. E. F. Dartnell at his office and showrooms at 157 St. James street. Mr. Dartnell has recently made extensive alterations in his place of business, and has now one of the finest displays of face brick, stone, marble, terra cotta, etc., to be seen anywhere. His extensive display comprises a great range of color and texture in brick, colors running from white to black, and in a variety of shades in red, grey, buff, brown, ironspot, mottled, etc., including the celebrated "Tapestry" brick, and the "Twin City" moss, mahogany, autumn leaf and other colors, as well as in the better known and older colors.

Mr. Dartnell has a large number of panels showing brick laid up in different styles as well as a complete display of marbles, building stones, ornamental terra cotta, terra cotta fireproofing, metal lath, damp resisting paint, "Duresco" washable water paint for tinting and other lines. For the convenience of architects, Mr. Dartnell has a fine reference library comprising high class works on brick and stonework and interior decoration.

We would draw the attention of those interested in building supplies to Mr. Dartnell's advertisement on the inside front cover, showing some of the firms he represents and the wide line of materials he is prepared to furnish the trade.

ENCLOSED TYPE MOTOR FAN.

AN ELECTRIC, direct connected, ventilating fan, in which the motor is kept cool by the fan itself, is an interesting device recently patented by The Ilg Electric Ventilating Company, of Chicago and New York, and shown in the accompanying illustration. The motor is fully enclosed as shown, and is thus protected from dust and dirt. The ventilation of the motor is accomplished by utilizing the vacuum created in front of the centre or axis of the fan to draw pure, fresh air from outside the building through a tube connecting with the motor hood, which hood completely encloses the motor on all sides, excepting that next to the fan. This cool air is drawn



The Ilg enclosed type motor fan.

through the motor and is carried away with the general exhaust.

The object in designing this fan was to overcome the difficulty experienced in the use of enclosed non-ventilated type motors, through the over heating of the armature and field coils, with a consequent decrease in the efficiency.

Messrs. Sheldons, Limited, of Galt, Ontario, have recently been appointed sole licensees and manufacturers for Canada, and architects and engineers will find it greatly to their interest to procure a copy of Bulletin No. 50, issued by this company, in which this ingenious and practical ventilating fan is fully described and illustrated.

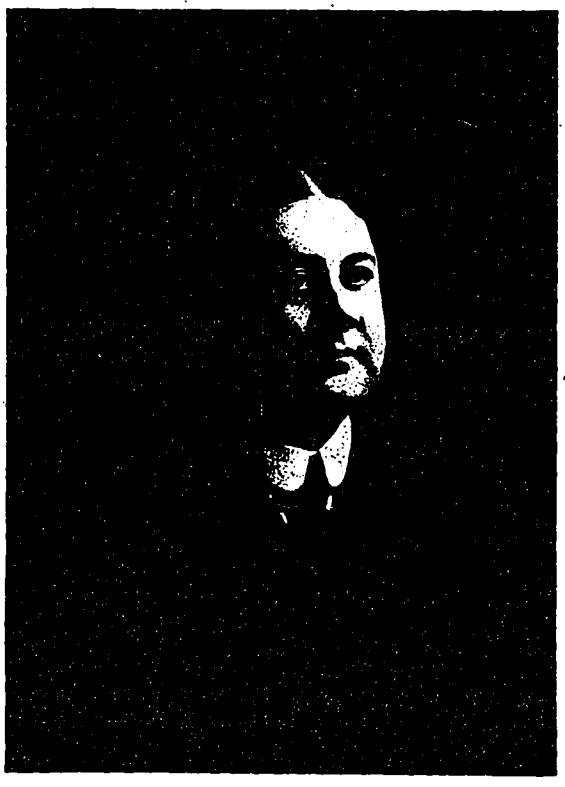
SOMERVILLE LIMITED.

AS A CONVENIENCE to the trade, the Somerville Limited, Toronto, who recently disposed of their jobbing business to the Standard Sanitary Company, will continue to maintain a down-town sales department and show room, having opened up a suite of offices on the ground floor of the Saturday Night Building, 25-28 Adelaide Street West.

The down-town branch as heretofore will be in direct

charge of Mr. Fred Somerville who will devote his entire time in looking after the interests of the Company's customers. Mr. Somerville is one of the best informed plumbing supply men in Canada and his popularity among the trade extends from coast to coast.

The show room in addition to displaying a complete line of plumbers' and steamfitters' brass goods, will include



Mr. Fred Somerville, who is in charge of the down-town office and sales department of Somerville, Limited.

such other products of the company's factory, as closet tanks, lead pipe, traps, bends and solder.

The general offices of Somerville Limited will be continued at the Company's extensive works on St. Helens Avenue, where Lorne Somerville is in charge of the executive department.

FIREPROOF DOORS AND WINDOWS.

WHILE THE ART of the printer displays its skill in the new catalogue just issued by A .B. Ormsby Limited, Toronto and Winnipeg, the art of the metal worker is its most striking feature. For indeed are many of the fireproof doors and windows illustrated within its pages an artistic revelation. It is impossible in looking through this little publication to lose sight of the high standard of excellence the company has attained in the manufacture of their products. In design and construction, in the perfect joining of their members, and in the taut, perfectly drawn surfaces, these doors and windows are preminently in a class by themselves.

The growing popularity of the Ormsby products is due to the company's ability to consisttntly meet the requirements of the architect as regards expression of design. How well they have succeeded in this respect is to be seen in the illustrations of kalameined and copper clad entrances, windows. and elevator enclosures of various buildings shown, all of which were made according to the drawings and specifications of the architects .

