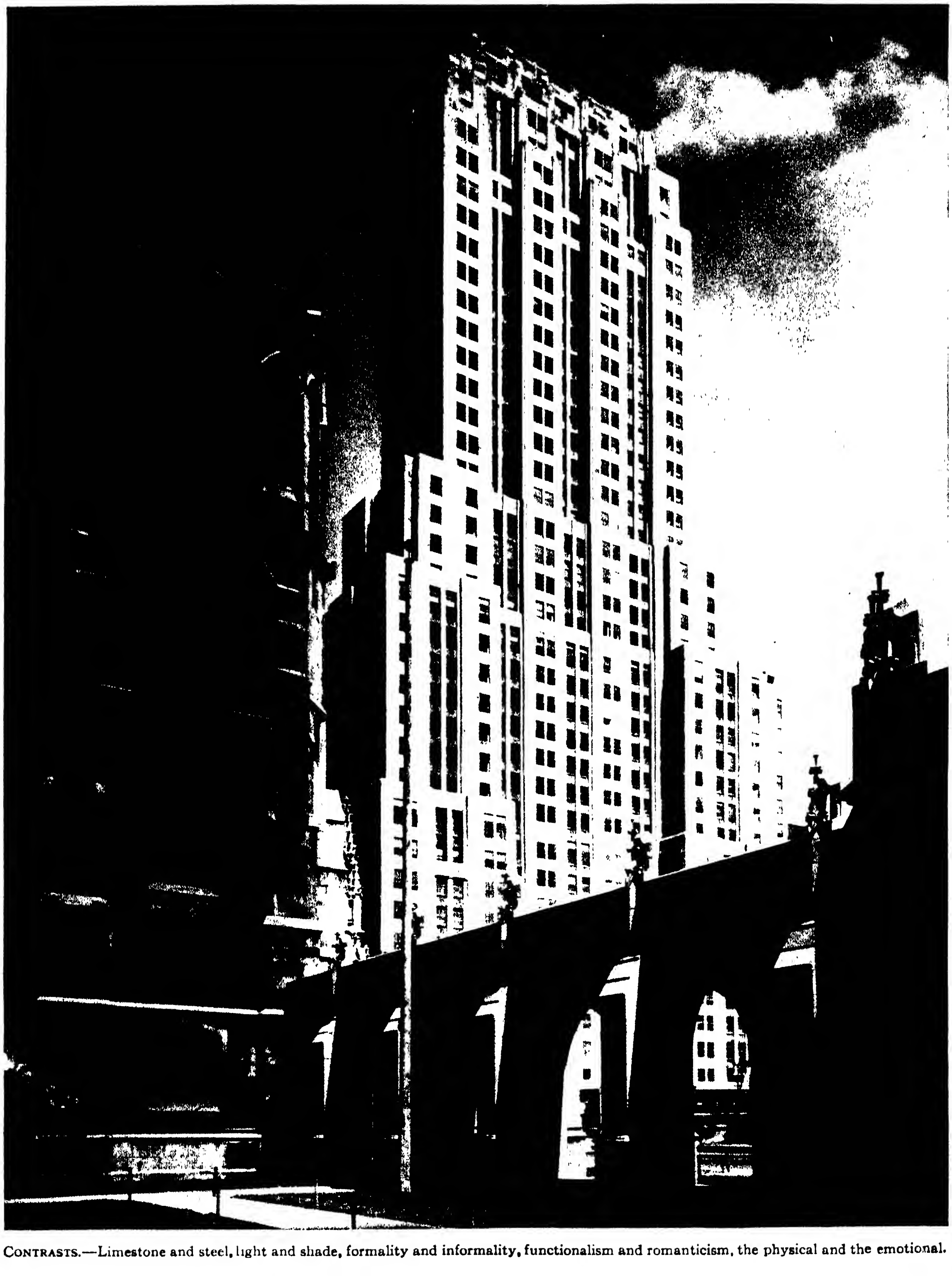
ARCHITECTURAL DESIGN



CONTRASTS.—Limestone and steel, light and shade, formality and informality, functionalism and romanticism, the physical and the emotional.

ARCHITECTURAL DESIGN

by

ERNEST PICKERING
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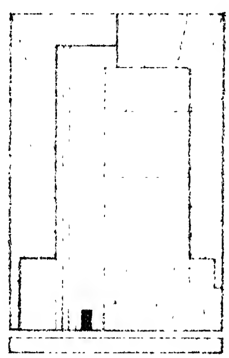
DRAWINGS BY THE AUTHOR

FOREWORD *by* REXFORD NEWCOMB



SECOND EDITION

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Dedicated to
my wife and daughter

FOREWORD

When the first edition of "Architectural Design" appeared several years ago, we had already reached a time when a non-organic, "compositional" approach to architectural design was no longer valid. An inestimable wealth of new materials was at hand; something of a "new tradition" was in the making. Professor Pickering's approach was sound in that it encouraged student and designer to examine the possibilities and abide by the limitations of the materials of architecture, and to look at the outer envelope of a building as the joint result of social necessity and fundamental architectonic procedures, expressing themselves in material forms. This approach won for the book a ready acceptance, not only as a simple and logical introduction to the subject in the classroom but as a handy manual for mature and thoughtful practitioners as well.

Now the book has been revised in the light of the author's experience with it in his classes and in accordance with suggestions which have been made by its various users. The result is a book abreast of the best thought in its field today and an improvement of the earlier book by an even simpler, more direct, and rational approach to the subject; all this without sacrificing those joyous, emotional fulfillments that should always accompany achievement in any vital, creative process. That this will continue to be the standard treatise in its field appears assured.

REXFORD NEWCOMB, *Dean*
College of Fine and Applied Arts,
University of Illinois

PREFACE

In the midst of changing social and economic systems, the practice of architecture and the education of the architect are reflecting the new cultural order. Since the first edition of this book began to take shape a decade ago, a number of influences have effected gradual but definite changes in architectural training. The designer of buildings today has been released more completely from the limitations of stylistic architecture, but with this freedom has come the necessity of developing a new philosophy toward the art and science of building and a new conception of the use of the creative principles of design.

There was a time earlier in this century when architecture began and ended with the derivations of the Classical and the Renaissance, with occasional excursions into the fields of the Romanesque and Gothic. Composition, both in plan and exterior treatment, was dictated by traditional forms and practices. Architectural education concerned itself with a study of the details of past movements, not in an effort to become familiar with the reasons for their development but for the purpose of copying their physical characteristics.

In recent years, however, all that has been changed. New materials and types of construction have made possible the expression of new forms which are more sympathetic toward contemporary ways of work and leisure. Architecture is now developing from the necessities of function, with a freedom from the limitation of earlier days and with the encouragement of untrammeled thinking. Architecture is lighter—more kinetic and less static. We now think of architecture in terms of volume, which has been conditioned for use, comfort, and appearance. Our training in architectural design must reflect this attitude and must be organized in such a way that an architecture expressive of contemporary culture will result. During any period of change, there are usually two factions, the conservative and the liberal. It is possible that the extremists of either side are not sound; one may be too far behind and the other too far ahead of the procession. Even though we are living in a changing world, it is not necessary or desirable to abandon all of the old or to embrace all of the new. Architecture is the result of gradual development—not of sudden breaks and new affiliations.

Architectural education must train architects for the culture in which they find themselves—a culture which is possible because of the contribution of the past. It is, therefore, essential that architectural design be organized to produce a sound and vital architecture expressive of the contemporary social order—an architecture which grows, as always, from preceding movements. Accordingly, this text presents in a single volume: (1) the fundamentals of a physical and social environment, (2) a historical background, (3) an analysis of the function of the elements of volume architecture, (4) a survey of the characteristics of old and new materials, (5) a study of the creative principles of design, and (6) methods of arriving at satisfactory solutions. It is offered as a text adaptable to various systems of teaching and as a reference book for the drafting rooms of schools and offices.

Cincinnati E. P.

