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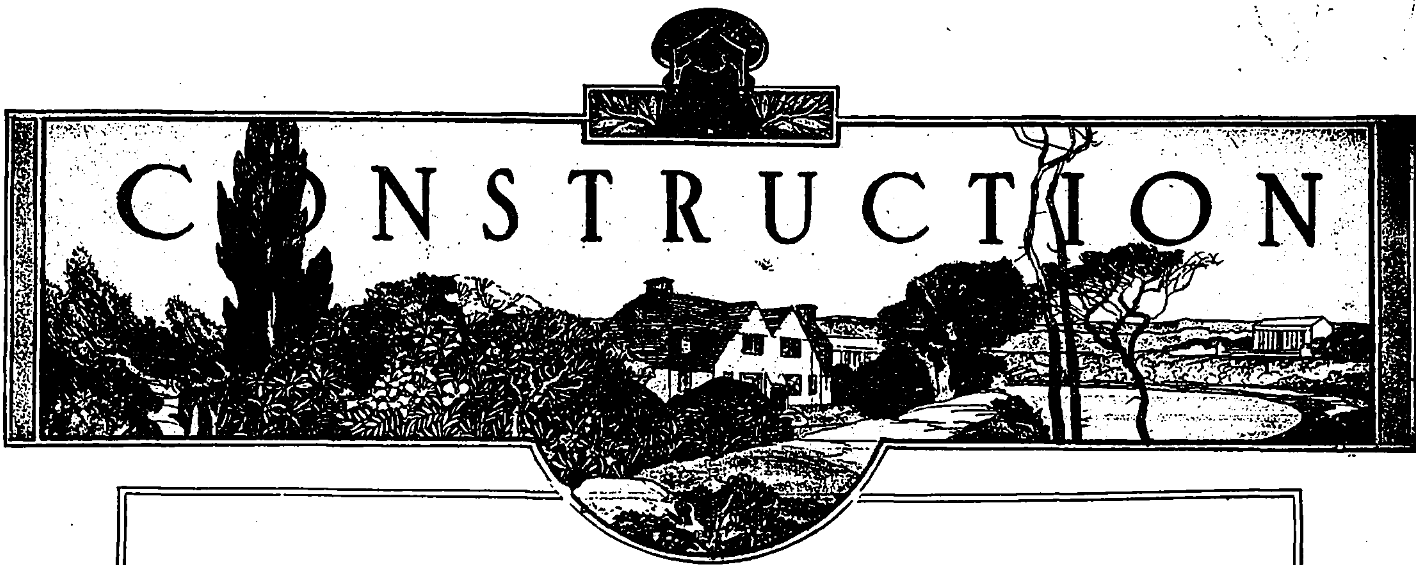

July, 1920 Volume XIII., No. 7

CONTENTS

Full Page Illustrations

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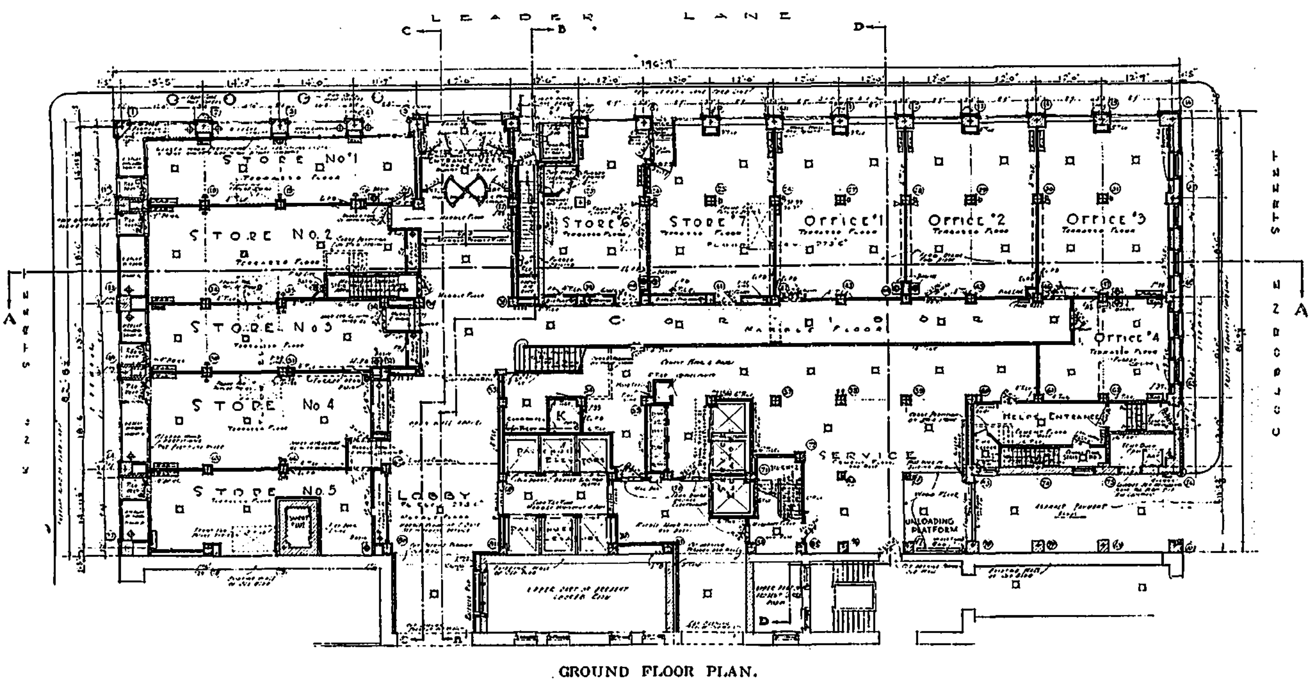
BRANCH OFFICES

MONTREAL NEW YORK

EIGHTEEN STOREY ADDITION TO KING EDWARD HOTEL, TORONTO, NOW IN PROCESS OF ERECTION.
ESENWEIN & JOHNSON, WATT & BLACKWELL, ASSOCIATED ARCHITECTS.



GROUND FLOOR PLAN.

A Sketch of the Old Houses of New England and the Middle States (1630-1700) and Early Canadian Examples

By Grattan D. Thompson.

AT the beginning of the seventeenth century that part of America now known as New England and the Middle States was made up of the colonies of New England, New Netherlands, New Sweden and Maryland. To-day New England includes the states of Maine, New Hampshire, Massachusetts and Connecticut; New Netherlands, the states of New York, Pennsylvania, and New Jersey. Pennsylvania and Maryland both took a part of New Sweden; the rest of Maryland is practically the same as the old state. Changes occurred continually up to the War of Independence, when the states were very much the same as they are now except that their western boundaries were not defined.

The period 1630-1770 includes all the work known as "colonial" and the early part of the "Georgian Style." The later "Georgian" work was merely a repetition on a smaller scale of the English Georgian. But these terms are confusing. Why use two names to describe one period? What is meant by the term "Colonial"?

Fletcher says: "During the eighteenth century buildings were erected which have been termed 'colonial' in style corresponding to what is known in England as Queen Anne or Georgian." He is fairly right as far as he goes, but that is not far enough. Another writer said: "The best buildings were erected after 1760." But what about the work of the seventeenth century? Surely those charming little cottages built in the seventeenth century are even more worthy of a name than the later examples which are so tinged with copyism. Strictly speaking, "colonial" means anything pertaining to a colony. The United States was a colony between the landing of the Pilgrim Fathers in 1620 and the War of Independence in 1770. Therefore the style developed between those dates is Colonial. The adoption of this interpretation allows us to include the early phase of Georgian influence on Colonial architecture and excludes the later buildings which were pure Georgian. Of course the student must understand that architectural periods cannot be cut and dried to coincide with any set date. Colonial architecture continued after the war till other styles gradually superseded it.

DOORWAY: OLD COLONIAL HOUSE, GEORGEVILLE, QUEBEC.

"Colonial" includes the architecture of all the colonies under one heading. But there are natural subdivisions owing to the different nationalities of the settlers. The two main divisions are the so-called "Dutch type" and the New England type. Others such as the plantation houses of Maryland and Virginia are merely variations of the two already mentioned.

NEW ENGLAND.

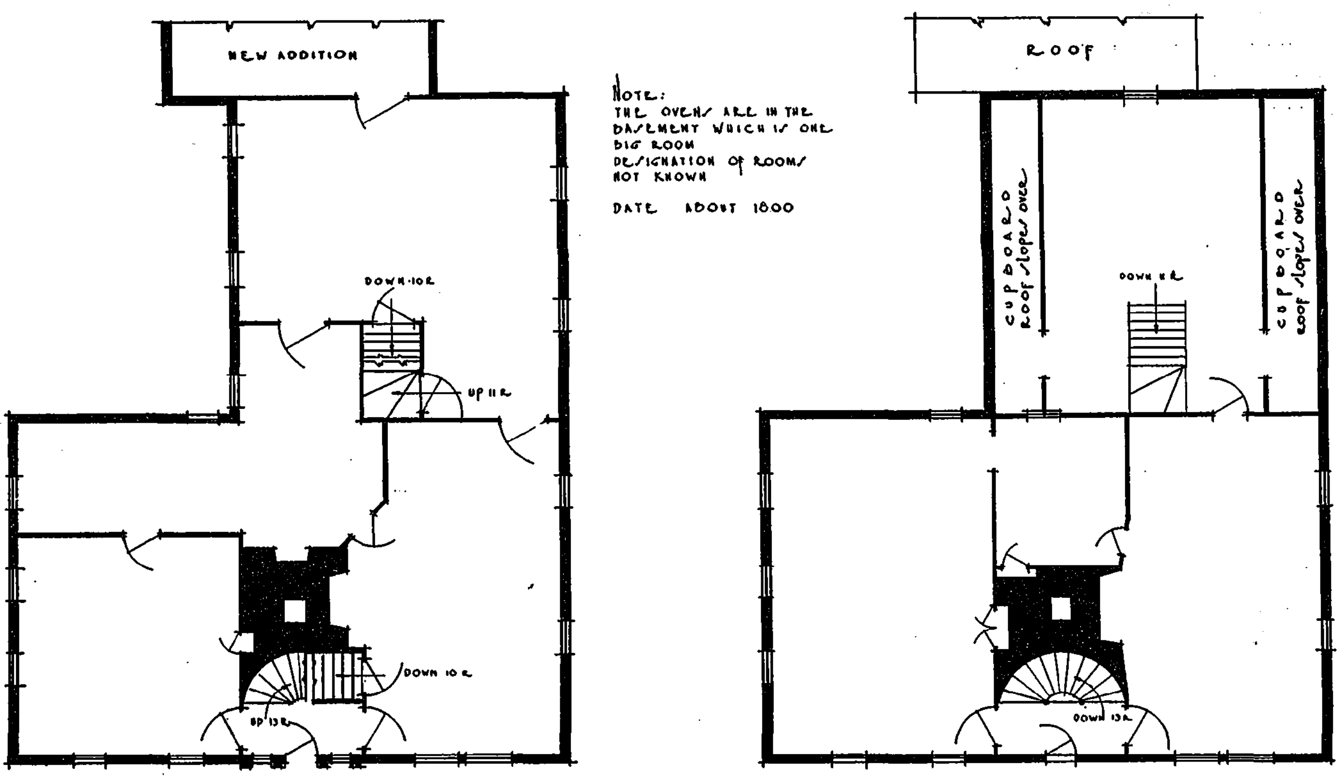
Though this colony was settled later than New Netherlands, the traditional dwelling seems to have been developed earlier than the Dutch type. The Capen House, Topfield, Mass., was built in 1683. There seems to be no Dutch example earlier than the eighteenth century. The Capen House has been completely restored, but it gives us a general idea of how these early English settlers built.

The traditional plan is rectangular, and in the early buildings is only one room deep. The distinguishing feature is the grouping of the fireplaces around one chimney stack. This was evidently a fire precaution, as the house was constructed of timber. The large stack is in the centre of the rear wall; immediately in front of it is the entrance hall off which the two rooms open. Into this tiny hall are packed the stairs which often had a rise of eight or nine inches. These lead to the two other rooms which were similarly placed to those downstairs. Later on more rooms were needed and an addition was put on the back to serve as kitchen and pantry.

OLD COLONIAL HOUSE, GEORGEVILLE, QUEBEC.

When we come to examine the construction we see the unmistakable influence of English building traditions. The framework was of wooden studs with an infilling of brick or clay, the typical English half-timber method. Over this was nailed a covering of clapboards. The framework rested on a foundation of field stones laid without mortar. If there were no cellar only piers were sunk, and the floor was made of clay mixed with straw and packed between the joists. The floors were framed on four or six girts with intermediate girts called summer beams. Into this were mortised the floor joists.

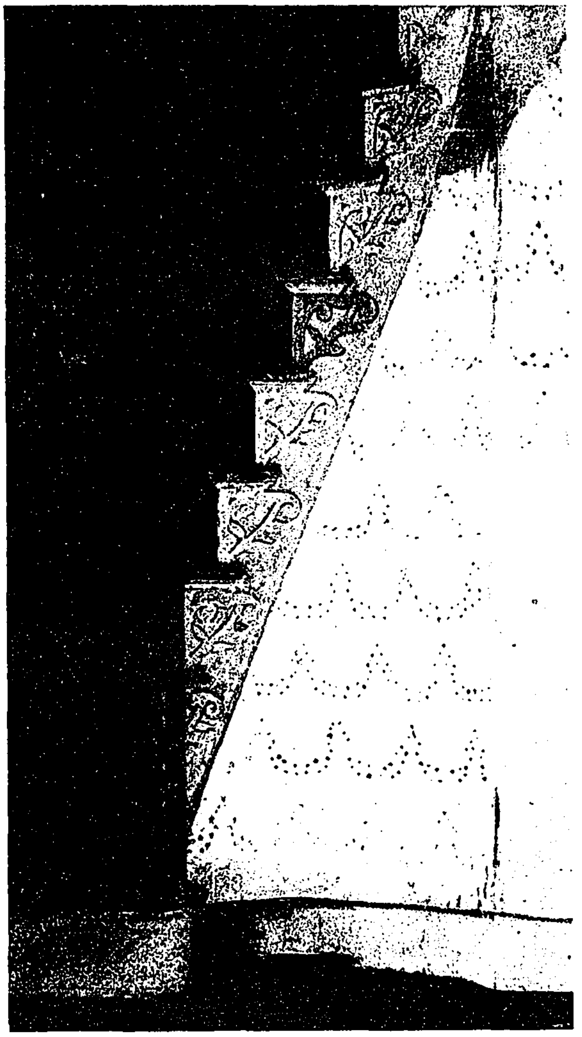
Pitched roofs were used exclusively till the beginning of the eighteenth century, when the gambrel form appeared. The rear slope was carried right over the addition at the back and gave the characteristic long sweep of roof. Another feature of these houses is the overhang of the first storey. It has been suggested that this is reminiscent of the fortified blockhouses. At first the idea might seem ridiculous, and rightly so if the overhang were only done by the usual method of framing. But there was another kind known as the "hewn" overhang. The solid posts of the ground floor were hewn back a few



OLD COLONIAL HOUSE, GEORGEVILLE, QUEBEC.
Showing how the Early Work spread just over the Border.

inches to allow the floor above to project. When a builder did that he must have been trying to copy something he had heard of or seen.

The openings were always regularly spaced, a central one with two on each side. The windows were casement with lozenge shaped leaded glazing. The slender proportions of the shutters which were always fitted to the windows added greatly to the dignity and charm of the house. In early examples the doorways were quite simple; later on they became more elaborate and were treated with classic motives though always retaining that delicacy of detail which was so characteristic of colonial work.



OLD COLONIAL HOUSE, GEORGEVILLE, QUEBEC.
Typical Colonial stairs (New England type) tucked up against the central chimney.

OLD COLONIAL HOUSE, GEORGEVILLE, QUEBEC.
Detail of interior door. The mouldings are all very simple and delicate.

The best examples of this type besides the one already mentioned are:

The Boardman House, Sagus, Mass. 1650.

The Ward House, Salem, Mass. 1654 (restored). This is one of the few examples with gabled roof.

The Adams House, Quincey, Mass. 1681.