In addition to these, there are a number of photographic reproductions of steel rolling doors and shutters, horizontal folding doors, Terne armored doors, corrugated iron counterbalanced freight doors, designed for mills, factories, warehouses, etc., as they are to be seen in practical use.

That Ormsby "Underwriter" doors are deserving of this affixed appellation is demonstrated in the illustrations showing the practically uninjured character of several of these doors after being subject to intense heat and fire.

The fireproof doors and windows in the new Southam Press Building, Toronto, illustrated on page 60 of this issue, were manufactured and installed by this company.

CANADA FOUNDRY CO.

UNDER THE TITLE of "Our Product," the Canada Foundry Company, Limited, Toronto, has recently issued an attractive little catalogue dealing with the various lines which this concern manufactures and handles.

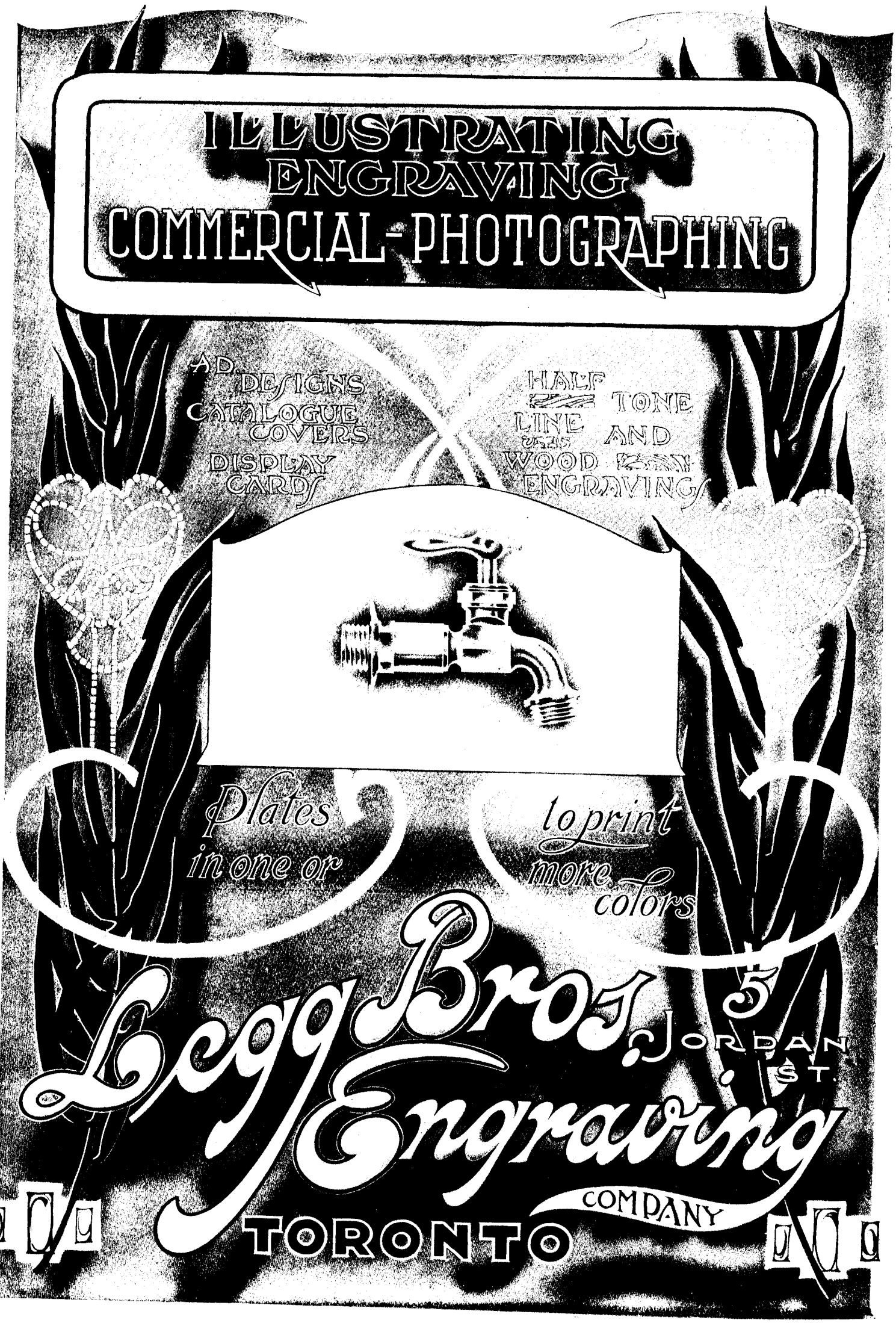
Within the pages of this complete little edition, is to be found illustrations of almost every appliance and character of equipment required in the contracting business. Locomotive (steam and electric), railway supplies, steam shovels, dipper dredges, wrecking cranes, pile drivers, and boilers of various types are shown. The company is now manufacturing the Koehring mixer which can be supplied in sizes to meet all purposes from sidewalk work up to jobs in which large masses of concrete are used.

Of especial interest to architects are the illustrations showing the work of the company's Ornamental Iron Department, such as bronze doors, counter grilles, elevator enclosures, and name plates, as well as metal staircases and balconies, gates, steel columns and capitals, and barlock sidewalk, floor and skylight prism glass construction.

Other views show structural steel and steel roof work which amply demonstrates this concern's ability along this line.

For municipal work the company has a complete line of steam rollers, stone crushers and road machinery, etc., while they also design and construct bridges and asphalt plants to meet any requirement. A copy of this catalogue wil be sent to the address of any interested party upon reguest.

Reception Hall, Nurses' Residence, Sick Children's Hospital, Toronto.—Sproatt & Rolph, Architects.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The Pedlar People.