January, 1941

ACKNOWLEDGMENTS

The frailties of man—his limitations and circumscriptions—are numerous and conspicuous. He leans heavily upon the shoulders of his associates for support and encouragement. Very brave is he who dares and very brilliant is he who can produce a creative endeavor without the influence and inspiration of others. The development of a text book almost invariably calls for the assistance and cooperation of those, other than the author, who may also be interested in the phase of activity under discussion. This help may assume various forms: spoken criticism, written advice, or loan of illustrative material.

The author of this book is particularly indebted to his friends and colleagues for the interest they have taken in this work. He wishes to acknowledge the help of Professor William S. Wabnitz, Mr. George Marshall Martin, and Mr. Ellery F. Reed, who gave so freely of their time in scrutinizing the subject-matter of the text. He is also grateful to Dean Rexford Newcomb, of the University of Illinois, for his advice and criticism. Credit is also due Mr. George F. Roth and Prof. C. Leslie Martin for their assistance. To the students of the Department of Architecture, University of Cincinnati, who furnished most of the rendered problems in Part V, and to the architects of Cincinnati and elsewhere who lent many photographs, the author is especially indebted.

An important contribution to the book comes from sources which are only allied with architecture. One of the outstanding characteristics of the contemporary movement is the development of new materials and of new uses of familiar materials. Architecture owes much to those individuals and associations of the manufacturing world whose research has helped to make possible the modern structures of today. The author wishes to acknowledge the cooperation of the following, who supplied many of the photographs illustrating the use of building materials:

Indiana Limestone Company, Georgia Marble Company, American Face Brick Association, Atlantic Terra Cotta Company, National Terra Cotta Society, Associated Tile Industries, Portland Cement Association, Lead Industries Association, Copper and Brass Research Association, International Nickel Company, California Redwood Association, Du Pont de Nemours and Company, Westinghouse E. and M. Company, Brick Manufacturers Association of New York, Owens-Illinois Glass Company, Pittsburgh Plate Glass Company, and the Aluminum Company of America.

It is through the cooperation of those mentioned above that the completion of this book has been accomplished.

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BOOK ONE

THE NATURE OF ARCHITECTURE

PART ONE

THE INFLUENCES ON ARCHITECTURE

Chapter I

GENERAL INFLUENCES

Fundamental similarities exist between the interests and activities of primitive man and those of civilized man. They both need only the basic, contributory elements of life in order to maintain an existence. The complex social structure of the twentieth century has not reared its head very high above the level of previous simple civilizations. Man has built slowly for centuries, losing ground and gaining, despairing and exulting, until his present position has been attained. But it is only a step back—if not mentally, at least with reference to physical necessities. Modern man can live comfortably and contentedly in places remote from the conveniences which are the product of the social culture of today. He may be well fed and clothed, and his dwelling, while not architecturally pretentious, may be sufficient for the maintenance of his well-being.

The Needs of Man

Primitive man and civilized man are both concerned in varying degrees with three types of interests: (1) the physical, (2) the emotional, and (3) the intellectual. The first of these embodies the essentials without which life could not be sustained. The other two may be regarded, in the simpler types of existence, as non-essentials, but they must be present in some form if man is to secure spiritual, as well as physical, comfort. All three have influenced the development of architecture, and architecture has been, in turn, a manifestation of the resulting activities. The state of man's existence depends upon the satisfaction of the following needs or desires:

1. Physical.
    - a. Self-preservation.
        - Food.
        - Clothing.
        - Shelter.
    - b. Reproduction.
2. Emotional.
    - a. Aesthetics.
    - b. Religion.
    - c. Recreation.
3. Intellectual.
    - a. Education.
    - b. Science.
    - c. Government.

PHYSICAL NEEDS. Primitive man and civilized man are motivated by the same physical forces. It is only in the interpretation of essentials and non-essentials that they differ. If the savage considered the higher types of shelter, art, or education necessary to his existence, and if he attained these ideals, he would cease to be primitive and would become civilized. Shelter is a fundamental need of man, even though it is at times not the most essential. Since it is the centre of his activities, let us discuss the phase of shelter which is represented by the dwelling, reserving for later an opportunity for a broader definition of the term "shelter." The following is a comparison of the attitudes of primitive man and civilized man toward the home:

PRIMITIVE MAN.

Necessities. Any shelter which would afford protection from the weather and the beasts of the forest was sufficient for primitive man.

Conveniences. After protection was provided, he realized that the small opening through which he had been crawling into his hut was inconvenient. This was enlarged into a door through which he could walk in an upright position. Thus he began adding to his list of conveniences.

Comforts. With a shelter strongly built, hunting grounds located, and tribal relations established, primitive man had more time to think about his own physical comforts. He remodeled his hut in such a manner that more warmth was provided during the colder months. Openings in the walls were made in order to admit the cooling breezes of the warmer periods, and a hole in the roof was provided to allow the smoke to escape instead of filling the interior. Floor coverings and objects upon which to sit and lie received more attention.

CIVILIZED MAN.

Necessities. The necessities of modern man are beyond even the conception of the comforts of primitive man. Civilized man must have a warm, dry house with glazed doors and windows and with some provision made for sanitation. His home must also be of permanent construction.

Conveniences. In the modern dwelling the rooms are usually arranged in such a way that they are economical of circulation. In addition, the house must be equipped for the functions related to the preparation of food and must make provision for sleep, cleanliness, and relaxation.

Comforts. The comforts of modern man are many and varied. Twentieth-century homes in this country must contain the labor-saving devices which provide heat, ventilation, and instant communication. The furnishings are usually designed for comfort, appealing to the physical nature of man, even though the aesthetic quality sometimes may be lacking.

EMOTIONAL NEEDS. We have already indicated that the emotional reactions of man, as distinguished from the purely intellectual, have to do with the instincts stirred by the forces of religion and art and with the desire to indulge in recreation. In this discussion, our primary interest is in art, and in a single but important manifestation of art which is called architecture. The basic interests of man have a predominant emotional content, and architecture is a medium of expression of the spiritual as well as the intellectual and economic phases of his existence. The influence of religion has been particularly strong in most periods of architectural development. The time element which makes recreation possible is also a factor in determining the character of the artistic life of a nation. Education, science, and government, representing the intellect, demand a proper architectural setting. Intellect or reason alone may erect a utilitarian building; emotion will endow it with beauty and interest. Thus, like music, architecture sounds many notes and strikes many responsive chords throughout the entire scale of human emotions.

When primitive man had provided the necessities of life—food, clothing, shelter, and, later, religion and government—he found himself with the leisure which permitted an indulgence of the desire to make something which is not strictly utilitarian. The decorating of those objects associated with his every-day existence furnished an opportunity for this expression, and he carved his wooden bowls and painted his earthen pots. This was the beginning of the decorative arts. The success of this excursion into the domain of art and the pleasure derived from it encouraged him to attempt a representation of the mysterious spirits and wild animals which hovered outside his cave. The forces of rain and wind and the beasts of the forest he feared or respected to such an extent that his attitude became worship, and these elements and animals constituted his gods. He needed likenesses of these deities, and wood, stone, and clay provided materials for the experiments of his unskilled hands and simple mind. The little idols thus fashioned became an important part of his family and tribal life. This was the beginning of sculpture. Later he mixed earthen colors and drew images of familiar beasts upon the walls of his cave, and painting was the result. As mankind ceased to be nomadic and became agriculturist, as life upon the plains grew more secure and various tribal relations more stable, men began living in villages. The dwellings then became more permanent in construction, and temples were erected for the worship of the gods. This offered an incentive for a consideration of appearance in connection with these buildings, and architecture came into existence.