The Hancock-Clarke House, Lexington, Mass. 1681. The front was renewed in 1734 and is more classic than the rest of the work.

The Holabud House, Falls Village, Conn. 1735. The pitched roof chimney has been removed and a flat roof substituted.

The Old House, Farmington, Conn. About 1700.

The Old Colonial House, Georgeville, Canada, About 1800.

BRICK HOUSES.

Owing to the great quantity of timber available, wooden houses were the general rule, but there are some early brick houses. They were far more costly because the bricks were generally brought from England and Holland. These houses show the general characteristics of the early traditional type: the great difference is due to material. The chimneys were placed on the end gables instead of being grouped in the centre. The roofs are gambrel and of fairly steep slope. Dormers were introduced in the later examples and the openings were spaced in the usual symmetrical manner.

The earliest is the Cradock House, built about 1634, though some doubt is cast on this early date. The cornice projects slightly, and there is a string course at the first floor level. Small loopholes were put on each floor for defence. The dormers and porch were a later addition.

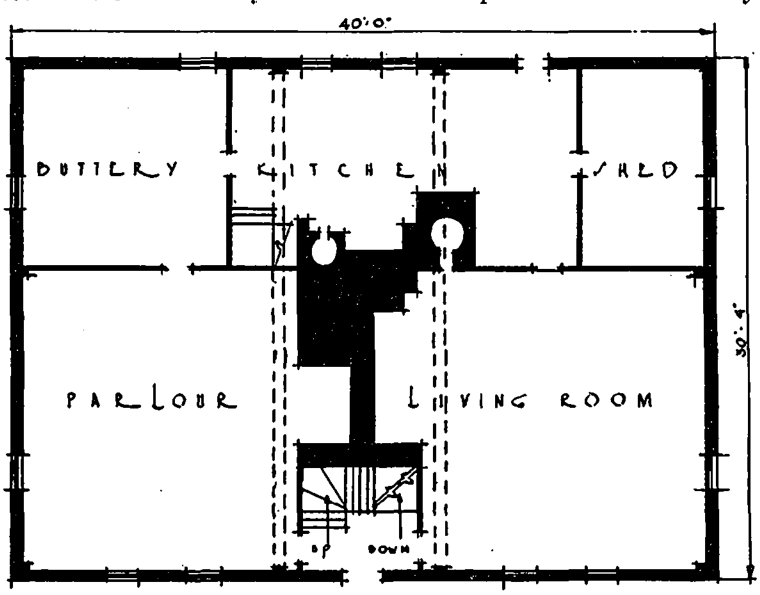
Another early house is the Hagen Garrison at Haverhill, Mass., built about 1680 or 1690. It is much the same as the Cradock House. The small windows at each end of the front elevation were probably loopholes at one time.

The other examples are later and show the beginning of Georgian influence. The Ruthard Derley House, Salem, Mass., 1761, and the Heldreth House, Concord, Mass., indicate the development of the style. Doorways are richer and the cornice more elaborate.

DOORHEAD: OLD COLONIAL HOUSE, GEORGEVILLE, QUEBEC.

QUEBEC AND ONTARIO.

Before going on to the later development of Colonial work, brief mention must be made of the effect of this architecture on the early buildings of Canada. As was only natural, the New England type spread over border, and at Georgeville on Lake Memphremagog, close to the State of Vermont, is a perfect example of an early New England house. The plan shows all the characteristics of the type, and the detail throughout is very delicate. The house has been bought by an American, and is being restored by the old village carpenter, to whom it is almost sacred. In it are some old chairs, which are the same date as the house, about 1820.



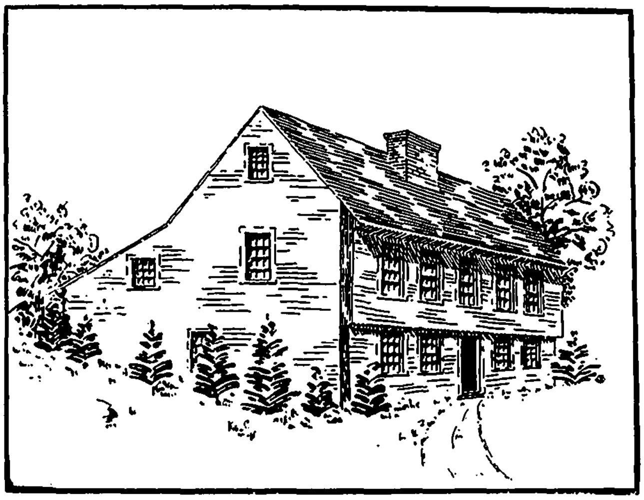
BOARDMAN HOUSE, SAGUS, MASS.
The earliest type of New England house, showing the method of grouping fireplaces.

As soon as we leave the border, traces of the New England influence disappear, and we find the French-Canadian stone house. This, in my opinion, shows a strong resemblance to the Dutch Colonial house. The material, the placing of the chimneys on the end walls, the hipped roof with the long, sweeping curve and large projection at the eaves, which, in most cases, continues over the gallery, are all reminiscent of many an old dwelling in New Jersey. Montreal and the surrounding country is rich in examples of these old French houses.

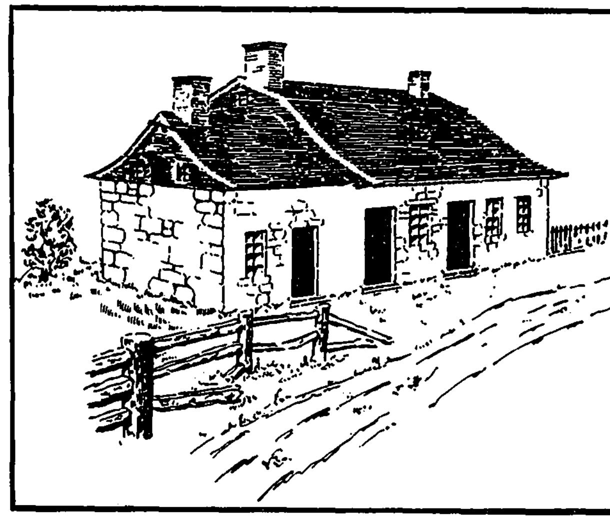
In the district around Grimsby, Ontario, there are other interesting examples of Colonial influence. Here and elsewhere in Eastern Canada these houses would well repay a little study.

THE MIDDLE STATES.

As the old name New Netherlands implies, this part of the country was settled by the Dutch. Its architecture has been called Dutch Colonial, but the term is misleading. Lower New York and New Jersey, where we find some of the best examples, ceased to be a Dutch colony in 1664, and its earliest dwellings, which were probably log cabins, have disappeared. Nor does the style display any markedly Dutch characteristics. But the traditional houses are quite distinct from those in New England. So strong did the local tradition become that it continued unmodified to the end of the eighteenth century. The Dutch settlers were little influenced by their English neighbors: where the English settlement ended the type of house immediately changed. This state of affairs lasted till the War of Independ-



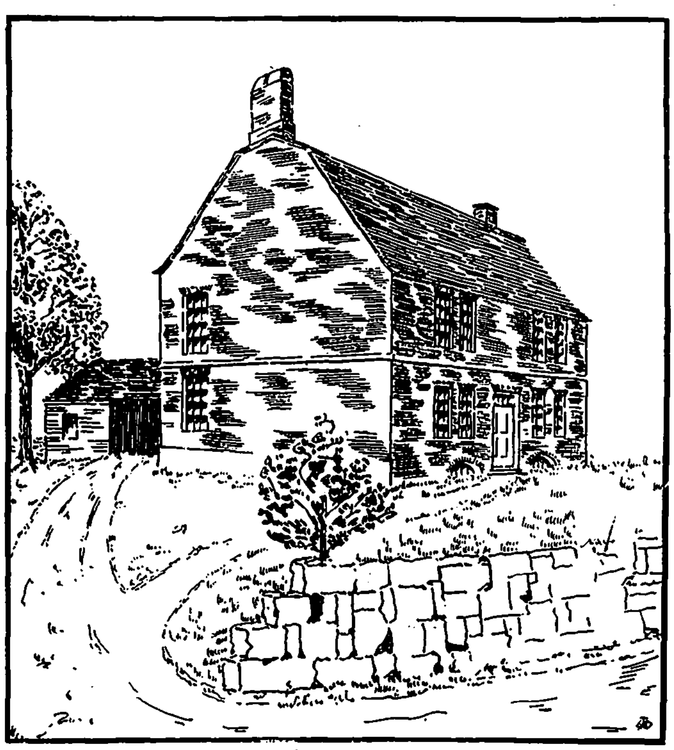
THE OLD HOUSE, PIGEON COVE, MASS.
A good example of New England house with the typical overhang of the second storey.



THE CRADOCK HOUSE, MEDFORD, MASS.
A quaint Dutch Colonial Example.

ence. The war broke the barriers, and English influence gradually asserted itself.

At first glance the plan of these appears quite distinct from that of New England, but on close examination we find that the main idea is the same. The change is due to the difference in material. Stone was the chief material employed, though there are examples in wood and also in roughcast. The use of stone may be due to the cheapness of labor, as the slave trade thrived in this district. Stone was just as plentiful in New England as here, though it was never used to the same extent. With stone, fire precautions were not so necessary; the chimneys were separated and placed on the end walls. (The chimneys in the farmhouses of the Province of Quebec are placed in the same position). The entrance is in the centre, but the hall, barred by no chimney stack, runs clear through to the back. On each side are two rooms, the larger in front, the smaller behind. The stairs in the early examples are unimportant for the attic was unfurnished and used only for storage. These houses were only one storey high, but covered more ground than those in New England. There was generally a wing at each end of the house, one containing the dining room and kitchen, the other used by the servants. Both were kept low and were roofed in the same manner as the main part.



THE DEMAREST HOUSE, NEW JERSEY.
An early brick house.

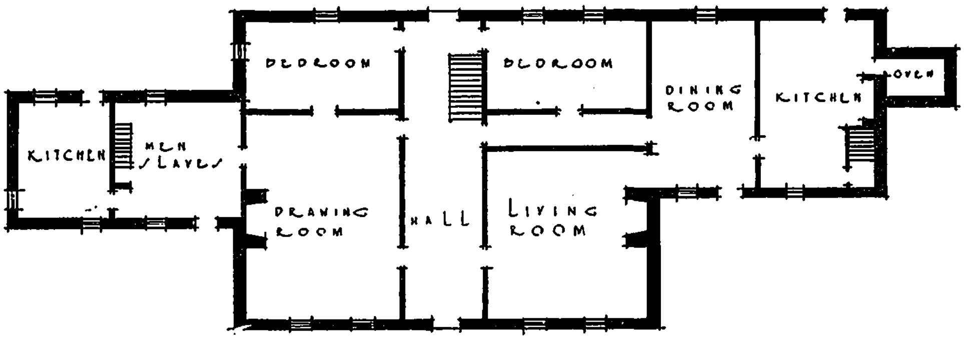
The roof was usually gambrel with long, sweeping curves and a large projection at the eaves. Plain hipped roofs were occasionally used. The great projection is one of the distinguishing characteristics of the type. It may have been due to the necessity of protecting the walls. The builders used ordinary clay from the fields, which served the purpose well enough but was washed out to a certain extent by the rain. Later on the overhang increased so much that posts were introduced to support it, and we commonly find galleries both at the front and the back. These roof eaves were often formed into a box cornice very delicately moulded. The cornice, window architraves and doorway are the only moulded features of the exterior.

In the early houses the attic was lighted by windows, usually three, in the end walls. When the attic became an extra storey dormers were introduced. In later examples they are a regular part of the design. As in New England, the spacing of the openings is regular, but the doorways never became as elaborate as those of the English. They were divided doors with heavy knockers.

The interiors were very simple. The broad, low rooms with the great oak beams showing, and the low broad fireplace gave a pleasing air of homeliness. Some of the best examples of the type are:

The Original Demarest House, New Jersey. 1700.

The Vanderbeck House, Hackensack, N.J. 1717.



THE HOPPER HOUSE, HACKENSACK, N. J.
Showing strong Georgian influence on later Colonial work. Note the end pilasters and the "Captain's Walk."

The Ackerman (Brinckerhoff) House. 1704.

The Terhune House, Hackensack, N.J. 1759.

The Old Homestead, Brooklyn, N.J. 1750.

THE EARLY GEORGIAN INFLUENCE.

During the first half of the eighteenth century communication between the Old Country and the new steadily increased. The Colonial settlers became wealthier and conditions of living generally improved. With this increased wealth came the natural desire to have larger and more imposing dwellings. The poor, of course, had to remain content with the simple houses, but something more imposing was demanded by the rich.

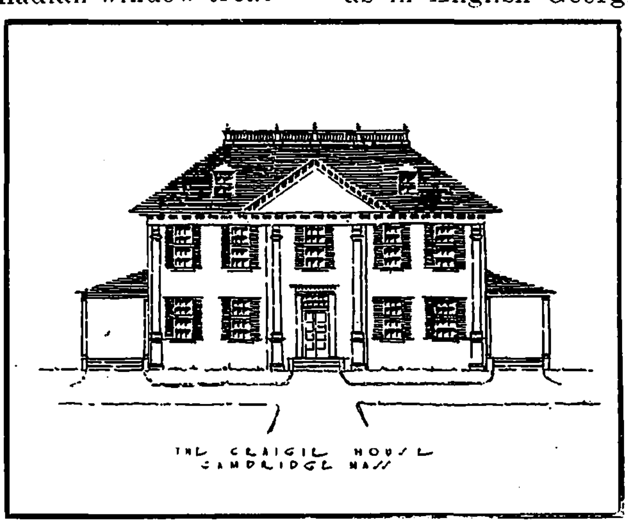
English Georgian was the field whence came the material for this new display. Its influence spread throughout the country irrespective of state borders. Traditional types seldom showed through the heavy coating of the new style, and the larger houses became, to all intents and purposes, reproductions of the English examples. At first we see evidences of the new influence in the increased amount of detail. The detail was classic freely applied. Cornices became heavier and richer, and later on were usually pedimented in the centre. Below this pediment was a typical Palladian window treatment. Doorways were greatly enriched by the use of columns, pilasters, etc. The shell-hood form of doorhead was very often used. It is evidently a genuine Colonial form as nothing of the kind is found in English work. Columned porches and verandahs were very common in the later examples. A favorite treatment was the use of long, slender pilaster strips extending from the ground to the cornice, one at each side of the door and one at each angle. The angle pilaster was generally found in wooden houses, and was possibly a convenient way of stopping the clapboarding.

The interiors were even more extensively treated. Panelling was largely used and mantelpieces were richly moulded and carved. But throughout there is a peculiar refinement which only occurs in Colonial work.

The plans remained rectangular with the stair hall in the centre. On one side was usually the large reception room and on the other were two smaller rooms, probably the dining and living rooms. With the increased number of rooms there came a corresponding poorness of service, a truly Georgian characteristic. The rooms are higher, but there are seldom more than two storeys and an attic. The secondary buildings were usually disconnected, though sometimes in New York and New Jersey we see evidences of tradition in the use of one or more wings.

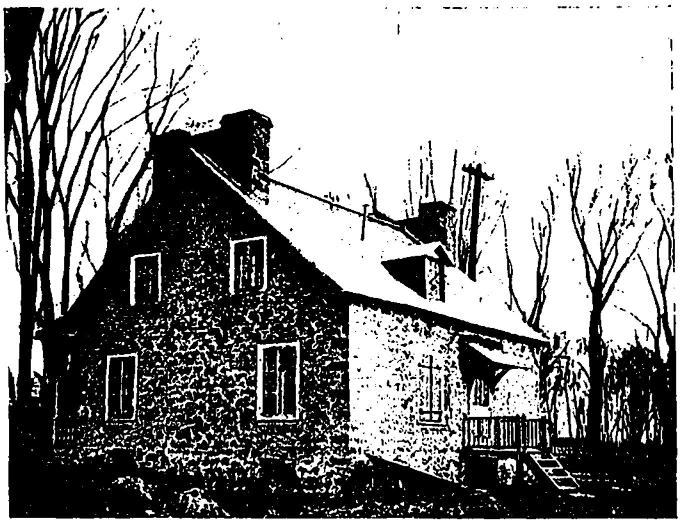
Roofs were hipped or partially so, the space on top being flat with a balustrade round it. This was a common feature and was known as the "Captains Walk." Probably the old sea captains wanted some deck to pace. Dormers were gabled and chimneys were equally spaced at or near the eaves. The openings are still regular, though often more than the traditional five. Symmetry was an essential and, as in English Georgian work, everything was sacrificed to it.