CAST IRON COLUMNS.
Vokes Hardware Co.
Gaudry & Co., L. H.
Dennis Wire and Iron Works Co., Limited.
The Pedlar People.

CEMENT.
Canadian Portland Cement Co., Limited.
E. F. Dartnell.
Vulcan Portland Cement Co., Ltd.
The Lakefield Portland Cement Co., Limited.
Owen Sound Portland Cement Co.
David McGill.
Francis Hyde & Company.
Stinson Reeb Builders' Supply Co.
Rogers Supply Co.
L. A. DeLaplante.
Leigh Portland Cement Co., Limited.
Thorn Cement Company.
Western Canada Cement & Coal Co.

CHIMNEY CONSTRUCTION.
Eadie-Douglas Co.

CHURCH FURNITURE.
Gold Medal Furniture Mfg. Co.
Canadian Office & School Furniture Co.
Globe Furniture Co.

COLD STORAGE & REFRIGERATOR INSULATION.
Kent Company, Limited.

CONCRETE CONSTRUCTION (Reinforced).
Clarke & Monds.
Jas. C. Claxton & Son.
Expanded Metal & Fireproofing Co.
Metcalf Engineering, Limited.
The Pedlar People.
Pitt & Co.
Trussed Concrete Steel Co.

CONDUITS.
Conduits Co., Limited.
Francis Hyde & Company.
The Pedlar People.

CORK BOARD.
Kent Company, Limited.

CORNER BEADS.
The Pedlar People.

CUT STONE CONTRACTORS.
E. F. Dartnell.
Roman Stone Co., Limited.
Canadian Art Stone Co., Limited.
Fred Holmes & Son.

CUT GRANITE.
Stanstead Granite Quarries Co., Limited.

DECORATORS.
Deecker & Carlyle.

DEPOSIT BOXES.
J. & J. Taylor.

DRAWING MATERIALS.
Eugene Dietzgen Co.

DOORS.
L. A. De Laplante.

DRYING APPLIANCES.
Sheldons, Limited.

DUMB WAITERS.
Otis-Fensom Elevator Co., Limited.
Parkin Elevator Company.
Vokes Hardware Co.

ELECTRICAL CONTRACTORS.
Goold Electric Co.

ELEVATORS (Passenger and Freight).
Otis-Fensom Elevator Co., Limited.
Parkin Elevator Company.

ELEVATOR ENCLOSURES.
Dennis Wire and Iron Works Co.,
Otis-Fensom Elevator Co., Limited.

ELEVATOR PROTECTIVE DEVICES.
Jas. Ruddick.

EXHAUST FANS.
Sheldons, Limited.

EXPANDED METAL.
Expanded Metal and Fireproofing Co.
Galt Art Metal Co.
Clarence W. Noble.
Gaudry & Co., L. H.
Metal Shingle & Siding Co.
The Pedlar People.
Trussed Concrete Steel Co.
Stinson Reeb Builders' Supply Co.

FIRE BRICK.
E. F. Dartnell.
David McGill.
Francis Hyde & Co.
Stinson Reeb Builders' Supply Co.

FIRE ESCAPES.
Gaudry & Co., L. H.
Dennis Wire and Iron Works Co., Limited.
Parkin Elevator Company.

FIRE-PLACE GOODS.
Vokes Hardware Co.
John Kay Co.

FIREPROOFING.
Don Valley Brick Works.
Clarence W. Noble.
E. F. Dartnell.
Eadie-Douglas Co.
Expanded Metal and Fireproofing Co.
David McGill.
The Pedlar People.
Pitt & Robinson.
Port Credit Brick Co.
Trussed Concrete Steel Co.

FIREPROOF STEEL DOORS.
Gaudry & Co., L. H.
A. B. Ormsby, Limited.
The Pedlar People.
Stinson Reeb Builders' Supply Co.
Vokes Hardware Co.

FIREPROOF WINDOWS.
Galt Art Metal Co.
Metal Shingle & Siding Co.
Metallic Roofing Co. of Canada.
A. B. Ormsby, Limited.
The Pedlar People.
Pilkington Brothers, Ltd.
Stinson Reeb Builders' Supply Co.

FLOORING.
Eadie-Douglas Co.
Seaman Kent Co., Limited.

FURNACES AND RANGES.
Cluff Bros.
Gurney Foundry Company, Ltd.
Warden King, Limited.
Dominion Radiator Co., Limited.
Taylor-Forbes Company, Limited.
Record Foundry & Machine Co.
Clare Brothers & Co.
James Smart Mfg. Co.

FURNITURE.
T. Eaton Co.
Canadian Office & School Furniture Company.
Globe Furniture Co.
John Kay Co.

GALVANIZED IRON WORKS.
Galt Art Metal Co.
A. B. Ormsby, Limited.
Metal Shingle & Siding Co.
Metallic Roofing Co. of Canada.
The Pedlar People.
Sheldons, Limited.

GAS AND GASOLINE ENGINES.
London Concrete Machinery Co.

GRILLE WORK.
J. & J. Taylor.

HARDWARE.
Vokes Hardware Co.
Taylor-Forbes Co.
L. A. De Laplante.

HARDWOOD FLOORING.
Seaman Kent Co., Limited.

HEATING APPARATUS.
Cluff Bros.
Gurney Foundry Company, Ltd.
Warden King, Limited.
Dominion Radiator Co., Limited.
Taylor-Forbes Co., Limited.
Sheldons, Limited.
Record Foundry & Machine Co.
Clare Brothers.
James Smart Mfg. Co.
Goldie & McCulloch Co., Limited.
Sheldons, Limited.