Thus art comes as a result of opportunity for thought and relaxation. There must be some surplus and leisure, even though it may belong to the few who direct the efforts of the many. Man must have time to devote to activities other than those connected with food and protection, if architecture is to exist. When the civilization of a country or an age is developing, the aesthetic and the intellectual activities (and the resulting architecture, literature, and science) are the last to appear. When disaster arrives they are the first to be abandoned. This abandonment, of course, simply hastens the downfall of civilization. In order to appreciate the importance of permanent structures in our present existence, it is necessary only to picture the demolition of all the existing buildings in this country. If these structures could not be replaced and if it were necessary for their inhabitants to take to huts or caves, the mode of life would of necessity soon become primitive. Architecture is necessary for civilization.

Art, in its broadest interpretation, assumes the various familiar forms of painting, sculpture, music, literature, and architecture. Architecture is basic. It has the advantage of being both utilitarian and aesthetic—of being useful and beautiful. By being useful, it houses the various activities with which man is concerned. By being beautiful, it becomes a medium of emotional expression which furnishes an outlet for the spiritual urges of man's existence.

Activities of Man

Since his physical, emotional, and intellectual activities assist in the production of architecture, let us examine further the basic interests of civilized man. In so doing, we must scrutinize the forces which motivate all social organization and which apply generally to the human race in all stages of its development. We shall see that there are fundamental impulses or desires—whose existence we have already suggested—which must be satisfied if life is to exist and civilization is to develop. These forces may be called the Stimuli to Action. Their effect upon life and architecture, which we shall soon discuss, may be designated as Resulting Manifestations.

The basic stimuli are:

Desire for:

1. Preservation.

   This is the most fundamental and causes man to provide shelter and comfort and to appease hunger and thirst. It also encourages the obtaining of security; security which may be religious, economic, or governmental.

2. Recognition.

   This is the desire for prestige. Pride and ambition, personal or civic, result in the struggle for position—for social status, physical supremacy, or intellectual attainment.

3. Response.

   This arises from the gregarious nature of man, from his wish for love, friendship, and sociability.

4. Self-Expression.

   This is the urge of man to assert himself as an individual, to do things in his own particular way. It may include interests concerned with the aesthetic—painting or architecture; the intellectual—education or science; or the recreative—play or the thrill of new experiences.

Thus man lives and develops by the satisfaction of the fundamental needs and their resulting emotions. Interests and activities ensue and have a direct, even though overlapping, relation to these basic stimuli, as follows:

Resulting manifestations, from:

1. Preservation.

   In obtaining food, clothing, shelter, and security, civilized man must have commerce, government, and religion. These activities call for their accompanying structures, or architecture.

2. Recognition.

   In attaining a social, religious, or political status, in expressing pride in achievement, individuals may build palaces or skyscrapers, or communities may erect cathedrals or public buildings and monuments.

3. Response.

   In seeking the companionship of his fellow creatures, man congregates. His social instincts call for fraternal buildings and city clubs. His semi-public buildings must contain banqueting halls and ball rooms; his home must have a living room to make human association possible.

4. Self-Expression.

In being individualistic, man has developed creative endeavor. This is responsible for aesthetic expression; for architecture in its highest form. The desire to play, to seek recreation, has encouraged the building of theatres and stadia. It has promoted travel, with its accompanying stimulating effect upon either the appreciation or production of art in general and architecture in particular.

Our approach to architecture has thus far been based largely upon sociology, or the science of the constitution and growth of society. We shall now vary our point of view slightly and consider the development of architecture from the standpoint of anthropology, or the science of man in relation to his environment and culture. The motive powers of thought and action develop a social structure by which man may obtain physical comforts and spiritual enjoyments.

Even though man has always had these previously mentioned basic desires and urges, the organic sciences are more fundamental than the social ones. Evolution and heredity determine the biological progress of man. This growth of man has been slow. We have only a vague idea of the number of centuries which have been necessary for the physical and mental development of the human race through the various stages of its civilizations. But we do know that the many activities of civilized man are the result of the evolution of the basic interests of primitive man. In satisfying his immediate physical and spiritual needs—in securing food and shelter, and in indulging in a form of worship—primitive man as an individual discovered that he could excel at one particular endeavor. Perhaps he lived in a more fertile valley than his neighbor and developed a knowledge of farming. It may be that he had access to the proper clay and became adroit in the making of pottery. Or he was skilled in the science of healing or could summon the spirits of the outer world in a more mysterious manner. These advantages encouraged the development of (1) a commodity which he was willing to barter for the product of some one in an adjacent village, or of (2) a service which he could render to the members of his own family or tribe. His ability to produce a surplus brought about the exchange of materials and information, and thus the beginnings of business and professional relations were established. As these contacts and dealings developed, man ceased to be primitive and became civilized.

The activities of modern man, which have resulted from the satisfaction of fundamental desires and interests, may now be rather simply classified according to the division of the hours of his daily existence. These interests may be concerned with his periods of work and periods of rest as follows:

1. Occupation, or working hours which are spent in an office, a factory, on a farm, etc.
2. Rehabilitation, or hours of relaxation, which are spent in the home, church, theatre, etc.

But still they deal with the physical, the emotional, and the intellectual—varied interests made possible by the progress of man and civilization.

The Architecture of Man

The items of exchange which led to the occupations of man, or to the establishment of business and professional relations, have increased until the complex social and economic structure of the twentieth century has been reached. Present-day life, or that part of it which is made up of our working hours, is the result of the production and exchange of:

1. Tangibles, which include such materials as those related to food, clothing, *shelter*, or transportation. *Architecture*, as expressed in a structure, is a tangible commodity and provides shelter for man and the interests of man.
2. Intangibles, which consist of information, such as the knowledge of law, medicine, or *design*. The practice of *architecture* as a profession is thus one of the intangible commodities which the architect has to offer in exchange for a remuneration.

The physical and intellectual needs of civilized nations are thus met by the creation, distribution, and assimilation of materials and information. The spiritual nature of man is satisfied by his participation in things which have to do with religion, art, and recreation. Buildings are needed to house these many activities. Architecture is Shelter, protecting man's physical interests and also expressing his emotional urges. The structures, which represent architecture, reflect the civilization of a people. Architecture thus comes to be a record of the progress of man.

Chapter II

THE INFLUENCES OF NATURE

The idea that architecture records the social structure of a nation has been suggested. Let us go a step farther and ascertain in what forms this evidence has been handed down to the present age and also what influences have left their marks upon these records. The past has produced the temples of the Greeks, the baths of the Romans, the cathedrals of mediaeval Europe, and the palaces of the Renaissance. The past has made possible the endless variety of the twentieth century. The people who built in the past were affected by the same sun and rain which today wash the surviving walls and contribute to the health and happiness of the present inhabitants. Climate and topography influence the life and habits of a nation. They decide what foods shall be grown and what occupations shall be followed. They determine what regions will develop farmers, sailors, or merchants. Climate aids in giving to races their own particular traits. These races in turn create architecture with local or national characteristics. Civilizations are continued by the combination of climate, topography, and resources. The elements account in no small measure for the nature of governments, business relations, commerce, and social and economic conditions, and these in turn mould the artistic life of a people. Influences affecting art and architecture may be divided into two groups depending upon the source of their inception. They are (1) the influences of nature and (2) the influences of man. Since the influences of nature are fundamental, we shall discuss the effect of climate, topography, and resources upon peoples and architecture.

Climate

EFFECT UPON PEOPLES. It requires only a casual study of the racial characteristics of various nations to discover the effect of climate upon peoples. The inhabitants of Siam are quite different in temperament from those of Scandinavia. Their appearance is dissimilar, and their modes of thinking and living are as far apart as the poles. Climate has been an important factor in determining these characteristics. The warm sun of the south and the frigid winds of the north have both exerted their influences upon the physiognomies and habits of the natives of these countries. In Siam the humidity and heat do not stimulate activity of the acquisitive type, and a living is secured with the least effort. Indeed, only those individuals and races capable of adapting themselves to an easy-going, care-free life survive in the tropics. The inhabitants of Scandinavia, to the north, have developed under different conditions. Here the climate is harsh. Food, clothing, and shelter are difficult to obtain and must be planned far in advance. This requires initiative, patience, and energy. Farming in isolated valleys or putting forth to sea for fish has developed a quiet, taciturn, yet bold people. As they differ from the Siamese in habits and temperament so also their architectures present great contrasts.