Colonial architecture takes on a new interest by the study of these early buildings. There is great charm in their simplicity and quiet dignity and much inspration in their straightforward construction. To be fully appreciated they must be seen in their surroundings, the beautiful rolling country of New England, and the Middel States.



THE CRAIGIE HOUSE, CAMBRIDGE, MASS.
A later example showing Georgian influence in the regularity of the plan.

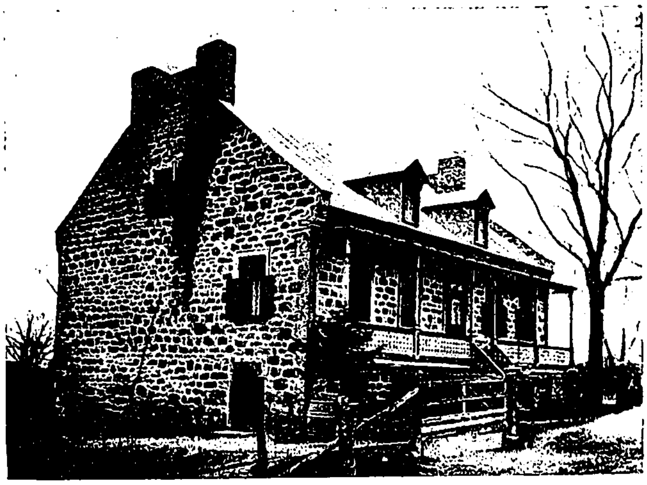
OLD HOUSE, COTE DES NEIGES ROAD, MONTREAL.



OLD HOUSE, AHUNTSIC, QUEBEC.

DETAIL, COTE DES NEIGES ROAD, MONTREAL.

OLD HOUSE, NEAR ST. VINCENT DE PAUL, ILE JESU, QUEBEC.



OLD HOUSE, NEAR ST. EUSTACHE, QUEBEC. (ABOUT 1820.)

OLD HOUSE, ST. EUSTACHE, QUEBEC. (ABOUT 1830.)

The Town Planning Institute of Canada

By Alfred Buckley, M.A.

THE Town Planning Institute of Canada was formed a little more than a year ago with the object of advancing the scientific study and practice of town planning in Canada. It was felt by the promoters that there was need of an organization that would bring architects, engineers, surveyors and landscape architects into definite professional relation with town planning with a view to qualification for the increased demand for town planning work. In England and the United States scientific town planning has become a definite profession and the Town Planning Institute of Great Britain has been the means of guaranteeing qualification when the demand has come from towns, cities and rural districts for the preparation of plans for future development. Engineers, architects and surveyors have shown themselves alive to the professional importance of the town planning movement and have been perfectly willing to submit themselves to the necessary studies and examinations that have been imposed by the Institute.

It is recognized that the most authoritative qualification might best come from the universities and it is part of the object of the Canadian Town Planning Institute to promote educational courses in the Canadian universities and make town planning a branch of applied science with the imprimatur of the university.

The Toronto University has taken the first step in this direction and has already held a series of lectures on town planning. General Mitchell, Dean of Applied Science, informed the members of the Institute at the second annual meeting held in Ottawa on July 5th, that he hoped more progress would be made in this direction in the immediate future. The Professors of Architecture in McGill University have also considered the question and are strongly in favor of the movement if the necessary funds become available. There is clearly a great opportunity here for wealthy and benevolent citizens to endow town planning chairs in the universities of Canada.

Meanwhile the Town Planning Institute, now composing 114 members, has set itself to do the preliminary work of qualification. More and more demands are being made from towns and cities for the services of professional town planners and already the demand exceeds the supply. Canadian patriotism likes to think that when important Canadian work has to be done its own sons should have an opportunity to do it. The Federal plan for the districts of Ottawa and Hull cost $80,000 and the work was given to an American town planner. There are some suggestions from professional men that no private body of men can set themselves up as examiners of their fellows, but it requires little thought to see that this is not reasonable. Education would have progressed very slowly if colleges had not been founded by private persons whose object was to supply men of experience and study as examiners of their fellows. Clearly until the universities decide to make town planning a specific branch of instruction in applied science, an organization such as the Town Planning Institute of Canada may do valuable work in promoting qualification for town planning practice.

The first year of the Institute has been largely occupied with organization and enrollment of members. At the Second Annual Meeting a constitution was presented and occupied most of the time of the conference.

The objects of the Institute are declared to be:—

(a) To advance the study of town planning, civic design, and kindred subjects, and of the arts and sciences applying to these subjects.

(b) To promote the scientific and artistic development of land in urban and rural districts.

(c) To secure the association of those interested in the study of town planning and to promote their interests.

The attention of engineers, architects, surveyors and landscape architects may well be called to the last five words under (c). It cannot be said that the promoters of the Institute desire anything for themselves that they do not desire for their colleagues. The time seems to have come for the differentiation of propaganda from practice or for the recognition of the fact that practice is the best kind of propaganda. Canada needs town planning but she also needs town planners. There have been many volumes written about the need of town planning and the economic and human disasters that have followed the lack of planning. It has been pointed out over and over again that the high taxation of cities is mostly due to the lack of planning for different uses, to the need of the zoning of cities. It was stated at a recent Chicago conference on zoning that practically all the large towns of America "now feel that it is almost impossible to continue further without the adoption of a building zone plan." It has been shown that many cities have spent millions of dollars of the people's money in repairing their own mistakes, due to the lack of foresight in planning. The time seems to have come for the definite organization of a body of men who shall be qualified to "take the job" when the call comes. This is the object of the Town Planning Institute of Canada.

The officials elected for the ensuing session were:

President, Thomas Adams, Ottawa; vice-presidents, Dr. E. Deville, R. H. Millson, and Noulan Cauchon, of Ottawa; council, J. B. Challies, Ottawa; H. B. Dunington-Grubb, Toronto; J. P. Hynes, Toronto; Dr. Otto Klotz, Ottawa; James Ewing, Montreal; T. McQuesten, Hamilton; Dr. E. Nadeau, G. Todd, Montreal, and Prof. Nobbs, Montreal; librarian, W. D. Cromarty, Ottawa; secretary-treasurer, F. D. Henderson.

Four committees with chairmen were also appointed as follows:

Public Education on Town Planning, Chairman, Brig.-General Mitchell, Dean of the Faculty of Applied Science, Toronto.

Legislation Committee, Chairman, J. P. Hynes, Toronto.

Publicity and Literature Committee, Chairman, A. Buckley, Ottawa.

Ways and Means Committee, Chairman, Jas. Ewing, Montreal.

The Publicity and Literature Committee expect to issue a bulletin on the progress of town planning in Canada for the information of the members and the press.

Information and forms of application may be had from the Secretary, F. D. Henderson, Topographical Surveys Branch, Ottawa.

A Message from Mars

The Martians are much disappointed with our town planning, according to a statement made by Dr. Otto Klotz, Director of the Dominion Observatory, at the Second Annual Meeting of the Town Planning Institute of Canada held in Ottawa on July 5th.

Following is the text of Dr. Klotz's communication:

"Last Thursday night after the static of the atmosphere had quieted down following the wireless to Mars about the sessional indemnity, I got in communication through the astronomer royal of Mars with its chief town planner, and he gave me a summary of what he had seen at their observatory after viewing the earth, particularly Canada and the United States.

"You all know that the inhabitants of Mars, from the fact that Mars is much smaller than the earth, are giants compared with us. You see there is less pull on Mars than on the earth—their civil service commission was instituted long, long ago. On account of the decreased weight of things the Martians will do more work in one day than any union here would allow to be done in three. For their government telescope, our telescope would only serve as an eye-piece; so you can readily understand that they know more about the earth than we do about Mars.

"These Martians are of great intellect, where we weigh our gray matter by ounces, they measure theirs by the bushel. But to get to the summary sent, I may say that we tuned our wireless to 20,000 metre wave-length, and with our amplifier got good notes.

"The brief report began by saying that he did not understand why we were possessed to lay out all our towns and cities in rectangular blocks; of course he had not heard that Euclid had invented that banal figure of a parallelogram to which we were glued. He wondered if that was a community plan or only of a single individual who was allowed, without let or hindrance, to inflict such a plan, having roads straight up hill and down hill, quite oblivious of the topography and configuration of the ground, and lacking main thoroughfares and arteries. I didn't get a chance to talk back to him, to explain how in this free country we have hitherto acted.

"Next he spoke of the dark canyons in some of the larger cities, where sky scrapers border the streets, excluding light and air from the inhabitants.

"He noticed too vast volumes of smoke emanating from different parts of the cities from various industries drifting across the city. This seemed strange to him. If smoke there must be why not confine it to one part of the city so that the prevailing winds carry it away from the city for the comfort of the inhabitants. 'We on Mars as you know,' he continued, 'have no smoke at all, our power and heat we derive from electricity directly from the sun, and also from the latent energy stored in atoms.'

"He noted too the promiscuity of our buildings—residential, commercial, industrial, tenement, suburban—planless, senseless, often vicious.

"Like ants he saw the inhabitants moving about; swarms where there were least habitations with fresh air and sunlight and open patches. Again he wondered whether we had no gray matter and consideration for the welfare of the masses. 'We do things differently on Mars,' he said. 'Every Martian is entitled to so many cubic feet of fresh air and sunlight, and every child to so many square feet of playground.'

"He admired our woods and rivers and mountains and plains, and said that nature had been more kind to the earth than to Mars, but that the inhabitants of the earth had evidently not properly made use of these gifts, and utterly failed in wisely planning for community living.

"'With us,' he continued, 'community living is planned and each community and place has its individual plan, adapted to the inhabitants and to the ground and surroundings and for the welfare of all.

"'You, who have so much on the earth and so diversified a surface, that you have all the material and circumstances for making beautiful, healthful cities where the work and inspiration of man can combine with nature's gifts to serve well the people in every walk of life, have great opportunities for benefiting the public and for leaving a rich heritage to posterity.'

"His telephone rang and he was off, leaving me pondering on this message from Mars."

Standardization in Building Construction

Greater production, the need of the hour, says a contemporary, is greatly influenced by labor and market conditions. These, to a large extent, are beyond the control of those directly responsible for management, but the important factor of standardization is largely in their hands. Particularly under unstable labor and market conditions will the beneficial influence of standardization be evident and under normal conditions its value in contributing to maximum production will be most apparent. In other words, standardization means greater production results under all prevailing labor and market conditions.

Standardization has already accomplished wonders in the manufacturing field, whether applied to the smallest and simplest manufactured article or to the most complicated mechanism. It is because of standardization that many American-made machines or products have been able to compete successfully in all parts of the world with goods manufactured locally.

Standardization in the construction industry, however, has lagged. It has not responded as it should have to the evident trend in other fields. It should be obvious that the construction industry loses much by the haphazard variety of design and construction still prevalent. Standardization would decrease cost and time of construction and would save cost and time in planning. It would tend also toward a more uniformly satisfactory, finished structure.

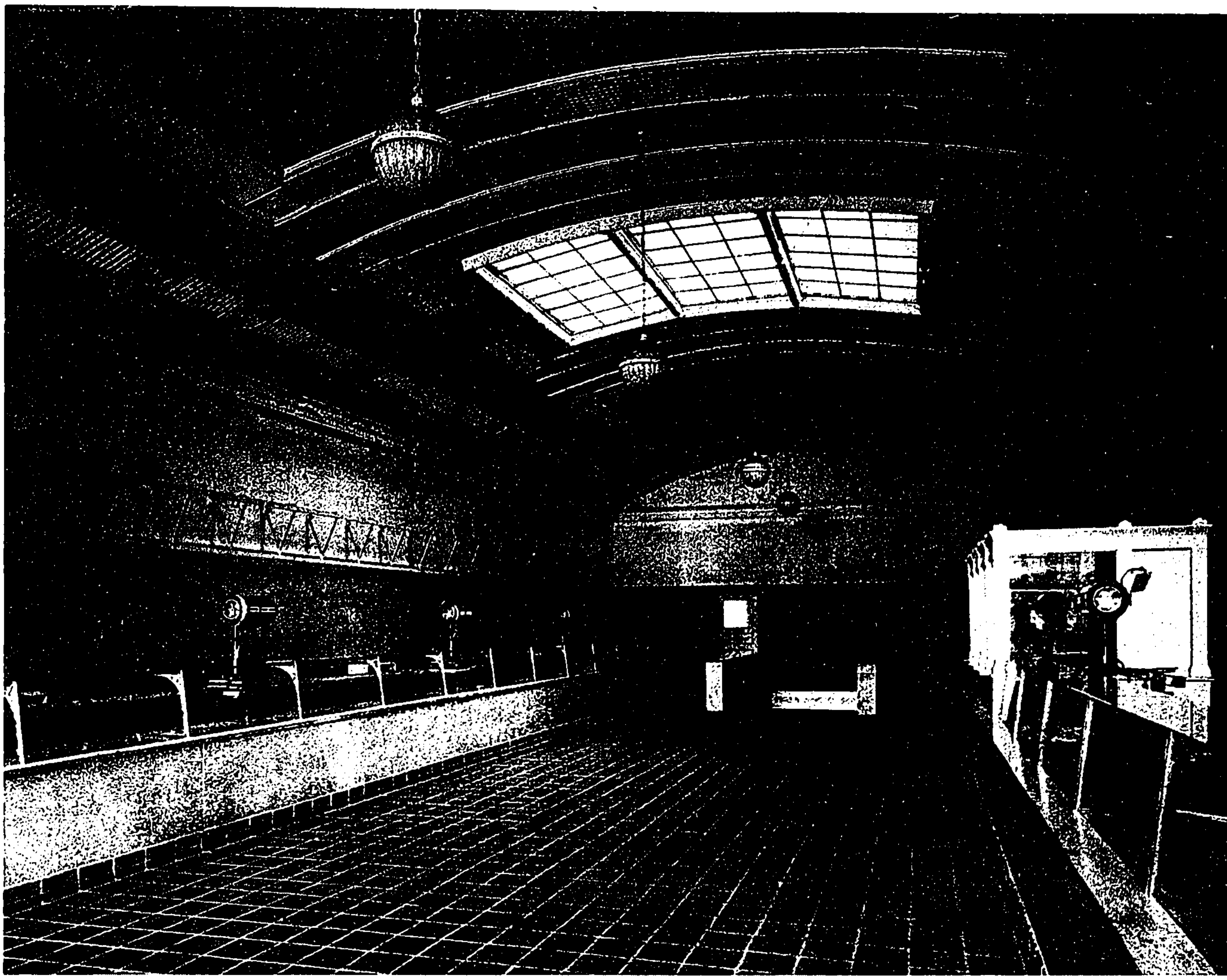
Opponents of standardization fear that through it architectural beauty and individuality may be sacrificed. This fear is unfounded, because no standardization should be carried to such an extreme that it produces monotony. In building construction, standardization should be confined to those operations and details which, while securing maximum utility, will enable the builder to produce a structure that will harmonize with its surroundings. Not only need architectural beauty not be sacrificed, but many offensively overdone attempts at adornment would be conspicuous by their absence. Sane standardization would reflect the spirit and quality of our life and activity without permitting conglomeration of plain walled buildings, jumbled up with every imaginable variety of facades which are within the range of vision at any spot on any one of the principal business streets of every large city. A standardization which would standardize good architecture should be welcome.

As a natural result of standardization in various manufacturing processes, a certain degree of it has been forced on the construction industry. Rolled shapes, commercial timber sizes, plumbing fixtures and millwork for example, are available to the designer in a variety of standard dimensions and he departs from these only when he is prepared to pay the penalty of the high cost of "specials."