HYDRANTS.
Kerr Engine Co.

IRON DOORS AND SHUTTERS.
J. & J. Taylor.

IRON STAIRS.
Canadian Ornamental Iron Co.
Gaudry & Co., L. H.
Dennis Wire & Iron Works Co.
Francis Hyde & Co.

IRON SUPPLIES.
Kerr Engine Co.

INSULATION.
Kent Company, Limited.

SEE INDEX TO ADVERTISEMENTS FOR ADDRESSES OF FIRMS IN THE ABOVE DIREC TORY

INTERIOR WOODWORK.
Globe Furniture Co.
Canadian Office & School Furniture Co.
Seaman Kent & Co.

JAIL CELLS AND GATES.
Dennis Wire & Iron Works Co. ited.
J. & J. Taylor.

JOIST HANGERS.
Vokes Hardware Co.
Taylor-Forbes Co.
Francis Hyde & Co.

LAMP STANDARDS.
Dennis Wire & Iron Works Co., Limited.

LATH (Metal).
Expanded Metal and Fireproofing Co.
Clarence W. Noble.
Galt Art Metal Co.
Gaudry & Co., L. H.
B. Greening Wire Co., Limited.
Metal Shingle & Siding Co.
Metallic Roofing Co. of Canada.
The Pedlar People.
Stinson-Reeb Builders' Supply Co.
Trussed Concrete Steel Co.
Vokes Hardware Co.

LAWN VASES.
London Concrete Machinery Co., Limited.

LEADED GLASS.
David McGill.
Pilkington Brothers, Ltd.
Canada Glass, Mantels and Tiles, Limited.

LIGHTING AND POWER PLANTS.
National Light & Mfg. Co., ...mited.

LODGE FURNITURE.
Canadian Office & School Furniture Co.
Globe Furniture Co.

MANTELS.
Canada Glass, Mantels and Tiles, Limited.
T. Eaton Company.
Vokes Hardware Co.
Hoidge Marble Co.
David McGill.
T. Eaton Co., Ltd.

MARBLE.
E. F. Dartnell.
Hoidge Marble Co.
Mississquoi Marble Company.
Smith Marble & Construction Co., Limited.

METAL SHINGLES.
Galt Art Metal Co.
Metallic Roofing Co. of Canada.
Metal Shingle & Siding Co.
The Pedlar People.

METAL WALLS AND CEILINGS.
Galt Art Metal Co.
Metal Shingle & Siding Co.
Metallic Roofing Co. of Canada.
C. W. Noble.
A. B. Ormsby, Limited.
The Pedlar People.

METAL WEATHER STRIPS.
Chamberlain Metal Weather Strip Co.

OPERA CHAIRS.
Canadian Office & School Furniture Co.
Globe Furniture Co.

ORNAMENTAL IRON WORK.
Canadian Ornamental Iron Co.
Gaudry & Co., L. H.
Geo. B. Meadows Co., Limited.
Dennis Wire & Iron Co., Limited.

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

PIPE COVERING.
Kent Company, Limited.

PLASTERERS.
W. J. Hynes.

PLASTER CORNER BEADS.
The Pedlar People.

PLATE AND WINDOW GLASS.
Canada Glass, Mantels & Tiles.
Pilkington Brothers, Limited.

PLUMBERS' BRASS GOODS.
Somerville, Limited.
Jas. Robertson Co., Limited.

PLUMBING FIXTURES.
Somerville, Limited.
Standard Ideal Co., Limited.
Jas. Robertson Co., Limited.

PNEUMATIC TOOLS.
Canadian Fairbanks Co.
Mussons, Limited.

PORCELAIN ENAMEL BATHS.
Somerville, Limited.
Standard Ideal Co., Limited.
Jas. Robertson Co., Limited.

RADIATORS.
Cluff Bros.
King Radiator Co.
Dominion Radiator Co., Limited.
Warden King, Limited.
Taylor-Forbes Co., Limited.
Somerville, Limited.

RADIATOR VALVES.
Kerr Engine Co.

REFRIGERATING MACHINERY.
Kent Company, Limited.
Linde British Refrigeration Co., Ltd.

REFRIGERATOR INSULATION.
Kent Company, Limited.

REINFORCED CONCRETE.
Expanded Metal & Fireproofing Co.
David McGill.
Clarence W. Noble.
The Pedlar People.
Pitt & Co.
Trussed Concrete Steel Co., Limited.

RELIEF DECORATION.
W. J. Hynes.

ROOFING PAPER.
Lockerby & McCoomb.
Alex McArthur & Co.
The Pedlar People.
Vokes Hardware Co.

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

ROOFING TILE.
E. F. Dartnell.
Francis Hyde & Co.
David McGill.
The Pedlar People.

RUBBER TILING.
Dunlop Tire & Rubber Co.
Gutta Percha & Rubber Mfg. Co., Limited.

SAFES, VAULTS AND VAULT DOORS.
J. & J. Taylor.
Goldie & McCulloch Co., Limited.

SANITARY PLUMBING APPLIANCES.
Somerville Limited.
Standard Ideal Co., Limited.
Jas. Robertson Co.

SCHOOL FURNITURE.
Canadian Office & School Furniture Co.
Globe Furniture Co.

SHEET METAL WORKERS.
Galt Art Metal Co.
Metallic Roofing Co.
Metal Shingle & Siding Co.
A. B. Ormsby, Limited.
The Pedlar People.

SIDEWALKS, DOORS AND GRATES.
Dennis Wire & Iron Works Co.

SIDEWALK LIFTS.
Otis-Fensom Elevator Co., Limited.
Parkin Elevator Company.