In the arctic regions we find that civilization is even less advanced than in tropical Siam. Here climatic conditions are so unproductive, and absorb so much energy, that the natives have little surplus with which to develop civilization or art. It is only in the more temperate zones that the people are energetic and progress seems to be assured.

Here is not the constant and discouraging battle with nature—the jungle on one hand and the bleakness of the north on the other. In the temperate climates, man may plan and may realize his ambitions without interference from droughts, monsoons, blizzards, or tropical fevers. Thus in these friendly climes man achieves the highest development of civilization, and architecture as one of the great manifestations of progress finds its most eloquent expression.

EFFECT UPON ARCHITECTURE. In the warmer climates the vegetation is more luxuriant, and this is reflected in the architecture. The buildings may be more flamboyant in their conception, and usually a closer relation exists between the works of man and nature. More attention is paid to the color and texture of surface treatment (Fig. 135 A). Plain wall areas give an opportunity for contrast with the colors of the foliage. In the colder climates the architecture is more severe and the designer depends less upon the landscape for his final effect. Colors are usually more subdued, and there is often a feeling that the building repeats the strength and solidity necessary to withstand the elements of the north.

PLANS. The effect of climate upon the plans of buildings is quite pronounced. In the warmer climates, the plans are more open and often include courts or patios (Fig. 9 A), such as are found in Italy and Spain, and in their modern reflections in California and Florida. Detached buildings are also possible on account of the mildness of the weather, which makes passage between the various units easy and agreeable. This arrangement is illustrated by reference to the plans of some of our Southern Colonial homes in which was developed the idea of the detached cook house.

On the other hand, the colder climates have produced the plans which are more compact in arrangement. It is desirable to avoid the wintry winds and snow by providing a cover from one portion of the building or group of buildings to another. Thus, where a rambling plan has been necessary, covered passages connect the various units, again for the purpose of protection. A ride through the New England States will reveal a type of farm group with the house, wood shed, and stable compactly arranged in one continuous structure, so that the farmer may attend to the chores with the minimum amount of discomfort.

STRUCTURAL ELEMENTS. The walls of a building are the most important structural elements, and it is interesting to notice how climate has in the past affected these architectural members. But the age in which we are living has developed a type of architecture which pays but scant attention to climate. Walls in many cases are no longer bearing walls and can be made almost as thin as the material will permit. The development of insulation makes it possible to keep out the heat and the cold in a highly satisfactory manner. Wall thicknesses and physical comfort are not now related as they once were. In the time of the mediaeval and Renaissance builders the situation was very different. Walls were made thick, not only to carry the load of the floors and the roof, but also in order to resist the extremes of temperature. Walls are often still heavy in the less progressive countries of the north and south, and protection from the climate is a determining factor. It is interesting to notice how many gestures man makes in self-defense. Primitive man protected himself against the wild beasts and unfriendly effect of sun and rain. Modern man erects structures to protect his investments from depreciation and himself from the curiosity of his neighbors.

PROTECTIVE ELEMENTS. However, there are some elements of architecture which are distinctly protective in their use. While the walls of a building protect the interior from forced entry, the roof is regarded as affording more protection from the elements than perhaps any other feature. In the warmer climates, the roofs are usually rather flat and quite colorful (Fig. 9 A). The rich red-and-brown tile roofs of Italy illustrate the possibilities of this material. As we travel to the north, the roofs become steeper and less colorful. The necessity of shedding the rain and snow makes the low, flat coverings of the warmer countries impractical, hence the greater pitch to the roofs of the north (Fig. 9 B). As was the case with walls, modern developments have taken much of the romance out of the roof. Steel construction, insulation, and modern drainage make almost any kind of utilitarian roof possible. The roof may be flat and invisible from the ground. This form is quite desirable in the architecture of the contemporary period, as in Fig. 9 C. The roof has now become a terrace, and the accompanying fresh air and sunshine contribute to the health of a nation.

During the Renaissance period the cornice grew in importance, on account of both its decorative and its protective qualities. It formed an accent at the top of the wall, and, in addition, it shed the water away from this vertical surface. Modern builders now understand the science of water-proofing the walls, while gutters and downspouts help to take care of the rainfall. In many instances in contemporary architecture, the cornice has degenerated into an unimportant belt course. However, in southern countries the cornice often retains its projection in order to cast a shadow and to protect the windows from the full force of the sun.

The entrance porches which form an integral part of the cathedrals of England (Fig. 9 D) are also the result of the desire for protection. The driving rains and cold winds of the English climate made these porches a desirable adjunct to the entrances. A somewhat similar situation is to be found in the two-story porches which are a feature of some of the homes of our southern states. They offer, not protection from rain so much as a cool retreat for a siesta during the heat of the day, and illustrate again the effect of climate upon architecture. It seems quite possible that the porch, and especially the screened porch, has too often been neglected in contemporary housing develop-

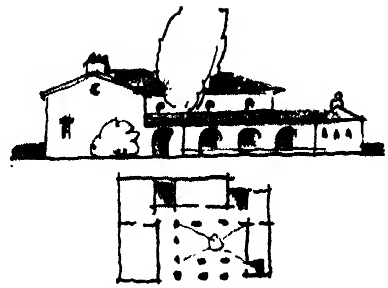


FIG. (A).—For a southern climate.

FIG. (B).—For a northern climate.

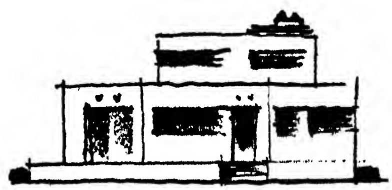


FIG. (C).—Contemporary expression.

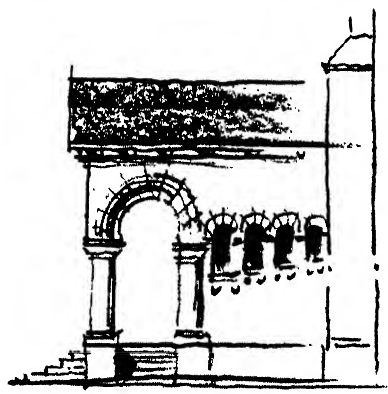


FIG. (D).—Entrance porch.

FIG. (E).—Climate and mouldings.

ments. The architect or the owner is often so intent upon following a Colonial or English precedent that this useful feature, which would permit the enjoyment of cool breezes without the annoying presence of insects, does not find a place in the design. It is possible to retain the spirit of the past without slavishly copying the details.

Circulatory Elements. Windows have been placed under this heading, not because they function in the same manner as doors, corridors, and stairs, but because they permit the entrance of light and the circulation of air. These two elements of nature as they vary in quality have a strong influence upon the design and size of windows. This is quite evident when the buildings of various countries are studied. In the warmer climates the windows are usually small because large openings admit too much light, which produces excessive heat and glare. In the colder countries during the mediaeval period before the general use of glass, the windows were small, this time for the purpose of keeping out the cold. As glazing came into existence, the sizes of windows increased, except in the modest homes where fuel was scarce and heat loss was an important item. In the more pretentious manor houses and châteaux, and especially in the churches, the voids crowded out the solids until the culmination of the window was realized in the beautiful stained-glass enclosures of French cathedrals. The increased size of windows in the north was due largely to climatic influences. Gray winters and summers less brilliant than those of the south made it necessary to attempt to capture the greatest amount of light. Consequently the windows were made as large as possible, see Fig. 152 A, and even the jambs were splayed, or cut back at an angle, in order to take full advantage of the small quantity of available light.