Of all types of construction, concrete is least affected by available sizes. The designer is allowed the utmost latitude, but this should be taken advantage of only when necessary to satisfy some particular requirement. Minute variation in sizes of floor beams, columns or girders is inexcusable in concrete construction because the cost of forms represents a large portion of its total cost and increases rapidly with refinement in sizes. It should be borne in mind that beams larger than necessary reduce the amount of reinforcing required and that a design calling for larger members in order to secure uniformity in size has the double advantage of saving steel and simplifying form work. The figuring of every column, beam and girder to the smallest fraction of an inch, and producing a variety of dimensions differing but slightly one from another, result inevitably in an unnecessarily costly building.

Heating Rooms by Power

In a lecture recently delivered before the Institution of Civil Engineers in London, England, Sir Dugald Clerk revived an interesting proposal made by the late Lord Kelvin for the heating of rooms. This proposal is not easy to explain without diving into mathematics and the abstruse laws of heat, but it may be expressed as a process of using an engine to extract some of the heat from cold air outside a room and adding it to the heat of the air inside the room. The curious and puzzling thing about this process is that the heat so added is under certain conditions, much greater than the heat equivalent of the work done by the engine. In theory, therefore, an electric motor may be used very efficiently to warm a room. Whether the notion will work out satisfactorily in practice remains to be seen, but in view of the ever-increasing cost of fuel this fascinating problem is likely to be soon attacked by British engineers.



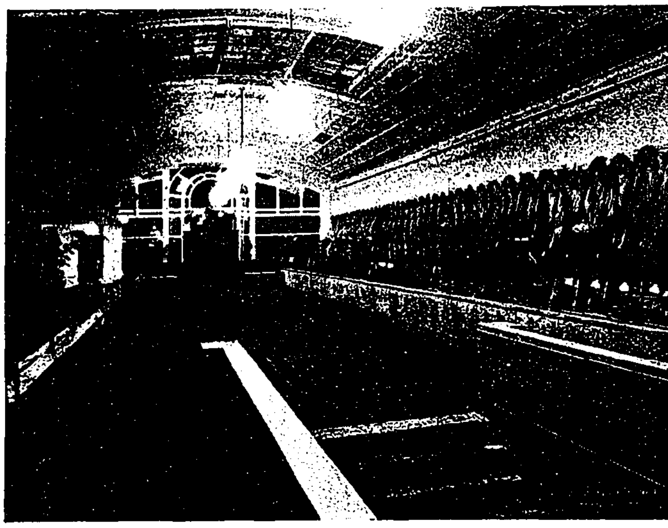
DOWNTOWN RETAIL MEAT AND PROVISION STORE OF WM. DAVIES CO., LIMITED, QUEEN STREET, TORONTO.
HYNES, FELDMAN & WATSON, ARCHITECTS.

Wm. Davies Co. Store, Toronto

Retail meat and provision stores have been so long rooted in the traditions of sawdust floors and commonplace fixtures that it has seemed a slow process in bringing them under proper architectural influence. At last, however, this is being accomplished. In the new downtown premises of the Wm. Davies Co., Limited, at 29 Queen street west, Toronto, of which protographic illustrations are presented herewith, one at least observes an establishment of this kind which is designed along entirely new and attractive lines. The architects have not only shown a thorough grasp of the owners' requirements, but in working out their problem have produced a most striking integral development. In the matter of arrangement and equipment the scheme has been so considered to arrive at a result which gives the utmost in the way of a systematic plan and at the same time to provide every facility and convenience to comfortably assist customers in doing their shopping.

Entrance to the store is through a revolving door into a spacious and decidedly inviting interior. The ground floor is devoted to the display of fresh meats and provisions, and the basement section, which is approached by marble staircase, is arranged for the display of smoked fish and general groceries. Grey Tennessee marble enters largely into the scheme on both floors, this material being used throughout for the walls and counters. The floors are of red tile with the tile work brought up on either side to form the base of the counters. The attractiveness of the scheme in itself is purely the outgrowth of its practical character and the materials used. The treatment throughout is very simple, and the only decorative touch to be seen is in the low relief ornament of the arched ceiling.

Considering the character of the design in relation to the nature of the business carried on, it is not only successfully developed from the standpoint of utility and appearance, but what is equally important in a meat and provision store, takes into account the element of sanitation as well. All food products are displayed



VIEW TOWARDS ENTRANCE.

BASEMENT FLOOR.

DOWNTOWN RETAIL MEAT AND PROVISION STORE OF WM. DAVIES CO., TORONTO.
HYNES, FELDMAN & WATSON, ARCHITECTS.

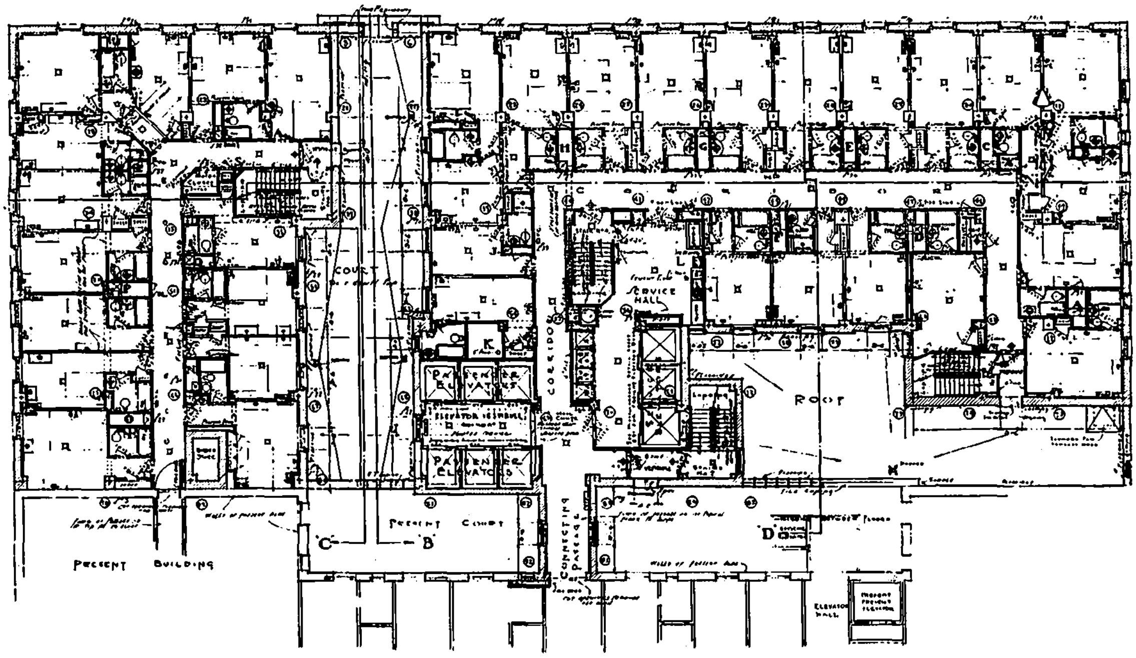
under glass along marble counters which extend a distance of 80 feet on either side of the wide aisle forming the public space. Both the counters and the window display space are equipped with a modern refrigerating or cooling system which ensures a constant cold temperature in all seasons. Beneath the counters are a series of compartments for the storage of supplies, and which results in an arrangement which gives the clerks the maximum of working space. A feature of these compartments is the lighting arrangement whereby the interior of the locker is automatically illuminated by electricity when the sales clerk opens the door, the light being extinguished again as soon as the door is closed.

Another feature which contributes to the appearance of the place is the fact that no carcass cutting is done in the store. A large cutting room at the rear provides facilities for this purpose, thus leaving the salesman free to devote all his attention to serving customers. Apart from a little slicing of meat, no cutting is done behind the counters.

The basement section repeats to a large extent the arrangement and decorative scheme which is carried out on the floor above. Refrigerator equipment similar to that on the ground floor has been installed, and under glass-topped counters are displayed various kinds of fish — the fresh fish occupying the right hand side and smoke or cured fish the left hand side. The cashier's office faces down the store, while at the further end is situated the grocery section, equipped with appropriately designed fixtures.

Accommodations for bringing supplies into the store has been amply provided for by means of elevator to the street level. This descends into the basement, where separate storage rooms are provided in which fresh meats and fish can be held

EXTERIOR.



TYPICAL FLOOR PLAN, NEW ADDITION TO KING EDWARD HOTEL, TORONTO.

until required. A tracker bar, running the entire length of the basement on one side, permits of carcass beef being brought from the chill room to another elevator, where it is hoisted to the cutting room at the rear of the main floor.

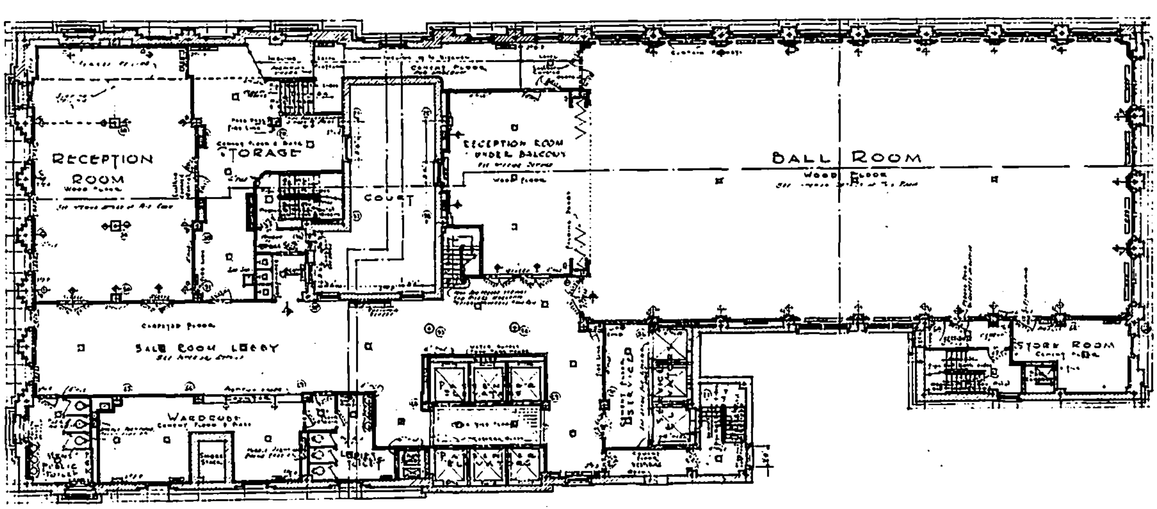
The building, which has been remodelled for its present purpose, is four storeys in height. The facade is chiefly of glass, with the color scheme in green and white. The head office of the retail business of the company, which conducts the largest chain of meat and provision shops in Canada, is on the second floor, while on the other floors, dressing rooms and lunch rooms have been provided for the comfort and benefit of the working staff.

King Edward Hotel Addition Toronto, Ont.

The new addition to the King Edward Hotel, Toronto, will give, when completed, an additional 530 rooms to the present hotel. The new wing takes in all the land between the easterly side of the present King Edward Hotel to Leader Lane, and is bounded on the north by King Street and the south by Colborne Street.

The promoters having dedicated to the city a portion of its property along Leader Lane, this lane will be used for vehicular traffic more than at present, and in the new hotel an entrance is located on this street extending through to the present lobby.

The new building will be eighteen stories high, the first floor will contain elevator lobby, service rooms, etc., and on King Street and Leader Lane there will be modern stores with entrances and show windows both from the street and the hotel corridors. These stores will be modern in every respect with marble floors, attractive show windows, etc., and will have ample storage rooms below each, with special service elevator for taking goods down to them.



BALL ROOM FLOOR PLAN, NEW ADDITION TO KING EDWARD HOTEL, TORONTO.

The mezzanine floor will contain lounge space, executive offices, and will also have a series of modern offices facing Leader Lane and King Street which may be rented either separately or en suite. As shown on plan it will be noticed that cafeteria on this floor has no connection with the rentable portion, it being a complete unit by itself.

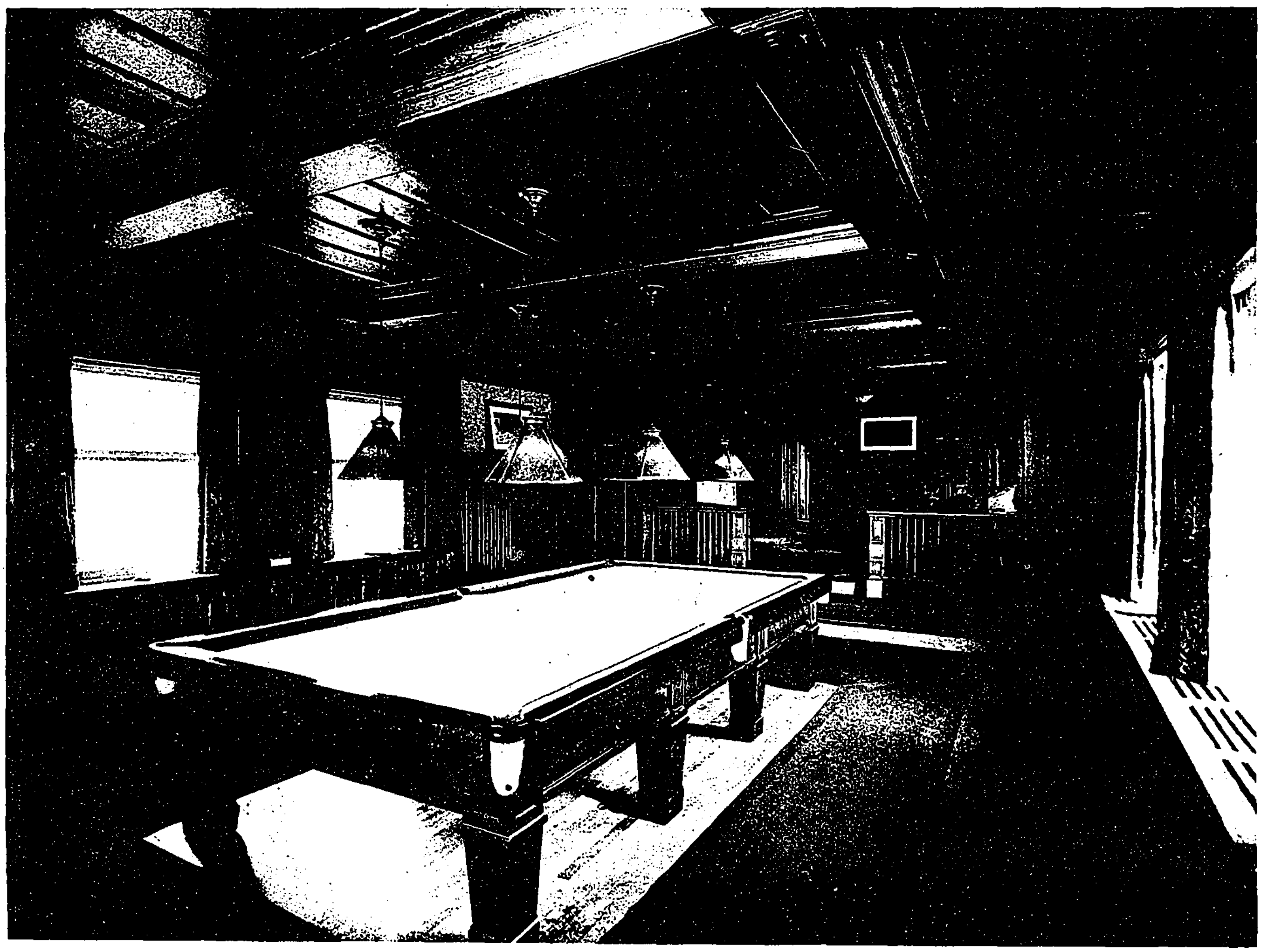
Above mezzanine will be fourteen floors of guests rooms, with connections at each of the first eight floors with the present hotel which is only eight stories in height. The guests rooms will be modern in every respect, well lighted and ventilated, and every room will have a bathroom in connection with it. A small proportion of these contain showers instead of tubs. Besides the guest rooms there are the usual service halls and maids' closets, etc. All bathrooms to have tile floors and walls.

On the upper floor is situated the ballroom along with the necessary wardrobes, reception rooms, etc., and on the mezzanine floor, which is practically on the same level as the ballroom balcony, is a kitchen for preparation of food when the ballroom is used as a dining room.