STABLE FITTINGS.
Dennis Wire & Iron Works Co., Lim-
Vokes Hardware Co.

STAFF AND STUCCO WORK.
W. J. Hynes.

STEAM APPLIANCES.
Sheldons, Limited.
Kerr Engine Co.
Taylor-Forbes Co.

STEAM AND HOT WATER HEATING.
Cluff Bros.
Warden King, Limited.
Dominion Radiator Co., Limited.
Taylor-Forbes Co., Limited.

STEEL CASEMENTS.
L. H. Gaudry & Co., Limited.
David McGill.

STEEL CONCRETE CONSTRUCTION.
Expanded Metal & Fireproofing Co.
Clarence W. Noble.
Pitt & Co.
The Pedlar People.
Trussed Concrete Steel Co.

STEEL DOORS.
A. B. Ormsby, Limited.
The Pedlar People.
Vokes Hardware Co.

STRUCTURAL IRON CONTRACTORS.
Hamilton Bridge Co.
Reid & Brown.

STRUCTURAL STEEL.
L. H. Gaudry & Co., Limited.
Hamilton Bridge Co.
Reid & Brown.
Dennis Wire and Iron Works Co., Limited.
Stratford Bridge Co.

STORE FIXTURES.
Gold Medal Furniture Mfg. Co.
Canadian Office & School Furniture Co.
Globe Furniture Co.

TERRA COTTA FIREPROOFING.
Eadie-Douglas Co.
Don Valley Brick Works.
E. F. Dartnell.
Francis Hyde & Co.
The Milton Pressed Brick Co.
David McGill.

TILE (Floor and Wall).
Canada Glass, Mantels and Tiles, Limited.
Vokes Hardware Co.
David McGill.
Smith Marble & Construction Co.
Francis Hyde & Co.
E. F. Dartnell.

VALVES.
Gurney Foundry Company, Ltd.
Kerr Engine Co.
Somerville, Limited.
Taylor-Forbes Co.
Dominion Radiator Company.

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

WALL HANGERS.
Vokes Hardware Co.
Taylor-Forbes Co.

WALL HANGINGS.
Deecker & Carlyle.

WATER HEATERS.
Canadian Fairbanks Co.
Somerville, Limited.
Drummond McCall Co.

WINDOW GUARDS.
B. Greening Wire Co., Limited.

WINDOW SCREENS.
Wm. Stewart & Co.

A DIRECTORY FOR CONTRACTORS' SUPPLIES & MACHINERY

ADAMANT PLASTER.
Francis Hyde and Co.
Stinson-Reeb Builders' Supply Co.

ARTIFICIAL STONE.
Canadian Concrete Machinery Co., Limited.
Canadian Art Stone Co.
Roman Stone Co.

ASBESTOS PRODUCTS.
A. B. Ormsby, Limited.

BELTING.
Dunlop Tire and Rubber Co., Limited.
Gutta Percha & Rubber Mfg. Co., Limited.

BLOWERS.
Sheldons, Limited.

BLOW AND VENT PIPING.
Metal Roofing Co., Limited.
Metal Shingle & Siding Co.
A. B. Ormsby, Limited.

BOILERS.
Cluff Bros.
Gurney Foundry Company, Ltd.
Warden King, Limited.
Dominion Radiator Co., Limited.
Berg Machinery Mfg. Co., Limited.
Somerville, Limited.
Taylor-Forbes Co.
Goldie and McCulloch Co., Limited.

BRASS WORKS.
Somerville, Limited.
James Robertson, Limited.
Kerr Engine Co.

SEE INDEX TO ADVERTISEMENTS FOR ADDRESSES OF FIRMS IN THE ABOVE DIRECTORY

BRICK AND TERRA COTTA.
E. F. Dartnell.
Don Valley Brick Works.
Eadie-Douglas Co.
David McGill.
LaPrarie Brick Co., Ltd.
Port Credit Brick Co.
Stinson-Reeb Builders' Supply Co.

BUILDING SUPPLIES.
Christie, Henderson & Co., Ltd.
E. F. Dartnell.
Eadie-Douglas Co.
Gold Medal Furniture Mfg. Co.
Francis Hyde & Co.
LaPrarie Brick Co., Ltd.
Lockerby & McCoomb.
David McGill.
The Paterson Manufacturing Co., Limited.
The Pedlar People.
Stinson-Reeb Building Supply Co., Limited.
Roger Supply Co.
Vokes Hardware Co.

BRICK MACHINERY.
Berg Machinery Mfg. Co., Limited.
Wettlaufer Bros.
London Concrete Machinery Co.
Scientific Brick Co.

CAST IRON COLUMNS.
Gaudry & Co., L. H.
The Pedlar People.
Vokes Hardware Co.

CAPS FOR COLUMNS AND PILASTERS.
W. J. Hynes.
London Concrete Machinery Co.
The Pedlar People.

CARS (Factory and Dump).
Sheldons, Limited.

CEMENT.
Canadian Portland Cement Co., Limited.
E. F. Dartnell.
Imperial Cement Co.
The Lakefield Portland Cement Co., Limited.
Owen Sound Portland Cement Co.
David McGill.
Vulcan Portland Cement Co., Limited.
Francis Hyde & Co.
Leigh Portland Cement Co.
Thorn Cement Company.
Rogers Supply Co.
Stinson-Reeb Builders' Supply Co.
Western Canada Cement & Coal Co.

CEMENT BLOCK MACHINERY.
London Concrete Machinery Co.
Canadian Concrete Machinery Co., Limited.
Ideal Concrete Machinery Co., Limited.
Mussons, Limited.
London Concrete Machinery Co., Limited.