In the architecture of the twentieth century there has ceased to be the relation between windows and climate that existed in the past. We can heat or cool our houses in a satisfactory manner with less reference to the sizes of openings, and windows often simply contribute to the cheerfulness of the interior. In the last few years, however, there has come a new conception of the hygienic and therapeutic possibilities of the window. A type of glass has been developed which does not filter out the ultra-violet rays of the sunshine, as does ordinary window glass. This promises to come into general use, especially in the cloudier climates and in cities where a premium is placed upon these health-giving rays of the sun. Man has also invented machines to provide those elements usually furnished by nature. This and the influence of the machine age have brought about the suggestion of windowless buildings, but as long as man has a love for the out-of-doors, windows will probably play an important part in our architecture.

Decorative Elements. The development of the various decorative elements of architecture has also felt the effect of climate. In a warm climate with brilliant sunshine, pronounced mouldings are unnecessary and undesirable. When mouldings are used, the curves should be flatter and more subtle than those suitable for the north, because deeply cut details create numerous dark shadows and give an impression of restlessness. In the colder countries, sculpture and mouldings are usually deeply carved and undercut to catch the maximum amount of light, as in Fig. 9 E and on page 123. Gothic architecture with its many sharp points and deep shadows is quite satisfactory in the grayness of northern Europe. Its use in sunny Italy results in confusion, and the style seems out of place.

Color is a decorative element which in warm countries assumes an importance rivaling that of carving. Plain wall surfaces in white or light pastel tones, with their various textures, catch the sunlight and allow an interesting play of shadows from projecting roofs and adjoining trees. Colored tiles are also conspicuous in the architecture of the Mediterranean countries (Fig. 179 A).

An important problem to be solved by the people of this country is one concerning the type of architecture most satisfactory for regions experiencing extreme changes in temperature conditions. Many of our states have summers which resemble the tropics and winters as cold as the more northern regions. What heritage of the past is adaptable to these climatic changes? Is it possible that only the architecture of the future will develop a satisfactory solution to this problem? It would appear at the present time that current fashions are often stronger than the dictates of climate, materials, or habits of the people. Houses which have their source of inspiration in southern Europe are to be found in the manufacturing towns of New England, while English manor houses greet those who travel through the plains or mountains of the Southwest. Architecture should reveal more clearly the influences of climate.

Topography

EFFECT ON PEOPLES. The topography of a country has exerted an influence upon peoples and their activities which rivals that of climate. In the earlier periods of civilization the elements of topography—mountains, deserts, and seas—constituted barriers to migration. This retarded the intermingling of peoples and the cross-fertilization of cultures. Ideas traveled slowly, and the customs and arts of different countries assumed definite national patterns. However, as navigation became more of a science, the sea that had been a barrier became an aid to travel and communication. Countries which were fortunate enough to have ports developed a commerce which took their seamen to all corners of the known world. The color and splendor of Venice were due to her position as mistress of the Adriatic and the contacts which she had with the rich and brilliant courts of the Orient.

EFFECT ON ARCHITECTURE. Topography, in its broadest sense, may mean the general terrain or contour of the surface of the entire country. If the country is small and the topography is uniform, there tends to be a similarity of character in the architecture. It may be nationalistic and may assume traits common to the entire area. A mountainous region requires a type of architectural treatment quite different from that used in a level country. The properly designed building relates itself harmoniously to adjacent nature. In a setting of rocks and cliffs, with violent changes in the direction of the contour of the site, the building should appear to grow out of its surroundings. Here buildings should be informal without any studied attempt to secure a picturesque effect. The architecture should be only the natural result of an effort on the part of the designer to relate it to the immediate site and to the spirit of the country. A trip down the Rhine with its turreted castles crowning the tops of the hills or a visit to Central Europe with its picturesque countryside (Fig. 12 C) will show what harmony can exist between the buildings and the topography.

Holland is a country which is very flat—a country with canals and dykes and with much of its land near or below sea level. Its landscapes offered so little to the Dutch painters of the Renaissance that they were forced to dramatize the trees, clouds, and windmills to secure interesting compositions, or to resort to the painting of still life, cattle, or the interior of homes. It is logical, then, that the contemporary movement in architecture in Holland should attempt to reflect this flat character of the topography. Many of the re-

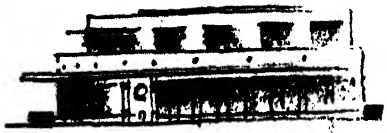


FIG. (A).—Horizontal functionalism.

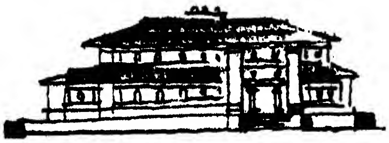


FIG. (B).—Prairie architecture.

FIG. (C).—Picturesque grouping.

FIG. (D).—Sloping site—informality.

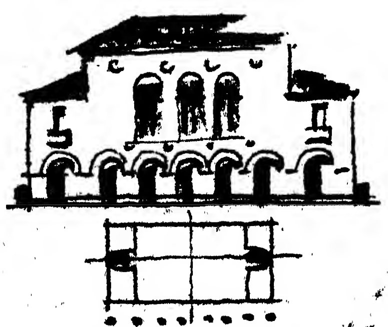


FIG. (E).—Level site—formality.

cent buildings have interesting vertical accents but are so horizontal in direction that the latter quality has almost become a national characteristic (Fig. 12 A).

That portion of America known as the Middle West, or the prairie country, presents an architectural problem similar in some ways to that of Holland, but the solution does not seem to be so close at hand. The prairies have as yet failed to have much influence upon the buildings erected thereon. The character of the topography is too often ignored, so that the same kind of architecture exists in the Rocky Mountain states and the Mississippi basin, an architecture which may be basically unsuited to either region. The few sincere attempts to develop a new type of architecture in harmony with the prairies have produced houses which have qualities similar to those shown in Fig. 12 B. The long, low lines are parallel to the level countryside and seem to be in complete sympathy with the surrounding terrain. If topography is used in a more specific sense as applying to the site upon which the structure is to be built, it is possible to bring to light some very significant facts about planning. It is then easy to understand why, for the successful solution of a problem, there should be perfect harmony between the building and the contour of the land. If a designer has a level site with which to work, his task is relatively simple. An unsymmetrical or informal plan (see Balance, page 252) is possible on such a site, but experience has taught that a formal or balanced scheme is often the more satisfactory. Except for buildings of domestic character or those in which informality is deliberately sought, symmetrical planning is usually more logical and desirable. A site without irregular shapes and sudden changes in grade will permit a formal arrangement of units, which is essential in many types of buildings, particularly those with Classical or monumental tendencies, as in Fig. 12 E.

However, if the site is not a regular one in shape or contour, full advantage should be taken of its peculiarities. The various elements of the plan should be arranged in an informal manner, and the floor levels of the major parts should follow, as far as is convenient, the slope of the ground. When the exterior is developed, an attempt should be made to cause the building to appear to grow from the site, as in Fig. 12 D, with the various masses building up into an interesting relationship between topography and structure. On a slope, the building should cling to the side of the hill. If it crowns an eminence, its steep roofs and vertical effects may serve as a fitting termination to a commanding height. Topography should influence architecture, and architecture should, in turn, accent topography.

Materials

Climate and geological conditions have played their parts in developing the use of building materials of many and varied kinds. Limestone and marble, white pine and mahogany, clay for brick, and ore for metals are the gifts of nature for the structures of man. In past periods, on account of accessibility and lack of methods of conveyance, certain materials have had a local use and have influenced the development of an indigenous architecture. Some countries have favored stone while others have been partial to brick. These conditions have not remained fixed, however; they have changed as new contacts were made and as new developments came into existence. Ideas were borrowed, commerce and industry grew, and now modern transportation has made building materials international in distribution and use. Architecture retains national traits, but the materials of man and nature belong to the world. Since this has more to do with the influence of materials upon design, we shall reserve further discussion for Part Three.