The building is fireproof throughout, being of steel skeleton construction with reinforced concrete floors. The exterior walls are faced with brick to match the present building, backed with interlocking hollow tile. Stone trimmings will be used on the lower floors and terra cotta on upper floors.

All frames and sash will be metal, and all doors between guests rooms and corridors will be fireproof, with metal trim.

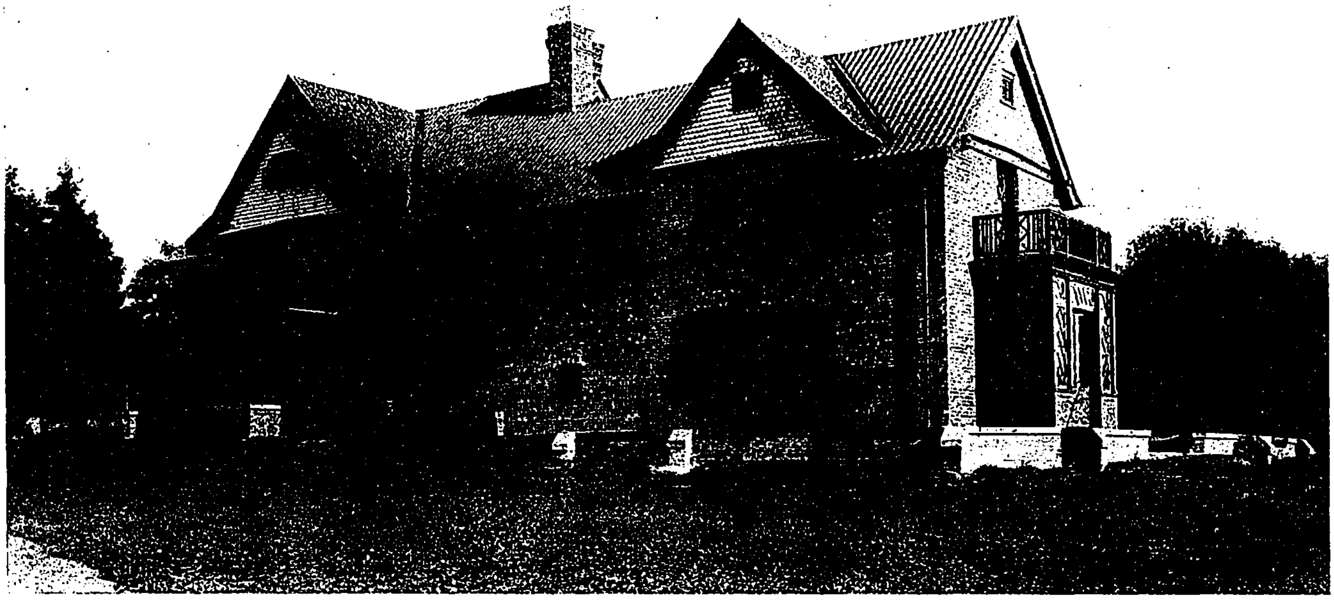
Special attention has been made for the safety of the guests in case of fire, there being more than the required number of hose-reels, and all exit-stairs are planned in such a manner that there is a vestibule at each floor open to the outside, thus in the event of a small fire breaking out in any room, there would be no danger of panic on other floors.

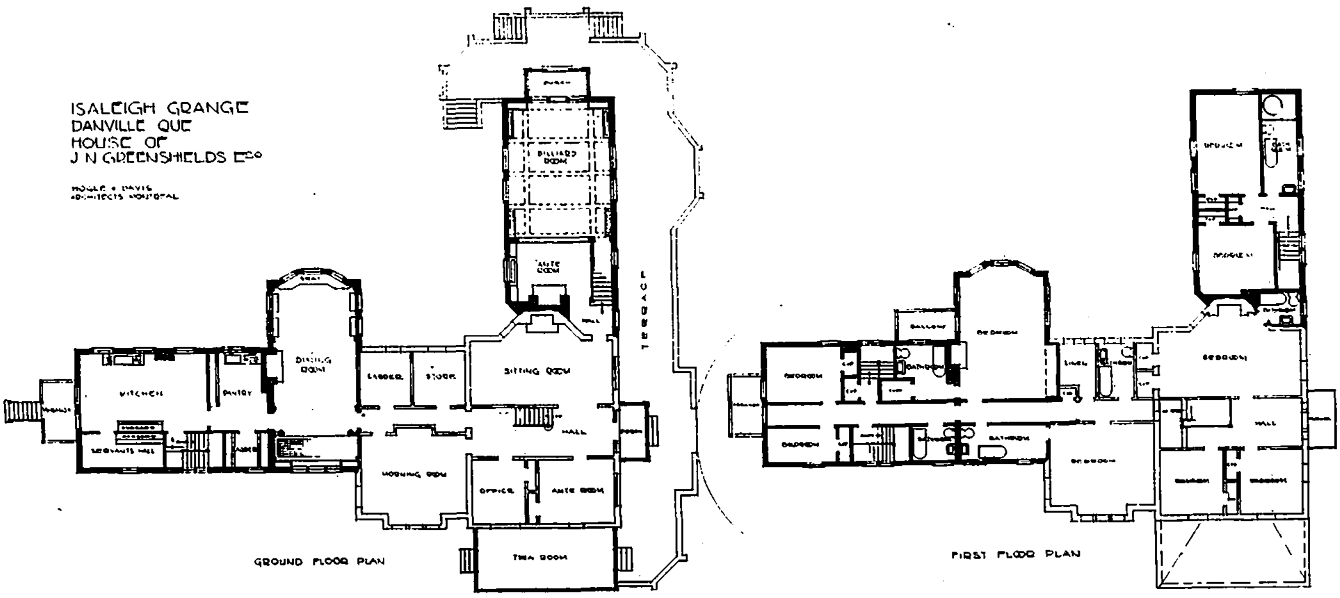


BILLIARD ROOM. REMODELLED HOUSE OF J. N. GREENSHIELDS, DANVILLE, QUE.

The plumbing and heating is to be the most modern in every respect, and it has been arranged to heat both the present hotel and the new addition from the one plant situated in the sub-basement of the new building.

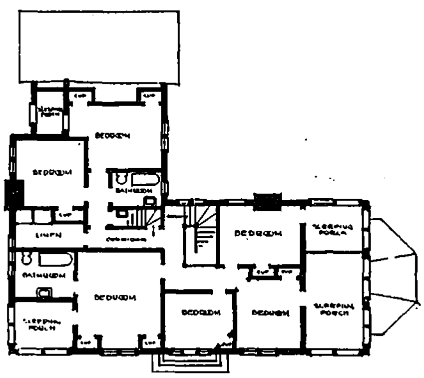
The elevator equipment of the new building will consist of a battery of six passenger and three service elevators. The passenger elevators will be of ample size and of high speed type, thus ensuring adequate service for the whole building.



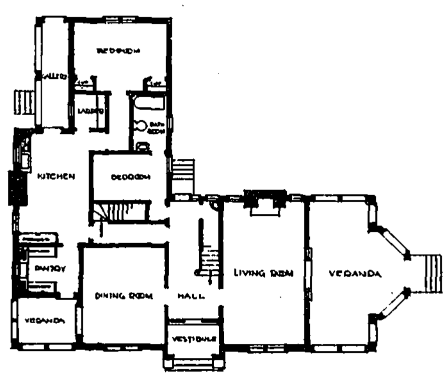


REMODELLED HOUSE OF J. N. GREENSHIELDS, DANVILLE, QUEBEC.
HOGLE & DAVIS, ARCHITECTS.

HOUSE OF MRS. MACKAY, DANVILLE, QUE. HOGLE & DAVIS, ARCHITECTS.



UPPER FLOOR PLAN.



GROUND FLOOR PLAN.

Remodelled House, J. N. Greenshields, Danville, Que.

This property has been in the possession of the family for a great many years, the original house being nearly one hundred years old, so that the owner did not wish to have the character of the place changed into that of a large "mansion," but to retain the earlier simplicity, while giving ample accommodation to a fairly large household.

Very little change was made to the existing house; the new large rooms required, namely, the billiard room and dining room being formed in the new wings. The new bath rooms required were also placed in the new wings, so that the older rooms were torn up but very little.

The billiard room wing is connected to the main house only through the sitting room. From the ante-room three steps lead down to the billiard room, and a stair leads up to the bachelors' bedrooms and bath above, thus forming a suite quite distinct from the house. All this wing is lined with B. C. fir in wide pieces with the joints covered by molded straps, with natural finish.

The dining room running through the house from side to side is lined from floor to ceiling in oak, one end being screened off with pilasters and columns to form a little flower room; this has a red tile floor. The dining room has also a wide stone mantelpiece with some delicate carvings.

A summer kitchen is provided in the basement below the ground floor kitchen, which serves to keep the house cool in summer. The numerous bathrooms all have tile floors and tile or marble lining.

The exterior of the house is brick with the roof in metal "spanish tile" painted a dull red.

The brick has fairly wide joints and is laid rather unevenly to match the old work as nearly as possible.

A second house for Mrs. Mackay has been built on the property at the top of a long slope, and against a wood. The lines of this house have been kept very simple and the verandas included in the main structure, in order that the large scale of the setting should not dwarf the house too much. The house is of wood, shingled on both the walls and roof, and is lined with strapped B.C. fir throughout.

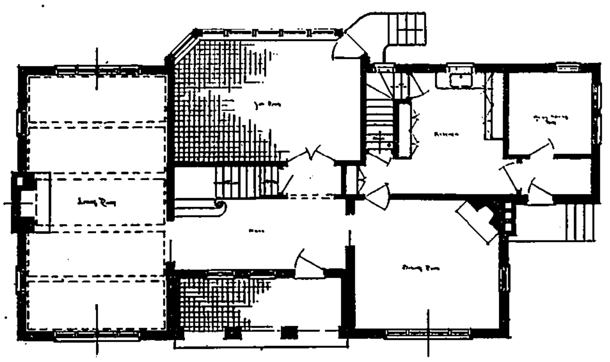
Both these houses are supplied with water from ample springs on the hill behind the new house.

ENTRANCE HALL, HOUSE OF MRS. MACKAY, DANVILLE, QUE.

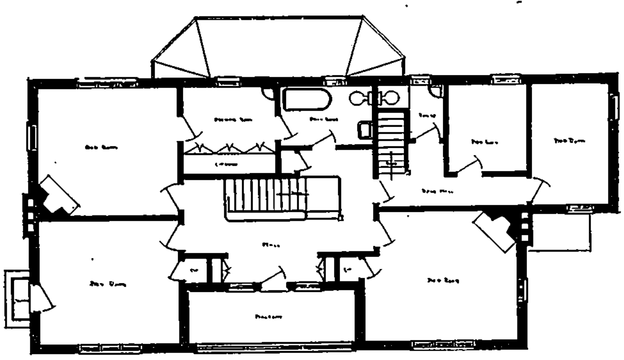
Satellite Cities

Much interest has been taken throughout England in a new plan for the building of a city about 20 miles from London on model lines. Under this Welwyn Garden City scheme it is intended that a town of ultimately about 50,000 inhabitants shall be gradually constructed as a complete unit, with its own factories, warehouses, shops, and residences, in contrast to the many districts which are almost exclusively confined to dwelling houses for people who go into the metropolis daily in pursuit of their livelihood. Such places have come to be known as dormitory suburbs, and the new scheme is based on the theory that the only solution of the whole problem of comfortable housing and convenient transport is to set up instead what are described as satellite cities, in the sense that London itself is the centre of all things, but that within a radius of 20 to 25 miles there should be a ring of these almost self-contained communities. An interesting feature of the scheme is that the capital provided will only receive a maximum interest of 7 per cent., and as the town is gradually built any increment of values arising from the settlement of the people will be conserved for their own social advantage.

LIVING ROOM, HOUSE OF MRS. MACKAY, DANVILLE, QUE.

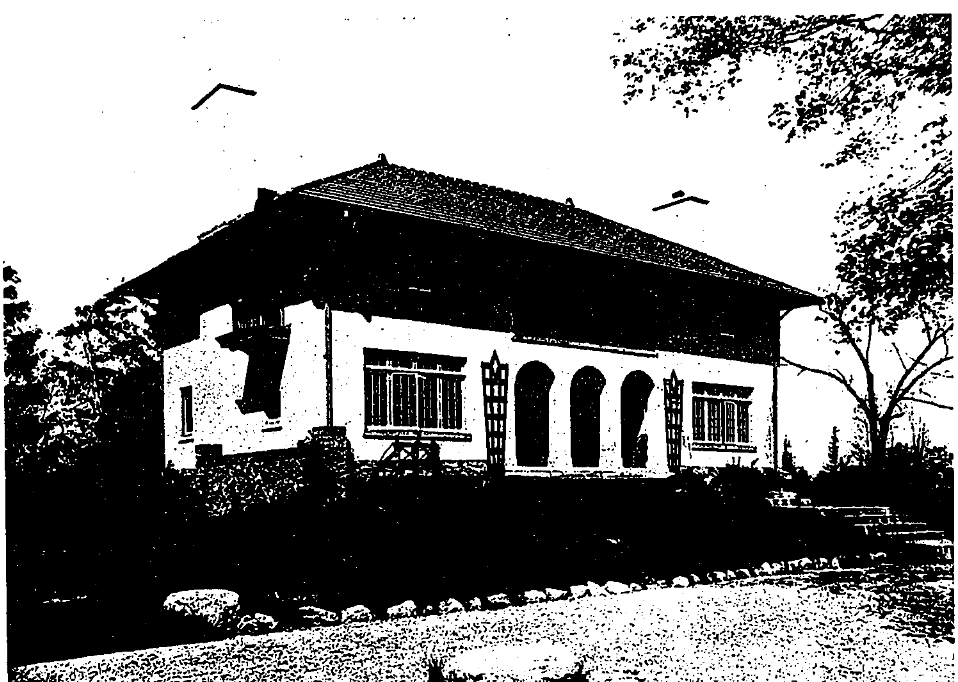


GROUND FLOOR

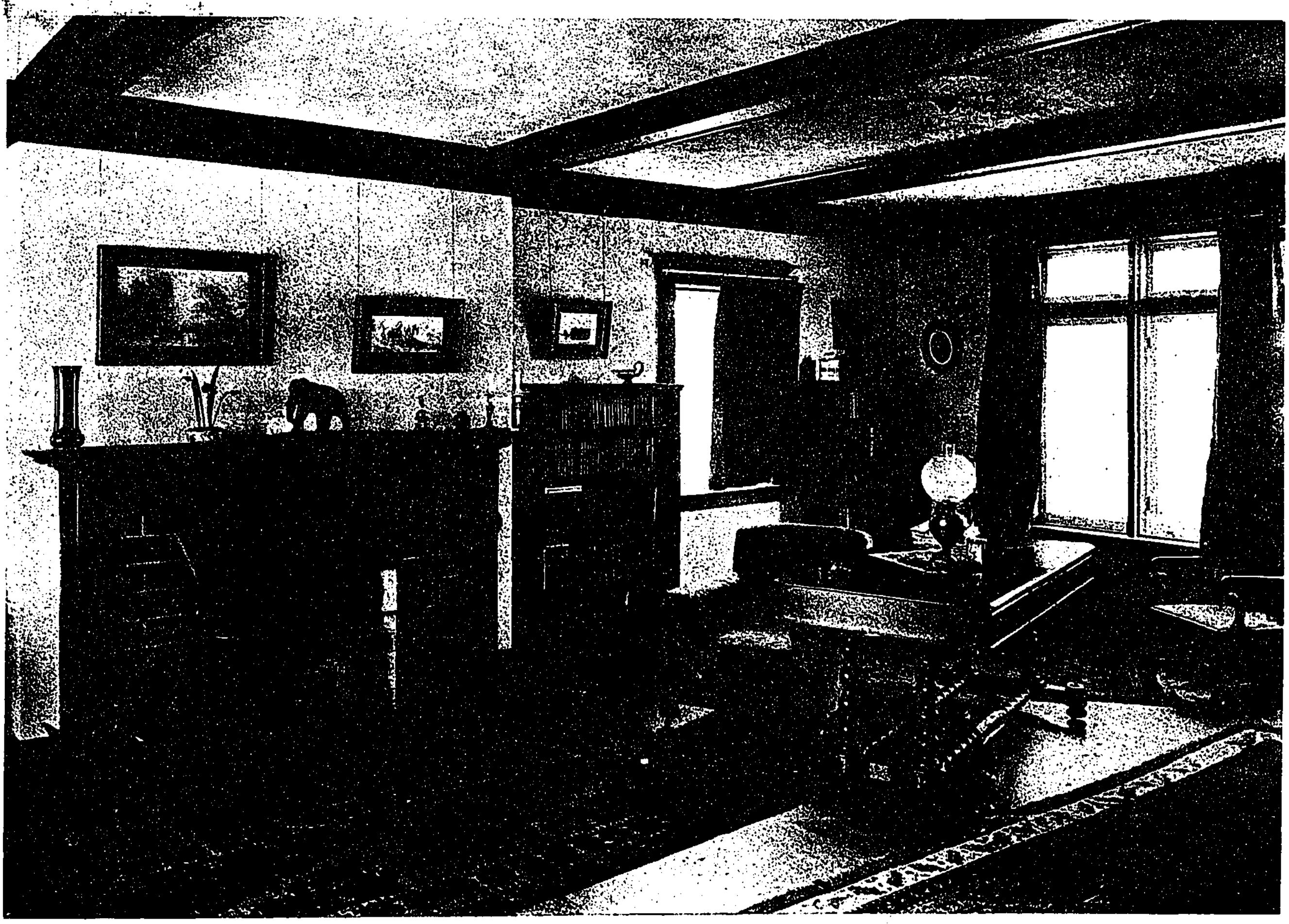


UPPER FLOOR

COUNTRY RESIDENCE OF COL. H. WILLIAMS, M.D. TOWNSHIP OF LONDON.