CEMENT BRICK MACHINERY.
London Concrete Machinery Co., Limited.
Ideal Concrete Machinery Co.

CEMENT MACHINERY.
Berg Machinery Co., Limited.
London Concrete Machinery Co., Limited.
Ideal Concrete Machinery Co.

CEMENT TILE MACHINERY.
London Concrete Machinery Co., Limited.
Ideal Concrete Machinery Co.

CEMENT WORKING TOOLS.
London Concrete Machinery Co., Limited.
Vokes Hardware Co.

CONCRETE MIXERS.
Canada Foundry Company, Ltd.
E. F. Dartnell.
Mussons, Limited.
London Concrete Machinery Co., Limited.
Ideal Concrete Machinery Co.

CONCRETE STEEL.
Dennis Wire & Iron Co.
Expanded Metal & Fireproofing Co.
B. Greening Wire Co., Limited.
Clarence W. Noble.
The Pedlar People.
Pitt & Co.
Trussed Concrete Steel Co.

CONDUITS.
Conduits Co., Limited.
Francis Hyde & Co.
The Pedlar People.

CONTRACTORS' MACHINERY.
Canadian Concrete Machinery Co., Limited.
Mussons, Limited.
London Concrete Machinery Co., Limited.

CONTRACTORS' SUPPLIES.
Eadie-Douglas Co.
E. F. Dartnell.
Francis Hyde & Co.
Kent Company, Limited.
David McGill.
Miller Bros. & Toms.
Mussons, Limited.
Stinson-Reeb Builders' Supply Co.
Rogers Supply Co.
Vokes Hardware Co.

CRUSHED STONE.
Christie, Henderson & Co., Ltd.
Rogers Supply Co.
Stinson-Reeb Builders' Supply Co.

CUT STONE CONTRACTORS.
Roman Stone Co., Limited.
Canadian Art Stone Co., Limited.
Fred Holmes & Sons.
E. F. Dartnell.

CUT GRANITE.
Stanstead Granite Quarries Co., Limited.

DOORS.
Gold Medal Furniture Mfg. Co.
L. A. De La Plante.

DRILLS (Brick and Stone).
Vokes Hardware Co.
Mussons, Limited.

ELECTRICAL CONTRACTORS.
Goold Electric Co.

ELECTRO-PLATING.
Somerville, Limited.
Dennis Wire and Iron Works Co.

ELECTRIC WIRE AND CABLES.
B. Greening Wire Co., Limited.
Jas. Robertson Co., Limited.

ELEVATOR PROTECTIVE DEVICES.
Jas. Ruddick.

ENGINES.
Berg Machinery Mfg. Co., Limited.
Goldie and McCulloch Co., Limited.
Sheldons, Limited.

ENGINEERS' SUPPLIES.
Somerville, Limited.
Kerr Engine Co.
Vokes Hardware Co.
Mussons, Limited.

ELECTRIC WIRE AND CABLES.
B. Greening Wire Co., Limited.
James Robertson Co., Limited.

EXHAUST FANS.
Sheldons, Limited.

EXPANDED METAL.
Expanded Metal and Fireproofing Co.
Galt Art Metal Co.
Gaudry & Co., L. H.
Clarence W. Noble.
Metal Shingle & Siding Co.
The Pedlar People.
Stinson-Reeb Builders' Supply Co.
Trussed Concrete Steel Co.
Vokes Hardware Co.

FIRE BRICK.
E. F. Dartnell.
Vokes Hardware Co.
David McGill.
Stinson-Reeb Builders' Supply Co.

FIREPROOFING.
Don Valley Brick Works.
E. F. Dartnell.
Eadie-Douglas Co.
Clarence W. Noble.
Expanded Metal and Fireproofing Co.
David McGill.
The Pedlar People.
Pitt & Robinson.
Port Credit Brick Co.
Trussed Concrete Steel Co.

FIREPROOF STEEL DOORS.
A. B. Ormsby, Limited.
Gaudry & Co., L. H.
The Pedlar People.
Stinson-Reeb Builders' Supply Co.
Vokes Hardware Co.

FIREPROOF WINDOWS.
Pilkington Brothers, Ltd.
Galt Art Metal Co.
Metal Shingle & Siding Co.
A. B. Ormsby, Limited.
The Pedlar People.
Stinson-Reeb Builders' Supply Co.
Metallic Roofing Co. of Canada.

FLOORING.
Eadie-Douglas Co.
The Seamen Kent Co., Limited.

FURNACES AND RANGES.
Cluff Bros.
Gurney Foundry Company, Ltd.
Warden King, Limited.
Dominion Radiator Co., Limited.
Taylor-Forbes Co., Limited.

GALVANIZED IRON WORKS.
Galt Art Metal Co.
A. B. Ormsby, Limited.
The Pedlar People.
Metal Shingle & Siding Co.
Metallic Roofing Co., of Canada.

GAS AND GASOLINE ENGINES.
London Concrete Machinery Co.

HARDWARE.
Taylor-Forbes Co.
L. A. De Laplante, Limited.
Vokes Hardware Co.

HEATING APPARATUS.
Cluff Bros.
Gurney Foundry Company, Ltd.
Warden King, Limited.
Dominion Radiator Co., Limited.
Taylor-Forbes Co., Limited.
Sheldons, Limited.
Goldie and McCulloch Co., Limited.

HYDRANTS.
Kerr Engine Co.

HOISTING MACHINERY.
Otis-Fensom Elevator Co., Limited.
Mussons, Limited.

INSULATION.
Kent Company, Limited.