Chapter III

THE INFLUENCES OF MAN

The forces of nature are revealed in climate, topography, and natural resources, and the latter elements in turn produce nationalities and cities with outstanding characteristics and individualities. The activities of man have come into existence, and manufacturing, commerce, and construction supply the material needs of a country, while worship, creative endeavor, and play provide the necessary emotional outlets. Out of these activities has grown a social structure which determines how men live and the relations they have with each other.

Social Conditions

Architecture—more than any of the other creative arts, because it is the most permanent and cumulative—reflects the social structure of the period in which it is developed. The interests of a people dictate the type and appearance of its buildings. A social order develops gradually as the result of desires and disappointments, of wars and peace, of retrenchment and expansion. It may influence an entire architectural movement or the smallest detail of a building. Early in the development of a government or community there is a time when civil strife or outside opposing forces are much in evidence. During these times the householder goes forth with servants or body guard, whether it be upon the streets of Florence embittered with the enmity of the Guelphs and Ghibellines, or through the Indian-infested woods of Pennsylvania. When he returns to his home with its heavy walls, the strong doors are barred and the shutters are placed over the windows. Protection dominates architecture. But stable governments and improved social conditions eliminate the necessity of many protective features. . . . Comfort and convenience now control architecture.

A progressive, liberal-minded public does much to encourage the development of the appreciation of good art. The architect, unfortunately, seldom rises above current social influences. He is held back by public opinion, and very brave is the individual who dares to go against the trend of popular thought. The sheer weight of indifference to progress and the inertia of the human mind have usually hampered a new movement in the arts. A nation's social structure, its inclination to be liberal or narrow in its attitude toward changes, is the factor which determines its importance in the field of creative endeavor.

PERIODS. A general survey of social conditions and influences during the various historic periods shows interesting relationships between the way in which nations lived and the architecture which they produced. These periods may be divided according to location and time as follows:

Classical. The social structure of Greece before the Christian era made possible the Golden Age of Athens. The religious interests and the culture of the Greeks are reflected in the beauty and simplicity of the buildings on the Acropolis. The Romans also built temples which were quite magnificent, but the ornate palaces and baths which their emperors erected were more typical of these luxury-loving people.

Romanesque. With the downfall of the Roman Empire, individual cities grew powerful as commercial centres, and conquests were successfully carried on in foreign lands. The church conquered its enemies and became a dominating influence with the resulting erection of numerous places of worship.

GOTHIC. The Gothic period was one of intense religious feeling. With a devout populace and a powerful clergy, it is not surprising that these years witnessed the erection of the cathedrals of France and England. The dwellings of the nobility also received considerable attention in an architectural way. The feudal system, with the yeomen giving service to the lords and barons in return for protection from bandits or rival rulers, made necessary the fortified castle. When gunpowder changed warfare and caused this type of structure to become obsolete, the castle with its turrets and small windows gave way to the more comfortable manor house of England and the château of France.

RENAISSANCE. During the Renaissance period, the cities of France and Italy increased in importance and were often strong enough either to dominate, or to be independent of, the surrounding country. This led to a development of civic pride, and magnificent public buildings and palaces gave each community a claim to superiority over its neighbors. Progressive governments encouraged the development of the arts, and houses, churches, and town halls were decorated with the brush of the artist, the chisel of the sculptor and the woodworker, and the skilled hammer of the artisan in metals.

COLONIAL. During the seventeenth and eighteenth centuries those who came to this country from the shores of Europe were busily engaged in developing a new and raw country. They were at first interested in securing the simplest kind of food, clothing, and shelter. Naturally any attempts at architecture were direct, and economical of materials and effort. As the enemies of the new world were gradually eliminated, the colonists had more time and wealth at their disposal, and their houses were patterned after the then prevalent Georgian style in England. Graceful mouldings and columns executed in wood added to the attractiveness of what is now called Colonial architecture. But with it all there was retained a simplicity which was in keeping with the life of the colonies during this period. Public buildings were domestic in character, and intimacy rather than grandeur was the outstanding quality.

NINETEENTH CENTURY. The last part of the nineteenth century ushered in a new era and witnessed the beginning of the industrial age. The vast resources of this nation were tapped so rapidly that its people were astounded at the possibilities which confronted them. The development of the railroads simplified the transportation of the raw and manufactured product and added still more to the prosperity of the country. New frontiers were opened, and new industries followed in the wake of the pioneer settlers. The foundations of many of the fortunes of today were laid. But art languished and almost died. Public taste dropped to the lowest level in the history of the United States. The architecture produced during this period was extremely ugly, or, at the best, simply uninteresting. New social forms came into existence overnight. A vulgar display of new-found wealth was typical of the cattle, coal, and railroad barons of the 'seventies and 'eighties. It is not unnatural that the debased architecture of the period should reflect the attitude of mind which created it. People were too busily concerned with the practical to give any serious thought to the aesthetic—or to realize that beauty and business are compatible.

TWENTIETH CENTURY. We are living in the twentieth century and hence are too close to it to make a satisfactory comparison or analysis. We do know, however, that our social structure has become so complex that confusion rather than simplicity is its chief characteristic. The automobile has made it possible for us to live many miles from our work but has created a traffic problem which tends to defeat the very purpose for which it was built. The movies and radio, together with inexpensive transportation, have brought us knowledge of foreign countries. Their ideas have been quickly adopted by our people, and ours by them. Thought, dress, and architecture are becoming international in style. This is a condition to be deplored when one sees what interesting customs are being eliminated. Standardization is more prevalent than individualism.

To the problem of transportation have been added housing, sensible recreation, and other social adjustments of a similar nature. Congestion in our large cities is the result of the desire of individuals for convenience in the matter of their relations to each other. Economic pressure requires proximity of allied fields of endeavor and adds to the problems of the architect and city planner. This complexity of our social system is reflected in our architecture. We must have every conceivable type of building to house all of the related activities. We have built rapidly, but not always wisely, in order to meet the demand for increased space and revenues. Often our architecture has been beautiful, but at times it is merely sensational. The future should hold an inducement for a return to a simplicity of thought and life, and, as a result, an improvement of architecture.

MAN'S PERSONALITY. In spite of the fact that the dress of individuals is becoming standardized, man's personality is still reflected in his clothing. A student of human nature can often identify the station in life to which a person belongs by his appearance. Something is known of his interests from the type of house in which he lives. In a similar manner, it is possible to trace a comparison between the personality of a nation as reflected in its clothing and its attitude toward architecture as seen in its buildings. Clothes give an indication of the simplicity or complexity of the existence of its inhabitants, which in turn controls the development of its architecture. Let us examine four contrasting periods.

GREEK. During the height of Greek civilization, when scholarly and philosophical refinement was characteristic of the lives of the people, we find that the costume consisted of a simple, flowing robe. Much attention was paid to the body and to physical health. Athletics played an important part in the life of the Greek people. Artemis, goddess of the chase, and Hermes, the fleet-footed, were favorite subjects of the sculptor. The existence of the Greeks was reduced to the essentials, and this was reflected in their dress and architecture (Fig. 17 A). They did not build on a grand scale, but rather sought for purity of detail and development of technical skill. Ornateness in dress had no place in their simple activities.

THE FRENCH RENAISSANCE was a period of multiplicity of detail in court life, in dress, and in architecture. The sun could not rise until Louis XIV conducted his daily levee from the sanctuary of his bed chamber. Social etiquette was so complicated that all naturalness was abandoned. Life was artificial and theatrical, and likewise the costumes of the period. Powdered wigs and brocaded coats made congruous the jeweled canes and lace frills. The furniture was colorful, but the chairs were often straight and uncomfortable, in order not to muss this finery of the followers of the court. All this splendor would have been inappropriate in a simple setting. The architecture had to be ornate in order to harmonize with the activities which it housed (Fig. 17 B). Buildings were crowded with rococo details which hid structural lines and often prevented truth of expression. This elaborate architecture lined wide avenues lavishly decorated with fountains and gardens—all designed for the purpose of being ostentatious.