JOHN M. MOORE, ARCHITECT.



ENTRANCE HALL. LIVING ROOM.

COUNTRY HOUSE OF COLONEL H. WILLIAMS, TOWNSHIP OF LONDON.
JOHN M. MOORE, ARCHITECT.

The Use of Steel in House Construction

The phrase "Steel Frame Building" is generally associated with large structures such as hotels, office buildings, etc., and it is only recently that the full possibilities of the use of steel framing in small dwelling houses have been realized. Within the last year a system of house construction has been developed by a large industrial concern in the North of England in connection with a Garden City scheme now being carried out for the housing of the firm's employees.

A type of house has been evolved consisting mainly of a self-supporting steel frame covered with reinforced concrete, the nature of the covering being the same for walls, floors, roof and, if desired, the bedroom ceiling also.

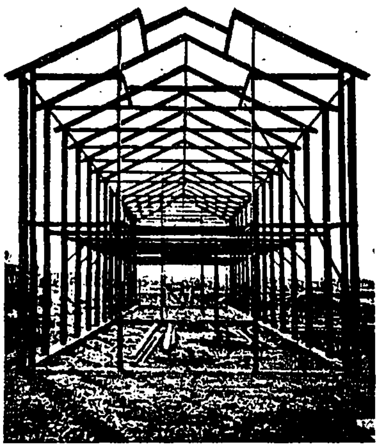


FIG. ONE.

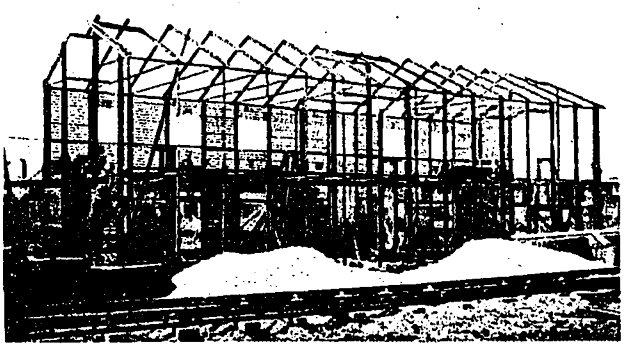


FIG. TWO.

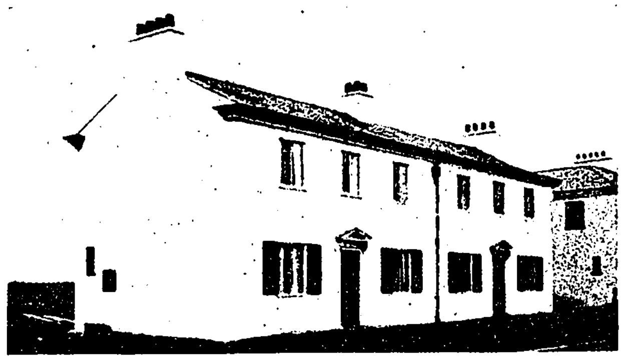


FIG. THREE.

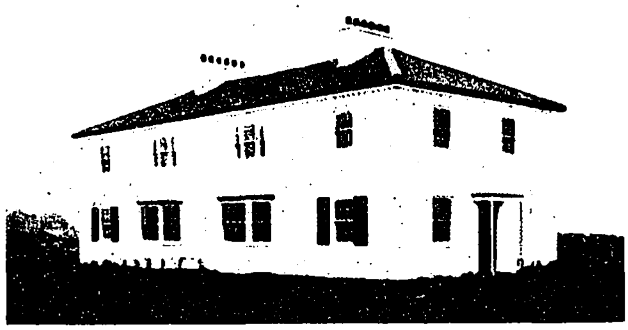


FIG. FOUR.

The steel work necessary for a house, according to STEEL STRUCTURES, an English publication, consists of a series of transverse frames set at regular intervals of about 4 ft., each frame consisting of two uprights, one floor beam and a light roof truss. This spacing of 4 ft. was found to be the most economical, inasmuch as it gave suitable space for the sizes of cottage windows and doors, and also enabled the wall, floor and roof construction to be used to the best advantage.

The design of the house was worked out by studying the house plan, the steel frame and the architectural requirements at one and the same time; and it may be remarked here that such procedure is absolutely necessary in order to apply the use of steel framing most successfully. The steelwork is more than a system of supports for the other classes of materials necessary to construct a house. It is the basis for the design of the whole house and requires the treatment of room arrangement, window spacing and chimney brickwork to be considered from a different viewpoint from that obtaining in an ordinary brick house.

In designing houses upon this system, our contemporary points out, it is desirable on account of the small size of the structure that complications such as an irregular ground plan, haphazard arrangement of fireplaces, elaborate dormers, valleys and gables are to be avoided. In order to obtain simple and economical connections, rolled steel channels, angles and flats have been principally used in the construction of these houses. All site connections are bolts, and there is very little shop rivetting necessary.

The steel framing, it is stated, has been found, in practice, remarkably speedy and easy to

(*Continued on page* 230.)

Greek Design

By JAY HAMBIDGE.

Read before the Royal Institute of British Architects.

WHEN we measure the greatest length and the greatest breadth of a Greek temple, a Greek unit of pattern, a Greek bronze or a Greek vase of the best period, we obtain the end and side of a rectangle. The lines which we thus obtain are almost always incommensurable or unmeasurable one with the other. As areas, however, these rectangles possess a fascinatingly curious commensurability. They are extremely easy to construct and, moreover, belong, or may be reduced, to one or two classes. Further, we almost invariably find that the details of a Greek design are logical parts of its containing rectangle. In fact this is the acid test by which we determine the grade of planning knowledge possessed by the classical designer. For example, if we measure the greatest height and the greatest width of a fine vase in bronze or clay we find that the width of the foot, its height, whatever definite sub-divisions there may be, the width and height of the lip, the height and width of the neck, and, in the great majority of cases, the ornamental band usually found underneath pictorial compositions, are all logical and direct sub-multiples, of a peculiar kind, of the containing or overall rectangle. If this doesn't prove to be the case, then the example is excluded as an exception.

When Greek designs were first measured the astonishing fact was revealed that the measured lines were incommensurable—*i.e.*, one line could not be divided one into the other. In later days certain enthusiastic archæologists claim to have discovered round numbers in some Greek measurements. It has been claimed, for example, that the stylobate flank was exactly 200 Olympic feet. Without questioning the accuracy of the modern interpretation of the Olympic foot, or accepting it as established, the fact remains that other lines of the ground plan, such as the facade width, the enclosing or sub-dividing lines of the cella, etc., cannot be divided into this so-called line of 200 feet. But, if we take this same temple plan and consider the rectangle it furnishes, also the rectangle of the plan of the cella and the column arrangement, we see immediately that they belong to a class of rectangular shapes which seem to have been well known to Greek designers for generations. Moreover, we recognize at once that the architect of the Zeus temple used a different type of rectangle from those we find on the Acropolis at Athens. Theoretically we should find round numbers in some shape in Greek design, but it is not likely that we shall find them more than once or twice in any specific example.

This is a very astonishing situation. As practical men, we know that, before works can be carried out by workmen, some measuring method must be employed which produces commensurability. For this purpose we use the foot or the metre, and divide it into even fractional parts. An exhaustive investigation of classic design shows clearly that in the early part of the sixth century B.C. Greek craftsmen were using a measuring method wherein commensurability of lines was an essential feature. And that some time during this century a change was made from the older to a newer system. The essential base of this new method was incommensurability of lines, but measurableness of area. The first system depended upon a unit of some sort. It is not necessary for us to know what this unit was; it may have been a cubit, a foot, a hand, or something quite arbitrary. The point to bear in mind is that measurableness of line or area will always remain measurable, no matter what the unit may be. A diagonal to a square in relation to a side, for example, will remain a diagonal to a square whether we use a foot, a metre, or any other length unit, or whether we fix it arbitrarily by construction. It is because of this fact that we are able to create an instrument for analysis which will determine accurately the character of a measuring scheme in any terms we may decide to select. The determination of the character of a measuring method in design in reality means the determination of the grade of *symmetry*, using the word in its Greek sense of analogy or relation of part to whole.

In this connection it is advisable to stress the point that design means very much what the word implies—that is, *intention*. Before we recognize a design as such there must exist in it an arrangement of elements of some sort which bear to each other and to the whole some degree of relationship. This may be conscious or unconscious on the part of the creator of the design. That there was intention on the part of the designer to make this relationship depend upon a definite proceeding, at certain periods of man's design history, we know, because treatises written upon the subject, as well as plans themselves, have survived. For the purpose of determining the grade of symmetry in a design, however, there is nothing better than the design itself, providing that we have the proper instrument for analysis. Recognition of the necessity for such an instrument led the writer, some twenty-three years ago, to undertake an examination of the bases of symmetry in nature. Five years later, in the autumn of 1902, a preliminary paper upon the subject was read before the Hellenic Society in London. At this time a minor phase of symmetry phenomena had been formulated. Later, during the winter of 1913, the entire scheme was developed and arrangements made for the reading of a concluding paper before the same Society, during the autumn of 1914. The coming of the war caused a postponement until 1919.

Examination of natural symmetry developed the fact that there were but two phases of this phenomena which could be of use to design. One of these is observable in the crystal and in other regular pattern forms. The snow crystal is an excellent illustration. Because of certain characteristics this was given the name of *Static Symmetry.* The other phase is to be seen in the phenomena of leaf distribution in plants, and in the curious assymmetrical balance of form in the shell. This, because it appeared to be the orderly arrangement of elements in growth, was given the name dynamic symmetry.

Examination of man's design efforts developed the striking fact that there existed a parallel between these and nature. It was found that the static type was more or less spontaneous; was indeed the type used consciously or unconsciously. This type, very often, is apparent by inspection, and in such cases it is not necessary to measure a design. It is difficult to believe, however, that the *dynamic* type could be employed unconsciously. When the general principles inherent in these two types of symmetry had been worked out, and their operating technique developed, it was found that the static was the type existing in the design products of all nations excepting the Egyptian and the Greek; also that it is historical that the Greeks had practically exhausted many phases of this dynamic type, probably as early as the beginning of the fifth century B.C.; that, as early as the fifth, some think the eighth, century B.C. the Hindus were familiar with many of the basic facts of dynamic symmetry. We learn this from an early Hindu work which has survived termed Sulvasutras. "The term *Sulvasutra* means 'the rules of the chord,' and is the name given to the *Kalpasutras,* which treat of the construction of sacrificial altars." Those curious to read about this interesting matter should consult "Indian Mathematics," by George Rusby Kaye, Calcutta and Simla.

The Indian phraseology in this old work, in the light of dynamic symmetry, is of curious interest. Some of it is:

(1) A cord stretched across a square produces an area of twice the size.

(2) Take the measure for the breadth, the diagonal of its square for the length; the diagonal of that oblong is the side of a square the area of which is three times the area of the (generating) square.

(3) The diagonal of an oblong produces by itself both the areas which the two sides produce separately.

(4) This is seen in those oblongs whose sides are three and four, twelve and five, fifteen and eight, seven and twenty-four, twelve and thirty-five, fifteen and thirty-six, etc.

The oblongs described in (1) and (2) are root-rectangles, and are identical with those we know, from history, that the Greeks worked out. The Greek phraseology, however, was "the determination of a square which should be any multiple of a square on a given linear base" (see Allman's "History of Greek Geometry," from Thales to Euclid).

The oblongs described in (3) and (4) are the triangles of history by which the rope-stretchers established right-angles and "corded the temples." The 3 and 4 oblong has 5 for a diagonal, 12 and 5 has 13, 7 and 24 has 25, etc., etc. It will be noted that the Hindu uses the term oblong. This immediately suggests the Pythagorean rule for the determination of right-angles by numbers, beginning with odd numbers. Take an odd number, say 3, square it and subtract unity, divide the result by 2: 3 multiplied by 3 equals 9, and 9 minus 1 equals 8, 8 divided by 2 equals 4, the second term; add unity, to obtain 5. This is the celebrated 3 4 5 triangle of Pythagoras, which has been in use for fixing right-angles from early Egyptian days to the present. Later Plato supplied a rule for finding right-angles beginning with even numbers (see Ballo, "Short History of Mathematics"): I have seen a carpenter in America establish a right-angle by a rope divided into twelve parts, and lay out his plan on the ground for a garage. Asked for the meaning of the proceeding, he replied that he supposed everybody knew the principle; he had known it since apprentice days. The historical method was to take a rope divided into twelve units; place three of these along an established line, four the other way, and permit the remaining five units to form the hypotenuse. This consideration of the right-angle leads us immediately to the crux of the matter of symmetry in Egyptian and Greek design, and one of the most interesting glimpses of ancient craft practice is furnished by the etymology of a Greek word. An explanation of this point will be found in Gow's "Short History of Greek Mathematics."

"The Greek philosopher Democritus is quoted by Clement of Alexandria as saying: 'In the construction of plane figures (lit., composition of lines), with proofs no one has yet surpassed me, not even the so-called Harpedonaptæ of Egypt.' It was evident, of course, that these Harpedonaptæ were famous geometers, but Professor Cantor has first pointed out that their name is compounded of two Greek words and means simply 'rope-stretchers.' He explains their function in the following way: 'There is no doubt that the Egyptians were very careful about the exact orientation of their temples and other public buildings. But inscriptions seem to show that only the north and south line was drawn by actual observation of the stars. The east and west line, therefore, was drawn at right-angles to the other. Now it appears, from the practice of Heron of Alexandria, and of the ancient Indian and probably also the Chinese geometers, that a common method of securing a right-angle between two very long lines was to stretch around three pegs a rope measured into three portions which were to one another as 3:4:5. The triangle thus formed is, of course, right-angled. Further, the operation of rope-stretching is mentioned in Egypt, without explanation, at an extremely early time Amenemhat I).' "

Sir Norman Lockyer, in his "Dawn of Astronomy," furnishes us with some pertinent Egyptian wall inscriptions bearing upon this matter of "cording the temple." It seems to have been an important ceremony, and the king, accompanied by the appropriate goddess, drove the pins with a golden hammer.

The historians tell us that the Egyptians were regarded by the Greeks as masters of figure dissection. From the above the rope-stretchers must be included in this class. The present investigation of design bases suggests unmistakably that these rope-stretchers were equivalent to the modern surveyor. Herodotus tells us that the annual overflow of the Nile destroyed property boundaries and created much confusion and dispute. To re-establish these boundaries frequent re-survey was necessary. If rope-stretching was a recognized science asearly as the time of Amenemhat I. the beginning of the practice must have long antedated that period. It must have taken many centuries to develop skill so publicly recognized.