IRON STAIRS.
Canadian Ornamental Iron Co.
Gaudry & Co., L. H.
Geo. B. Meadows Co., Limited.
Francis Hyde & Company

JOIST HANGERS.
David McGill.
Vokes Hardware Co.
Taylor-Forbes Co.
Francis Hyde & Co.

LATH (Metal).
Clarence W. Noble.
Concrete Engineering and Construction Co.
Expanded Metal & Fireproofing Co.
Galt Art Metal Co.
Vokes Hardware Co.
Gaudry & Co., L. H.
B. Greening Wire Co., Limited.
Metal Shingle & Siding Co.
The Pedlar People.
Trussed Concrete Steel Co.
Stinson-Reeb Builders' Supply Co.
Metallic Roofing Co., of Canada.

LOCOMOTIVE SUPPLIES.
Somerville, Limited.
Mussons, Limited.

LUMBER.
Gold Medal Furniture Mfg. Co.
L. A. De Laplante, Limited.

MARBLE.
E. F. Dartnell.
Hoidge Marble Co.
Missisquoi Marble Co.
Smith Marble and Construction Co., Limited.

METAL SHINGLES.
Galt Art Metal Co.
Metallic Roofing Co. of Canada.

METAL WALLS AND CEILINGS.
Galt Art Metal Co.
Metal Shingle & Siding Co.
Metallic Roofing Co. of Canada.
A. B. Ormsby, Limited.
The Pedlar People.

METAL WEATHER STRIPS.
Chamberlain Metal Weather Strip Co.

MUNICIPAL SUPPLIES.
Francis Hyde & Co.
Mussons, Limited.

ORNAMENTAL IRON.
Canada Foundry Company, Ltd.

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

PIPE.
Gaudry & Co., L. H.
Somerville, Limited.
Francis Hyde & Co.

PLATE AND WINDOW GLASS.
Pilkington Brothers, Ltd.
Canada Glass, Mantel and Tile Co., Limited.

PLASTER BOARD.
Francis Hyde & Co.

PLUMBERS' BRASS GOODS.
Somerville, Limited.
James Robertson Co., Limited.

PLUMBING FIXTURES.
Somerville, Limited.
Standard Ideal Co., Limited.

PLUMBER AND STEAM FITTER SUPPLIES.
L. H. Gaudry & Co.
Somerville, Limited.
Standard Ideal Co., Limited.
Taylor-Forbes Co.
Dominion Radiator Company.

PORCELAIN ENAMEL BATHS.
Somerville, Limited.
Standard Ideal Co., Limited.

SEE INDEX TO ADVERTISEMENTS FOR ADDRESSES OF FIRMS IN THE ABOVE DIRECTORY

PUMPING MACHINERY.
Mussons, Limited.
Otis-Fensom Elevator Co., Limited.

RADIATORS.
Cluff Bros.
King Radiator Co.
Dominion Radiator Co., Limited.
Warden King, Limited.
Taylor-Forbes Co., Limited.
Somerville, Limited.

RADIATOR VALVES.
Kerr Engine Co.

REFRIGERATING MACHINERY.
Linde British Refrigeration Co., Limited.

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

ROOFING PAPER.
Lockerby & McCoomb.
The Paterson Manufacturing Co., Limited.
The Pedlar People.
Vokes Hardware Co.

ROOFING TILE.
E. F. Dartnell.
Francis Hyde & Co.
David McGill.
The Pedlar People.

RUBBER TILING.
Dunlop Tire & Rubber Co.
Gutta Percha & Rubber Mfg. Co., Limited.

SAND.
Sand and Dredging Company.

SAND AND GRAVEL SCREENS.
B. Greening Wire Co., Limited.
London Concrete Machinery Co.

SHAFTING PULLEYS AND HANGERS.
Goldie & McCulloch Co., Limited.

SANITARY PLUMBING APPLIANCES.
Somerville, Limited.
Standard Ideal Co., Limited.

STEEL CASEMENTS.
L. H. Gaudry Co.
David McGill.

STRUCTURAL STEEL.
Gaudry & Co., L. H.
Hamilton Bridge Co.
Dennis Wire & Iron Works Co., Limited.
Reid & Brown.
Stratford Bridge Co.

TERRA COTTA FIREPROOFING.
Eadie-Douglas Co.
Don Valley Brick Works.
E. F. Dartnell.
Francis Hyde & Co.
The Milton Pressed Brick Co.
David McGill.
National Fireproofing Co.

TILE (Floor and Wall).
Canada Glass, Mantels and Tile Co., Limited.
Vokes Hardware Co.
David McGill.

TILE AND SEWER PIPE MOULDS.
London Concrete Machinery Co., Limited.
Francis Hyde & Co.
Smith Marble & Construction Co.
E. F. Dartnell.

VALVES.
Gurney Foundry Company, Ltd.
Kerr Engine Co.
Somervale, Limited.
Taylor-Forbes Co.
Dominion Radiator Co.

VENTILATORS.
Wm Stewart & Co.
Sheldons, Limited.

WALL HANGINGS.
Deecker & Carlyle.

WALL HANGERS.
Taylor-Forbes Co.
Vokes Hardware Co.

WATER HEATERS.
Somerville, Limited.

WINDOW SCREENS.
Wm. Stewart & Co.

WATERWORKS SUPPLIES.
Somerville, Limited.
Kerr Engine Co.
Mussons, Limited.
Dominion Radiator Co.