VICTORIAN. It is possible to bring a similar comparison down to two periods in the history of our own country, namely, the last half of the nineteenth century and contemporary times. Scrutiny shows that they are quite far apart in the matter of dress. We have only to find daguerreotypes of our grandparents who lived in the 'seventies and 'eighties to realize how decadent public taste had become in the matter of dress, at least according to present ideas. The flowing whiskers, beribboned bonnets, mutton-leg sleeves, and bustles were simply a reflection of the jig-saw ornament and sheet-metal cornices of the buildings of that period (Fig. 17 C). Again it was an era of ornateness, but of an ugly and drab variety, without the color of the French Renaissance.

CONTEMPORARY. Although present-day civilization is complex, we have been blessed with simple attire for both men and women. We may well ask whether the efficient, precise architecture of our commercial buildings has given rise to the new dress, or whether sensible clothing has encouraged sensible architecture. The dress of today is probably due to the fact that the science of medicine and health has kept step with other developments, and our people have been impressed with the necessity of fresh air, sunshine, and exercise. These were difficult to obtain under the restrictions of the nineteenth century, so that the prudishness of that period has been overcome in favor of cleanliness and comfort. In many respects there has been a return to the ideals of the Greeks in our desire for freedom of movement and our interest in athletics. The same spirit is reflected in the contemporary movement in architecture, which, in seeking to interpret buildings in terms of the needs of the people, is placing the emphasis upon plain wall surfaces with little decoration and the use of considerable window space (Fig. 17 D). Our work places combine the benefits which come from proper light, ventilation, heat, and plumbing. For those who can lose sight of the romantic movement in domestic architecture, domestic design is following in the footsteps of other types. It is simple and direct—it is in complete harmony with contemporary ideas in dress.

FIG. (A).—Greek. Dignity.

FIG. (B).—French. Colorful Complexity.

FIG. (C).—Victorian. Drab Ornateness.

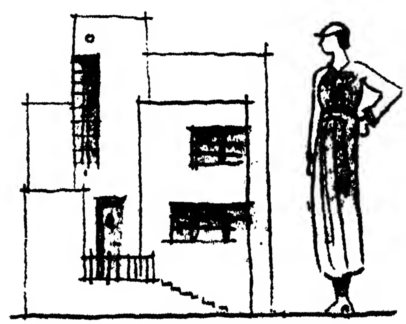


FIG. (D).—Contemporary Simplicity.

MAN'S INTERESTS. It has been pointed out that the activities and interests of man are directly responsible for the type of architecture which he develops. Let us now examine three of the most typical structures of the present age and discuss their evolution. The house provides shelter for man during his hours of rest, the factory offers a place in which to work and to produce a commodity of exchange, while the church affords spiritual relaxation and opportunity for worship. Social conditions have influenced the development of these buildings, during the various periods, in the following manner:

EARLY AMERICAN HOUSE. During the early days of this country, life was simple, and materials and labor were limited. Houses were small and compact, designed to provide the bare essentials. The "hall" was the service portion of the house—the kitchen and work space—and here the major activities of the family took place (Fig. 19 A). A large central chimney made possible a fireplace in both the kitchen and the one other room of the house, which was called the parlor. At a later date, when time and money were more plentiful, an addition was made to the rear of the house, providing area for more sleeping space and for a real kitchen, the hall still being used as a work room and dining room.

COLONIAL HOUSE. As the affairs of the colonists prospered, their ideas of comfort increased and the houses became more elaborate. The central chimney and cramped staircase gave way to a central hall running from the front to the rear of the house. The stairway became spacious and graceful, harmonizing with the more formal treatment of the interior and exterior. The rooms were arranged in an orderly manner on either side of this hall and were usually of ample size—in keeping with the growing elaborateness of the social functions of our forefathers (Fig. 19 B).

EARLY FARM HOUSE. As the descendants of these colonial people grew restive of life in the eastern states, they pushed westward to conquer the frontiers which challenged their courage and industry. Again necessity dictated the type of shelter which was erected. Before the invention of farm machinery, the prairie farmer's family had little time for leisure. The kitchen was the work space, as in the earlier days, and here were carried on the activities of cooking and canning, of washing and weaving. In addition, it was convenient to eat in the kitchen the food which had been prepared there, and, after the meal, to remain in the room which had already been warmed by the fire. Thus the kitchen again became the communal hall—the cooking, dining, and living room. When later the so-called parlor was added, it usually remained closed and unused except upon important occasions. It was not until furnace heat eliminated the stove, and a rebellion against the uncomfortable Victorian furniture and depressing wall and floor coverings rescued the parlor from its forbidding aspect, that this portion of the house came into its own and was made livable.

VICTORIAN HOUSE. When the scene changed from the farm to the city, the situation was somewhat different. Here were wealth and servants, and large houses were easily maintained. There was also a wide difference between the living standards of the rich and the poor. Those who possessed more than their share of worldly goods were inclined to make some visible display of their wealth. It was the age of pretense and show, and the homes of the wealthy displayed these characteristics. A reference to Fig. 19 C shows how complicated were the plans of the houses of the Victorian period. There were often many rooms of various sizes and shapes, disorganized and unrelated to human needs. (Fig. 31 B.)

CONTEMPORARY HOUSE. Since the beginning of the present century there has been a gradual improvement in domestic design. Until quite recently we have rather slavishly copied European examples, but, in many cases, it has been fairly well done. The majority of homes designed by reputable architects have been very satisfactory in plan arrangement and in exterior appearance. The kitchen has now become a laboratory for the preparation of food, but the dining room is losing its importance because we eat less leisurely and make less of a ceremony of this activity. However (Fig. 19 D), the living area of the home is coming to occupy a more prominent position. Considerable space is devoted to that room which helps to provide relaxation during our waking hours.

In the ultra-modern house, there is a tendency to design a place of habitation which is very flexible in plan so that it can be changed to suit the conditions of the moment. The kitchen and the bath are among the few fixed units, and the remainder is arranged with light partitions, screens, and furniture in such a way as to make it interesting and usable. In a house of this so-called "functional" type there is a desire to take full advantage of sunlight and air. The walls are opened up as much as possible, and the interior is related to the exterior terraces and gardens in a pleasing manner (Fig. 19 E).

Thus, as we study the progress that has been made in domestic design, it is seen that the chief advantage that the twentieth century holds over the eighteenth is one of comfort. We have yet to conceive a type of architecture that is more beautiful in its simplicity and orderliness than the Colonial. However, features which cater to the comforts of the inhabitants have steadily increased and have modified the character of modern homes. There were no screens or screened porches in the early days of our national history. This was before the machine age, and a satisfactory and inexpensive material had not been found. But more directly, perhaps, necessity had not as yet driven the people to consider the situation seriously. Servants were plentiful and they could fan the insects away from the members of the family and thus assure comfort. In a like manner the presence of servants took the kitchen out of the homes of the southern states and into a detached cook house—a matter of comfort at that time but one of inconvenience now. Labor is an important item in the erection or maintenance of a building.

The Factory. In the early days of this country our business relations were very simple, and a man often worked at home. His first work shop was an extra room

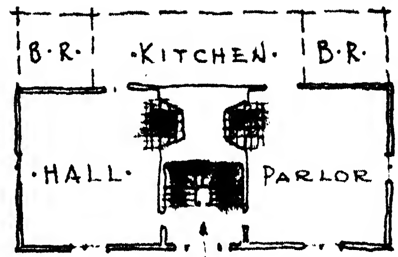


Fig. (A).—Seventeenth Century.

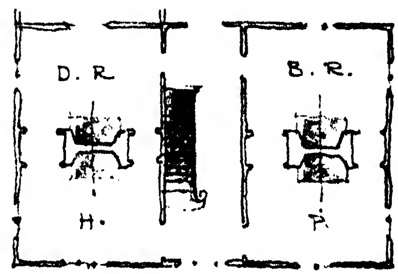


Fig. (B).—Colonial house.