Dynamic symmetry shows us that it must have been out of some such practice as rope-stretching or surveying that the basic ideas of correlated or formal design in both Egypt and Greece developed. We may take any one of the right-angled triangles which are obtainable from the rules of Pythagoras and Plato and obtain readily, and with the utmost accuracy, all the proportions which we find in classic design.

It will probably have occurred to the audience that dynamic symmetry, in its essentials, is simply a method of measuring. This is indeed true. Design analysis in general shows that the spontaneous method of measuring is linear. In our day we use the linear unit; but this method produces static symmetry of the most commonplace kind. A much better grade of the static variety was used during the Middle Ages. The facts appear to justify the assumption that some genius, undoubtedly in Egypt. but possibly in Greece, after a linear scheme had been in use for some time, made the extraordinary discovery that another method of measurement was possible: that a diagonal to a square, used in relation to a side, produced shapes which, while incommensurable as lines, were delightfully measurable as areas. The fascinating series of root-two shapes which Greek design supplies rest upon this side and diagonal relationship. Later still some other observant designer hit upon the idea that the diagonal to two squares, in relation to the side of one of the generating units, supplied a much more powerful and flexible method of area measurement. This latter method is the most satisfactory scheme so far discovered for correlating the elements of design.

To us the interesting aspect of the matter lies in the fact that a diagonal to two squares is the base of the phenomena of leaf distribution in the vegetable world. Modern botanical research has sufficiently established this.

Owing to his understanding of a method of measuring by areas so simple—indeed, that a string and a few pins or a string merely held in the two hands is all the instrument necessary —the Greek designer had knowledge of an infinite series of remarkable shapes entirely unknown to the modern designer. We may use strong emphasis on this point because extraordinary precautions have been taken to ensure accuracy of results. The Parthenon at Athens, of course, stands on Penrose's measurements. When we consider the ground plan of this building as a rectangular area (this are must include the Euthynteria or lowest levelling course), and divide the end into the side, we obtain a ratio which is immediatel yrecognizable as belonging to the series of dynamic shapes mentioned. Penrose was most painstaking in his survey of this building, so we may take his figures, and without making a drawing or diagram prove the correctness of the measurable area scheme by a little arithmetic. When we follow out the logical process of subdivision, which is a peculiar property of this particular rectangle, we find that every detail of this ground plan forms part of an arrangement wherein the basic design idea is similarity of figure. The main motive is a square plus an area obtianed from a diagonal to two squares. The principle by which the subdivisions are obtained depends upon establishing a reciprocal to the major idea. This idea of a reciprocal to a shape seems to be quite unknown to modern design, but there is overwhelming evidence that Greek designers thoroughly understood it. The division of the area of the Parthenon ground plan results in an arrangement of similar figures in which the column centering plays the most important part: this includes the relationship of the neighboring columns to the angle columns. The error throughout is the error of workmanship, as Penrose's measurements disclose it. After the ground plan we may take the facades and all of their details, such as columns, architrave, triglyph, and metope or pediment. Further, we may unfold the buildings—*i.e.*, place the front and side elevations, with half the roof on either side, in two-dimensional position on the four sides of the ground plan and obtain another larger rectangle. In this shape every superficial square inch of the exterior of the building may be inspected. This new rectangle will be found to belong to the same base as the rectangle of the ground plan. In other words, the building supplies us with an area theme of a peculiar character. Moreover, it is easily proven that this particular theme has a base in nature.

During the past year and a half Dr. L. D. Caskey, Keeper of Greek and Roman Antiquities of the Museum of Fine Arts, Boston, has devoted his entire time to the preparation of a large volume on the Greek pottery under his care, wherein the whole fabric is scholarly and exhaustively treated in the light of dynamic symmetry. Dr. Caskey's work is corroborative in every detail of the dynamic theory. At the Metropolitan Museum of Art, New York City, Miss G. M. A. Richter, Keeper of Greek and Roman Antiquities, took unusual precautions to obtain reliable measurements. The pottery was first measured in detail by a secretary and a rough sketch made of the example. This material was sent to me at Boston. From these measurements I quickly determined the grade of symmetry of each example. An expert draughtsman, with the assistance of a few specially prepared instruments, made an accurate drawing of the projection of each example. These were also sent to me, the drawings being first inked, so no changes could be made. If these drawings and measurements did not coincide the example had to be reinspected. Later I made an interpretation of the straight line and curve proportions of all the examples. It should be borne in mind that it is not necessary to make a drawing of any example of Greek classic design: a few measurements settle the matter. So far classic design shows something like 80 per cent. based upon a diagonal of two squares as a measuring base; approximately 10 per cent. on the diagonal to one square, 5 or 6 per cent. static, the remainder indeterminate.

We obtain the same percentage from the British Museum. I have been gradually obtaining examples of Greek bronzes of the best period, both here and in America. The results show even a higher quality of symmetry than the pottery. I stress the importance of the Greek vase because it has developed that this pottery is the only pure architectural pottery. Almost nothing is known about the shapes of this extraordinary fabric, while volumes have been written on the paintings and drawings on them. The Greek vase compels our admiration, and has persisted as an object of rare beauty probably because of its exquisite proportions and shape. The paintings are often inferior. Professor Baur, of Yale University, has pointed out that the Greeks themselves thought thus because we find more signatures of designers than of painters. Edmond Pottier, Keeper of Greek and Roman Antiquities in the Louvre at Paris in 1906, had to say of the proportions found in Greek vases:

"I will add that the proportions of the vases, the relations of dimensions between the different parts of the vessel, seem among the Greeks to have been the object of minute and delicate researches. We know of cups from the same factory, which, while similar in appearance, are none the less different in slight, but appreciable, variations of structure (n'en sont pas moins differentes par des nuances appreciables de structure) (*cf.*, for example, Furtwangler and Reichold, 'Griechische Vasenmalerei,' p. 250). One might perhaps find in them, if one made a profound study of the subject, a system of measurement analogous to that of statuary. We have, in fact, seen that at its origin the vase is not to be separated from the figurine (p. 78); down to the classical period it retains points of similarity (*accointances*) with the structure of the human body (Salle). As M. Froehner has well shown in an ingenious article ('Revue des Deux Mondes,' 1873, c. civ, p. 223), we ourselves speak of the foot, the neck, the body, the lip of a vase, assimilating the pottery to the human figure. What, then, would be more natural than to submit it to a sort of plastic canon, which, while modified in the course of time, would be based on simple and logical rules? I have remarked ('Monuments,' Piot IX, p. 138) that the maker of the vase of Cleomenes observed a rule illustrated by many pieces of pottery of this class when he made the height of the object exactly equal to its width. M. Reichold (c. 1, p. 181) also notes that in an amphora attributed to Euthymides the circumference of the body is exactly double the height of the vase. I believe that a careful examination of the subject would lead to interesting observations on what might be called the 'geometry of Greek ceramics.'" (E. Pottier, Musee National du Louvre, "Vases Antiques, III," p. 659.)

THE PARTHENON PLAN SCHEME.

The Parthenon plan must be considered as a straight line or rectangular area arrangement. The curves are refinements added after the plan was developed. (See Penrose and Prof. Wm. H. Goodyear.) Dynamic Symmetry shows us that a Greek design must be considered in its totality—*i.e.*, the entire or overall dimensions must be contained exactly in some definite rectangle. For a Greek building these overall dimensions must include the Euthynteria or lowest levelling course. The width of the end of the stylobate of the Parthenon is 101·341 English feet. Penrose gives the width of the three steps as 4·65 feet on one side and 4·67 on the other. The width of the Euthynteria as a small step is ·33. This added to 4·65 equals 4·98; to 4·67 it is 5·. For convenience of arithmetical calculation we may assume that 5· is correct. Multiplied by 2 we obtain 10· English feet as the width of the steps on either side of the stylobate. The full width of the end of the rectangle of the ground plan therefore is 111·341 feet. The length of the top step on the flank is 228·154+; with 10· added it is 238·154+.

111·341 divided into 238·154 equals the ratio 2·1382.

111·341 multiplied by 2·1382 equals 238·069, actual error ·045 feet. The actual ratio should be 2·13819+. We have a degree of accuracy here which is difficult to realize in a building built by man.

Students of dynamic symmetry will immediately recognize the ratio 2·1382 as a compound shape composed of two familiar areas which are arithmetically represented by 1·4472 plus ·691. Of the ratio 1·4472 the whole number 1· represents the area of a square and ·4472 is a root-five rectangle. The square root of five is 2·2360 and this number, normally, would be the ratio for a root-five area—*i.e.*, a rectangle the end of which is 1· or unity and the side 2·2360 (N.B.—These areas may be scaled sufficiently close for an ordinary drawing by using a metric scale. In the present case the root-five area is standing on its short end with its side against the side of a square, consequently the side is regarded as unity or 1·. The short end must be in root-five proportion to unity—*i.e.*, the area must be a reciprocal of the root-five area. This notion of a reciprocal is entirely new to modern design, but we have abundant evidence that the Greeks thoroughly understood its functions. A reciprocal of a root-five rectangle—or indeed any root area—may be obtained by dividing the number representing the root into unity or 1 0. A root rectangle always contains an even number of reciprocals. A root-five rectangle contains 5 reciprocals, root-four 4, root-three 3, root-two 2, etc.

2·2360 divided into 1·0 equals 0·4472, or
2·2360 divided by 5 equals 0·4472.

The ratio 1·4472 is now clear. The simple geometric method for the construction of this area is as follows:

Construct a square and bisect the area by the line A B, Fig. 1, *a* (p. 221). Draw the line B C.

This is a diagonal to two squares. Make B D equal to B E and through E draw F G parallel to B D. The area F D is a root-five rectangle. F G is equal to unity or 1·0 and G D is equal to 0·4472. In Fig. 1*b*, the root-five area C B is added to the square A B, and A D is a 1·4472 rectangle. The fraction 0·691, because it is less than unity, must represent a reciprocal of some ratio greater than unity. To obtain this ratio we divide 0·691 into 1·0. The result is 1·4472. A reciprocal of a rectangular area is a similar shape to the whole, therefore a 0·691 area is also composed of a square plus a root-five rectangle.

The geometrical method for the construction of a 1·4472 shape plus its reciprocal is shown in Fig. 2.

A B is a diagonal to a 1·4472 area. B C is a diagonal to a 0·691 area. The two lines form a right angle at B.

General methods for geometrically determining reciprocals are shown in Fig. 3 *a* and *b*.

A C, Fig. 3 *a*, is any rectangle. A B is a square on the end of the rectangle "applied" to the area of the rectangle, and E D is a diagonal which cuts F B, a side of the square A B at G. The line G B is the end of a reciprocal to the major shape. A B, Fig. 3 *b*, is any rectangle, and D C is a diagonal, A F D is a semicircle described on A D, the end of the rectangle. The diagonal D C cuts the semicircle arc at F. Draw A E through the point F. The area A E is a reciprocal and a similar shape to the whole. Diagonals of reciprocals cut diagonals of the whole at right angles and introduce continued proportion into the area of a rectangle. E F is to F D as F D : F A : F C; or E D : D A : D A : A C, etc. A F D is a triangle in a semicircle, and, consequently, is a right-angled triangle.

Referring to the Parthenon ground plan, A B, Fig. 4, is a 2·1382 rectangle, A G a 1·4472, and C B a 0·691 area.

A D is a square "applied" to A G, and C I, a diagonal, cuts J D at F. The line F D is equal to G B. Draw the line F H parallel to D B. C D is a root-five rectangle as is also H C. A D, B K are squares.

The area C H, Fig. 5, is a root-five rectangle. This area is composed of a square plus two 0·6180 shapes, 1·0 plus 0·618 plus 0·618. This area, represented by the fraction 0·618, is a rectangle which has been given the name, by the writer, of the "rectangle of the whirling squares," because of a certain property possessed by its reciprocals. If 0·6180 be divided into 1·0 the result is 1·6180. The geometrical method for the construction of this shape is shown in Fig. 6 *a* and *b*.

A B, Fig. 6 *a*, is a square. B C, a side, is bisected at D and D E drawn. D E is a diagonal to two squares. D F is made equal to D E. The rectangle A F is completed. This area is a rectangle of the "whirling squares." A C is unity or 1·0, and C F is equal to 1·6180. C B is equal to 1·0, and B F 0·6180. F E is a reciprocal to F A. The square-root of five is 2·2360. If to 1·6180 the fraction 0·6180 be added, the result is 2·2360. In Fig. 6 *b*, C D is a square. D F, a side, is bisected at E and E G, a diagonal to two squares, drawn. E G is made equal to E B or E H. H C G B is a semicircle; H C, G B are 0·6180 rectangles. A D, B C are 1·6180 rectangles. A B is a root-five rectangle composed of a square C D plus the two 0·618 shapes B G, A F.

A B, Fig. 7, is a 2·1382 rectangle. C D is a root-five rectangle, and D F an area composed of two 0·6180 shapes. To the 0·691 area B D we apply the root-five area B G, equal to C D. B K is a square, and K L two 0·6180 areas; and H F is composed of two 0·6180 areas; and J K is a square greater in area than the squares B K or C E. To the other end of the rectangle A B we "apply" the squares A M and N O, equal to the squares C E and B K. We now have by simple geometrical construction defined an area similar to the ground plan of the Parthenon with four squares, one on each corner. To obtain the numerical value of the line N L we multiply the known line A N—*i.e.,* 111·341 by 1·4472. The result is 161·1326+ English feet. B L is 111·341 multiplied by 0·691 or 76·9366 English feet. Added, the two lines give us 238·0693, or the flank length of the ground plan. The square B J is 76·9366 by 76·9366. B C is equal to 76·9366, and C P 34·4044 or the difference between 76·9366 and 111·341.

We now have for the sides of the four squares at the four corners of the plan the numerical value of 34·4044 feet. We may now consider the centering of the columns, and at the same time define the error between Penrose's measurements and the plan.

Fourteen columns from a flank give us the following measurements from centre to centre.

13·983
14·052
14·124
14·110
14·079
14·093
14·058
14·094
14·066
14·089
14·113
14·068
14·124
14·084
————
197·137

Dividing this by 14, we have as a mean 14·081 feet.

The mean distance from the edge of the top step to the centre of the second column is 15·456 + feet. Multiplying this by two and adding 10 feet, the width of the steps, including the Euthynteria, multiplied by 2, we have 40·912 feet. This, added to 197·137, equals 238·049. The ratio measurement was 238·069. The error is 000·020—*i.e.,* two one-hundredths of a foot. It will be noted that the error by construction is always within the error of workmanship as we find it in the building. The mean distance from centre to centre of the columns is 14·081 feet. Penrose gives the distance from the edge of the top step to the cella wall in one case as 15·330, and in another as 15·350. The step width is 5·0; this added to 15·350 is equal to 20·350. If we consider the distance from centre to centre of the columns as the end of a rectangle, and the distance from the cella wall to the extremity of the Euthynteria as the side, such an area will be composed of a square plus a root-five rectangle—*i.e.,* the column centering widths, extending all around the building and excluding the angle columns and their immediate neighbors, with the distance from cella wall to step base, produce a series of areas similar to the generating area of the ground plan and directly connected with it by proportion.

14·081 × 1·4472 equals	20·378
Penrose's figures	20·350
	———
Error	00·028

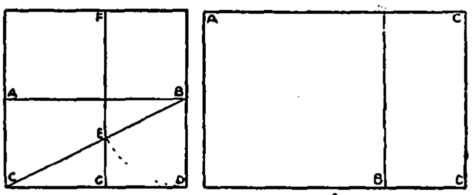
The greatest variations in the ground plan occur at the angle columns and their relation to their neighboring columns. This was probably due to the difficulty of making adjustments for refinements. In no case, however, is it much greater than an inch, a degree of accuracy difficult for others than practical architects to realize. From the centre of the second column to the top step the mean distance is 15·456 + step width 5·0, result 20·456; mean centre to centre distance 14·081, result 34·537.* Side of the root-five square on each corner, obtained from the generating scheme, 34·4044, error 0·1326. This approximate error probably was a factor in the increment of curvature in the stylobate. Asked once by the writer what he thought the increment of curvature or sagitta actually was, Penrose replied that it was difficult to say, though he had assumed it to be a definite amount in his book. He thought two to two and a half inches would be close enough.