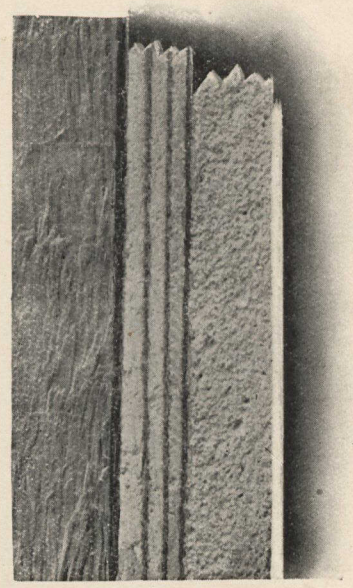
WHEELBARROWS.
London Concrete Machinery Co., Limited.
Vokes Hardware Co.

WIRE ROPE AND FITTINGS.
B. Greening Wire Co., Limited.
Otis-Fensom Elevator Co., Limited.
Mussons, Limited.

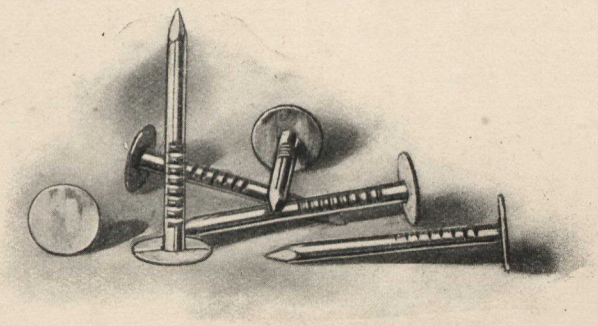
AN INDEX TO THE ADVERTISEMENTS

SACKETT PLASTER BOARD—Instead of Lath

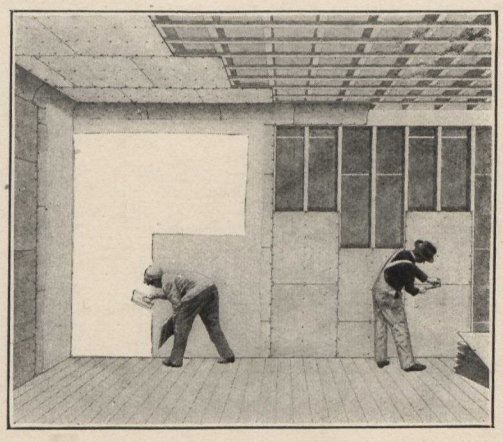
What the Architect and Builder desire to know:
First—What are its demonstrated advantages over older methods?
Second—What has experience proven to be the method of application necessary to secure best results?



Sectional View (full size) of Sackett Plaster Board, applied to Wooden Stud, with ¾-inch grounds.



Large Head, 1¼ inch 11½ Wire Nails best adapted to secure Sackett Plaster Boards in place.



Method of applying Sackett Boards to Walls and Ceilings.

FIREPROOF AND ECONOMICAL

Sackett Plaster Boards have been successfully used since 1891 in thousands of buildings of all classes, including small cottages, prominent hotels, costly residences, churches and theaters.

Walls and ceilings of *Sackett Plaster Boards* will be DRY AND READY IN HALF THE TIME required when lath is used, as less than HALF THE QUANTITY OF WATER IS NEEDED.

LESS MOISTURE means LESS DAMAGE from warped and twisted trim and woodwork.

Sackett Plaster Boards are accepted by BUILDING DEPARTMENTS and UNDERWRITERS for slow-burning construction on the same basis as metal lath.

Walls and ceilings properly plastered on *Sackett Plaster Boards* will show NO CRACKS OR DEFECTS other than those caused by settlement of the building or the shrinkage of timber; and, owing to the perfect adhesion between the plastering materials and the boards, THE PLASTER WILL NOT FALL.

Their SUPERIOR INSULATING QUALITIES make warmer houses with less fuel. The first cost is NO MORE than good work on wood lath, and LESS than on metal lath.

Sackett Plaster Board is an EFFICIENT AND ECONOMICAL FIREPROOFING, not only for walls and ceilings, but between floors, and for protecting exposed wooden surfaces in mills, warehouses and industrial structures. *It is also used extensiively instead of lumber as outside sheathing under weather boards.*

Sackett Plaster Board comes in sheets or slabs 32x36 inches, ready to be nailed direct to the studding, furring or beams.

Carried in stock by up-to-date building-material dealers everywhere.

General Directions for Application

To cut Boards, use an ordinary saw, or score with Lather's hatchet and break on straight edge.

In nailing use 1¼-inch 11½ wire nails with large heads, like those shown in photograph (Fig. 2). Nails should be 4 to 6 inches apart, and driven home firm and tight to prevent any working under the plaster coat. One keg of nails will properly apply 8,000 square feet of Board.

For First-class Work We Advise ¾-Inch Grounds

The best results are obtained by applying a base coat, ¼ to ⅜ of an inch in thickness, of what is known in the plaster manufacturing trade as "Wood Fibre Plaster," which is simply a good grade Plaster of Paris (calcined gypsum) with which has been mixed the necessary retarder and about 100 pounds of wood fibre to each ton of plaster. This makes a superior brown coat without the addition of any sand; but to a good "Wood Fibre Plaster" as described above, 100 pounds of fine, clean sand to 100 pounds of "Wood Fibre Plaster" may be added without prejudice to resulting effects, thereby reducing the cost of the base coat, where suitable sand is conveniently obtained. Manufacturers of wall plaster mix the sand by machinery to "Wood Fibre Plaster" as required by purchasers.

The advantages of "Wood Fibre Plaster" over the ordinary sand mixtures are that it is *more pliable and stronger*, hence less liable to check or crack than sand mixtures, which are more brittle.

Stinson-Reeb Builders' Supply Co., Limited

904 Eastern Townships Bank Building **MONTREAL**

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