We now must consider the subdividing of the corner squares to place the centering of the first and second columns in relation to the third columns. Sides of these squares pass through the centres of the third columns. Thus we have an

* By construction we obtained 34.4044 for the side of this square. If we consider 20.350 plus 14.081, or 34.431, as the side of this square the error is reduced to 00.027.

arrangement of the subdivided area of a square as in Fig. 8.

A B is a square; A C, B C, two areas each composed of a square plus a root-five figure; E D, F C are squares. If A E be regarded as unity, then the areas F E or F D are composed of the square F C plus an area of a square and a root-five figure; that is to say, 1·691. The reciprocal of this ratio (it is one frequently found in other Greek designs) is 0·5913. The area B E or A D is com-



a *Fig. 1.* b

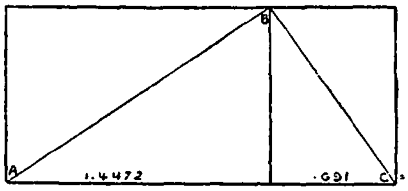
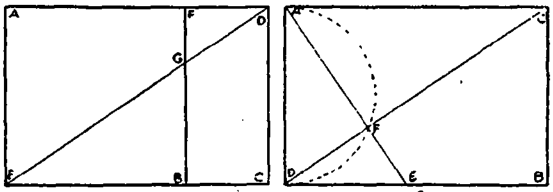


Fig. 2



a *Fig. 3.* b

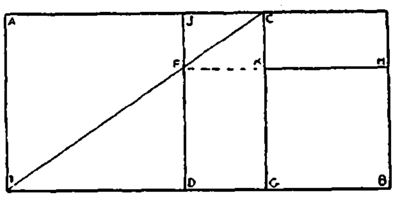


Fig. 4.

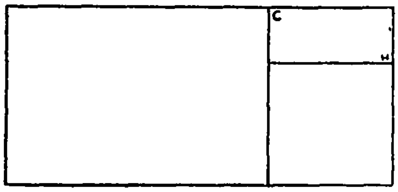
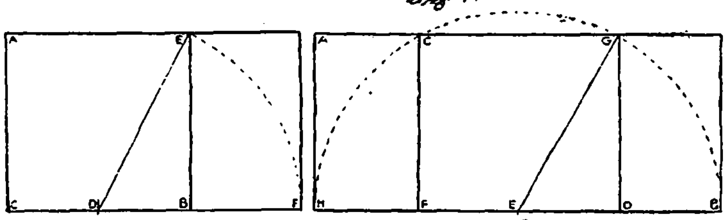


Fig. 5.



a *Fig. 6* b

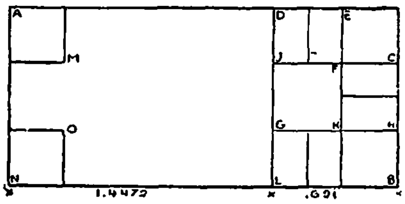


Fig. 7

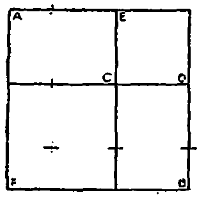


Fig. 8.

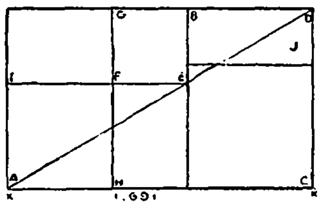


Fig. 9

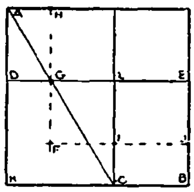


Fig. 10

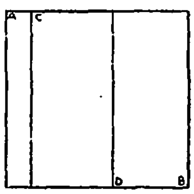


Fig. 11.

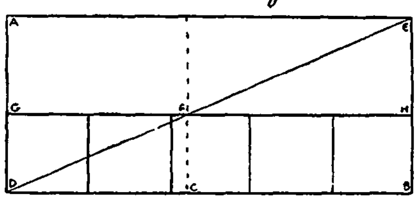


Fig. 12.

posed of the square E D plus the square and root-five areas A C or B C, the ratio being 1·4472 plus 1·0 or 2·4472. The reciprocal of this is 0·4087. The reciprocal ratios 0·5913 plus 0·4087 equal unity or the line F B.

To construct within a square a square plus a square and a root-five rectangle: add a square and a root-five rectangle to a square The ratio then will be 1·691, see Fig. 9.

A B is a square, B C a square, C E, plus the root-five rectangle J B. A D is a diagonal to the entire shape. A E is the area desired within the square A B. A F is a square within the area A E. A G is a similar shape to A E. G E is a square.

The centering of the columns in relation to the step width is done by a diagonal to the 1·691 area within the square on the corner of the plan as in Fig. 10.

A B is a corner square; A C a 1·691 area within it, and the diagonal A C of this shape cuts the line D E at G. This point G is the centre of the first column from the angle column F—*i.e.*, the area G C is similar to A C. The columns G and I are closer to the angle column F than they are to the columns H and J exactly as we find them in the plan. The width of the steps on the plan is fixed by constructing a root-five area within the 1·691 areas of the corners, Fig. 11.

A B is a corner square; A D a 1·691 area; C D a root-five area within A D; A C is the width of the steps.

Of course, the entire details of such a building as the Parthenon cannot be discussed within the limits of an evening's talk, especially when the subject itself has to be introduced. We must neglect the cella and the elevations with their details. It may be said, however, that the symmetry of all these conforms strictly to that of the ground plan. Moreover, the area arrangement we find in the Parthenon was not new to Phidias or Ictinus, close inspection of the symmetry of over a thousand examples of Greek design from the sixth century to the first century B.C. shows that the motif or theme found in the Parthenon appears many times in designs previously made.

It should also be remembered that analysis is not synthesis. It is often a perplexing matter to follow a cold trail, while the trail itself was easily and simply made. The evidence appears to indicate that these proportions of dynamic symmetry were the outcome of a method of surveying by area wherein a diagonal to two squares formed the base. The figures given above may be varied slightly and the errors reduced because it is not always clear what the exact measurements were. According to Penrose, the plan is not an exact rectangle—is any building plan exactly rectangular as it is carried out in the work? The stylobate on each front is 101·341 for one, and 101·361 for the other; the flank length on one side is 228.154 for one, and 228·141 for the other. If we take the double step width as 10·0, and use 111·361 for the end and 238·141 for the side of a rectangle, the ratio 2·1382 leaves an error of 3/100ths of a foot. Many confusing points of this character can only be cleared by another inspection of the building as it stands.

It may be added that the following ratios connected with 1·4472 and 0·691 appear in facades and details:—

Width of front, 111·341.

Height of facade by construction, 64·60+.

The lesser divided into the greater produces the ratio 1·7236. The fraction 0·7236 is equal to 1·4472 divided by 2. Penrose gives the average width and height of the triglyphs as 2·766 and 3·840. The lesser into the greater gives the ratio 1·382 (error 0·018). The reciprocal of 1·382 is 0·7236, or again 0·691 multiplied by 2. If the metopes were originally planned as squares, then metope plus triglyph is a similar figure to the facades, or 1·7236. The height of the angle columns, minus increment of curvature, is 34·250, the width of the abacus 0·685+; the lesser into the greater gives root twenty-five or 5 squares. The area factor which supplies all the details of the column head is root-five.

Root 25 equals 5·000
Root 5 equals 2·236
———
2·764 difference.

The difference 2·764 divided by 4 equals 0·691; or by 2 equals 1·382. The five squares of the angle columns are obtained by simple construction from a root-five area of the plan, see Fig. 12.

A B is a root-five rectangle; A C an "applied" square on the end. D E is a diagonal; it cuts a side of the square A C at F. D H is an area equal to the area of the square A C and is composed of five squares—*i.e.*, it is a root-twenty-five rectangle.

To those unfamiliar with the present method of analytical proof by arithmetic the process may seem complicated. It is, however, quite the reverse, as a little familiarity with the method will prove. Very early in his work the writer found that geometrical analysis was fallacious in every way; it invariably results in mere playing with lines and shapes. With it rigid proof is impossible. As the method by arithmetic now stands we may determine with great accuracy the symmetry of any design whatever without making a drawing. Diagrams and drawings are used to help the student visualize the facts and have nothing whatever to do with the proof.

The Use of Steel in House Construction

(*Continued from page 222.*)

erect, as every piece is carefully marked, so that with the aid of a corresponding plan no special skill is required in assembling the work. The erection of the steel frame enables the roof to be completed at the outset of the building operations, so that a large proportion of the remaining work may be carried out under cover. In the locality where most of the houses of this class have been built the steel framework has been severely tested for rigidity at all stages of construction by a continuous series of heavy gales, and the finished houses are found to be absolutely dry and stable under the worst conditions of weather.

To enable the reader to appreciate the results of the development of this new system, several interesting photographs are presented showing these houses in various stages of construction

1. Shows the steel framework for a pair of semi-detached parlor houses.

2. Shows the metal lath fixing in progress.

3. Pair of semi-detached parlor houses completed, the earlier stages of construction being shown in 1 and 2.

4. Type of parlor house with hipped ends to roof and with bay windows.

Three types of these houses, classed respectively as "A," "B," and "B4," have been approved by the Ministry of Health as standard types to be used freely in housing schemes.

The development is one which is undoubtedly not only of interest to Canadian architects and steel manufacturing firms, but it also suggests the possibilities of the use of steel framing for residential work other than the type of houses described.

CONSTRUCTION

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W. H. HEWITT, Business Manager

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Plans, Taxes and Small Houses

The matter of providing needed housing accommodations in the Province of Ontario is something which is up to the municipalities themselves. The Provincial Government grants the right to municipalities to issue their own bonds and to sell their debentures under a Government guarantee for housing purposes. Moreover legislation has recently been passed known as the "Municipal Tax Exemption Act," which, upon the assent of the rate payers, gives the council of any city, town, township or village the power to pass a by-law granting certain tax exemption upon building improvements. According to the Act this exemption for the first year that the by-law goes into effect is not to be less than 10 per cent. or more than 25 per cent. of the assessed value of the improvement, and from year to year thereafter, an additional percentage of such assessed value of not less than 10 per cent. or more than 25 per cent. is allowed under the Act until (a) the whole, or (b) such portion as may be fixed by the by-law of such assessed value is so exempted from taxation.

The legislation in theory follows the single tax principle; the object being to take a portion of the burden of taxation from improvements and add it to the taxation of land values. This should operate to stimulate building. But in going this far in the matter of municipal bonds and tax exemption to encourage developments, it would seem that it is necessary to go still further, particularly as regards the small house. The housing problem in Canada is anything but solved in its true economic sense. There is still the important factor of plan and design to be considered. The economic value of any building is not in fulfilling an immediate need, but in the influence it exerts in the community as a permanent asset. True, progress has been made under the Ontario Housing Act, and by private enterprise, in which architects have participated to a degree of establishing a desirable type of small house design, but this represents at the best merely a preliminary endeavor. The above-mentioned legislation, which will undoubtedly give an impetus to the erection of small houses, also gives the architectural profession special opportunities to co-operate in such developments. A very practical plan whereby this could be accomplished was put forth recently by the Minneapolis Chapter at the fifty-third convention of the American Institute of Architects. According to the WESTERN ARCHITECT the initial feature of this plan is a bureau which all architects may join who wish to aid in the betterment of humanity and recognize some obligation to their profession and its advancement. Each member-architect agrees to prepare a set of plans and specifications for a small residence. This membership will be divided into regions, and regional directors elected, so that each locality may have direct supervision and prompt action. The bureau will be under a director, and the national headquarters will be in the Octagon at Washington. The bureau in each region will give advice in financing projects and in making contracts, and will act as is the architect's practice in large matters, the cost to the house builder to be nominal in the extreme. The benefits to be derived by the public through this movement inaugurated by the Minnesota Chapter cover a large field and range from the securing of a better type of houses, conveniently and compactly planned, to securing more lasting and durable houses with a consequent reduction of cost for repairs and the added financial values their construction will have on neighborhoods. The profession will gain in that the public will become more familiar with the value of architectural services and its carrying out is worth the serious and energetic work of the ablest in the profession.

In Canada a somewhat similar plan has been discussed relating to the small house problem, but as far as present knowledge goes, no definite action has been taken.

Paris to Construct Homes for Workers

The municipality of Paris, a contemporary informs us, has taken in hand the housing problem there and proposes to spend 1,700,000,000 francs (nominally about $340,000,000) to solve it. It contemplates building 1476 new two-room workingmen's apartments at once, with 950 more to be erected later. They will be built in the heart of Paris and near the fortifications. It was stated that probably many half-finished houses being built for wealthy persons will be requisitioned by the municipality and turned over to workmen's families.

The shortage of housing facilities in Paris has raised a cry from many quarters, and to meet the situation many miniature "skyscrapers" have been built in Montmartre, much to the disgust of the artists who live there. They have formed a Parliament to discuss the question and have organized parties which take their names after the art school to which they belong. Thus there are the "Cubistes," the "Montmartrois," the "Sauvagistes," the "Dadaistes" and the "Gassieristes."

Some of the extremists are so enraged over the encroachment of the "skyscraper" builders into their district that they are urging all artists in the Montmartre to move to Marseilles.

Dark Walls Waste Light

The color selected for walls and ceilings has a decided effect upon the lighting of rooms and upon our light bills. Even where the darker shades are used for artistic or other reasons, information as to the exact value of each color to reflect light is useful.

The illumination required in a room depends largely upon the amount of light absorbed by the walls and other surfaces. Dark surfaces absorb light, while light surfaces reflect a good proportion of the light back into a room. If the source of light is not changed, the effective illumination will vary with the reflection factors of the surfaces in the room. If, on the other hand, it is desired to maintain a fixed intensity of illumination, then the amount of light reflected by the walls on which the different colors are used will be in the following percentages of the light used: Enameloid, white, 80; flat tone, white, 79; flat tone, ivory white, 76; flat tone, cream, 71; enameloid, ivory, 64; flat tone, buff, 59; enameloid, pink, 51; flat tone, tan, 37; enameloid, tan, 27; enameloid, sky blue, 31; enameloid, cardinal red, 27; flat tone, forest green, 21; enameloid, wine, 12; enameloid, grass green, 10.—L. G. DENIS, CONSERVATION.

Building Steel Roofs by Electricity

One of the most important developments of electric welding in Great Britain lies in its application to building construction. The steel roof of a large factory recently erected in London was entirely welded, not a single rivet being employed. Each truss was completed on the ground, the various sections being merely laid in position and welded with mild steel by the arc process. When a truss was completed it was hoisted into position and welded on to the steel supports. The whole process of erection can be carried out much more quickly than when riveting is employed, and there is also a great saving in material.

New Brick Making Plant in Northern Ontario

According to a recent news item a brick-making plant, representing a new industry in Northern Ontario, is to be established at Matheson by the Matheson Products Company. One hundred and ninety acres of land, with a clay deposit that is said to be 40 feet deep, will be utilized by the company which will manufacture brick, tile and terra cotta products. The plant will have a capacity of 20,000 bricks per day to start with, and the output is expected to increase to five times this amount in a short time. R. S. Potter is president of the company, and R. L. Ollman, manager.

Moves to New Quarters

Mr. C. H. Acton Bond, architect, has removed his offices to Suite 20, No. 4 Wellington St. East, Toronto. Phone Main 1973.

The Swedish Government, according to the LABOR GAZETTE, is dealing with the house shortage, both directly by a state building programme providing for the erection of dwellings within the next five years to contain in all 40,000 rooms, and indirectly by building grants to local authorities, and through these to private persons, companies or societies. Builders will be required to raise capital to cover up to 50 per cent. of construction cost, apart from ground values. The state would grant a loan, secured by a mortgage, and valid for at least twenty years, for the remainder of the cost of building. These loans will be exempt from interest charges up to ten years, or in lieu of such exemption a further capital grant may be made up to 2 per cent. of the total cost. Similar building grants are also made to associations of civil servants.