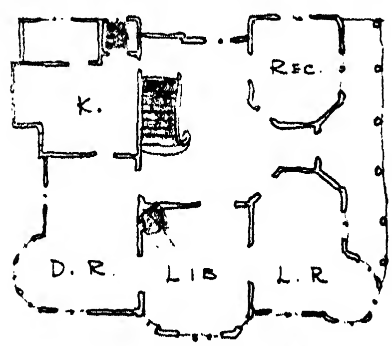


Fig. (C).—Victorian house.

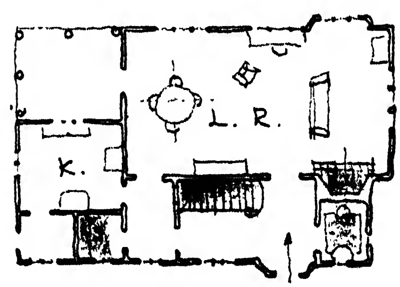


Fig. (D).—Large living space.

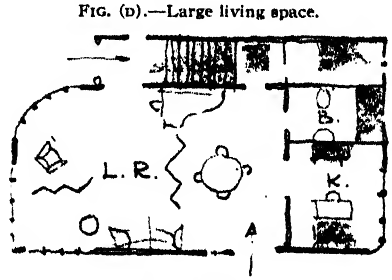


Fig. (E).—Simplification.

in his dwelling. As his trade increased it was found necessary to move his business to a more central location where he could better serve his public and, at the same time, interfere less with the activities of his family. Even after this first period of expansion, the shop or factory retained its domestic character, and the process of manufacture underwent little change. This was still the age of craftsmanship, the period of individual effort. Those who created products required by their fellow men took pride in each article. Mass production had not yet been developed, and business was personal rather than impersonal.

When the industrial period arrived with the last half of the nineteenth century, all was changed. The small shops grew into factories, and little thought was given to efficient arrangements or pleasant working conditions. Labor was unorganized and did not have any comparisons upon which to base a protest. In the home work shop a few windows furnished sufficient light and air, but when this idea was applied to a factory, the result was gloom and inefficiency. The work places of this period were simply enlarged shops of an earlier day.

The present century has seen the growth of a great commercial period. It is the age of competition and mass production. In order to manufacture a commodity which compares favorably in price and quality with others of a similar nature, it has been necessary to stress the idea of efficient operation. Proper working conditions have been an outgrowth of this kind of business life, and, as a result, well-planned factories and pleasant surroundings are often typical of portions of our industrial cities. They are not analogous to the picturesque, vine-clad mills of early nineteenth-century New England, but their functional lines do express the energy and strength of American industry.

The Church. One of the natural impulses of man is that of worship. Early man set up crudely carved idols about the hearth and paid homage to them. Succeeding peoples grew more skillful in the representation of their gods and in the erection of structures in which they might be worshiped. The Egyptians built in a colossal and permanent way in order to preserve the bodies and to perpetuate the memories of the dead and also to emphasize the supremacy of the deities. The simplicity of Egyptian forms is reflected in the temples of the Greeks, but mystery and massiveness give way to refinement of detail. Although the places of worship of the Greeks and Romans were called temples and those of the followers of Christianity are known as churches, nevertheless they are all religious buildings. It is interesting to notice the relation between religion and architecture during various periods.

Greek. The worship of the Greeks was based upon the glorification of many gods, each represented by a magnificent and often colossal statue housed in a temple built of beautiful marble. Priests attended to the details of the ritual in connection with the worship of a particular god, they alone going into the temple and holding communication with the deity. The populace simply worshiped from a distance and received their impression of the power of the god from the exterior appearance of the temple. Since space was not needed for a congregation, the temples were comparatively small (Fig. 21 a). Since all eyes were turned toward the temple from a respectful distance, the exterior rather than the interior received the attention of the Greek artisans.

Christian. The Christian religion is based upon the participation of the worshipers in a personal and direct way. Christian churches are built to hold congregations, and for that reason the interior is in many respects more important than the exterior.

During and after the downfall of the Roman empire, the structures which remained were adapted to Christian uses, but as the faith converted its enemies, new buildings were erected for the definite purpose of worship. The elaborate ritual of the mediaeval period dictated the design and caused the development of the cross-shaped plan with the choir aisles bounding the altar and the sanctuary which, together with the nave aisles, made a place for the processionals (Fig. 21 B). The mediaeval church was not only a place for worship, but was also a centre of education for the masses who could neither read nor write. The carvings and sculpture of the exterior and the interior furnished a chronology of Biblical events. The realism of Judgment Day was represented more vividly in stone than in a sermon. The church was the spiritual home of the people. But it was, in addition, the art museum, library, and school of the community.

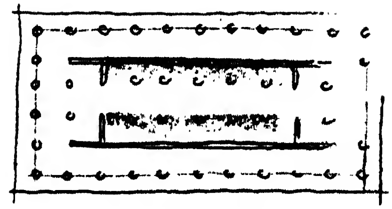


FIG. (A).—Greek temple.

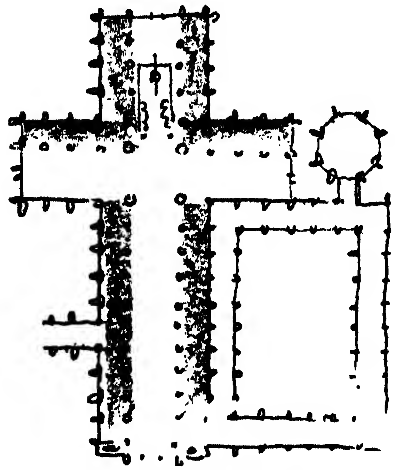


FIG. (B).—Mediaeval church.

As social changes took place and many of the people learned to read and write—chiefly through the invention of the printing-press and the accessibility of the printed book—the church lost some of its importance as an educational centre. Its primary appeal was to the spirit of worship. In subsequent buildings, sculpture has been conspicuous, but the decorative quality, instead of the pictorial, is usually stressed. The plan has undergone the greatest change, particularly with those denominations whose rituals are rather simple. The preaching type of church has developed, in which an attempt is made to seat the congregation in an auditorium where their participation is a mental rather than a physical one. The cross-shaped plan has either disappeared or has been greatly modified. In contemporary design we find plans which are often polygonal, square, or even circular, as in Fig. 21 C.

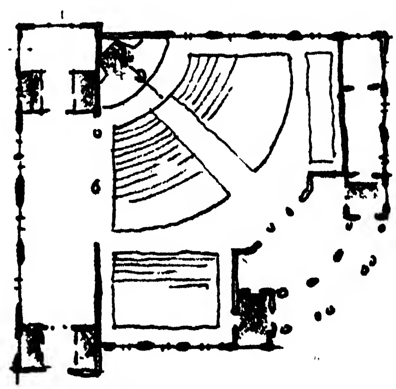


FIG. (C).—Auditorium type.

During the past few decades there has been a tendency to return to the functions of the church of the mediaeval period—an effort of the church to hold its own against the liberal forces of the present age. The church plan has been enlarged so that it can provide mental and physical as well as spiritual relaxation. The modern church plant now has class rooms for educational work, halls and parlors for social intercourse, and a gymnasium for the exercise of the body. The activities of the modern church are many and varied, and the plan, see Fig. 21 D, is more ambitious and complex.

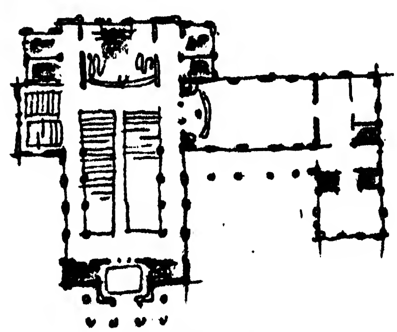


FIG. (D).—Multi-purpose church.

TWENTIETH CENTURY ARCHITECTURE. The present century has brought countless inventions and discoveries. Old standards of thought and living have been modified or abandoned. New activities have called for structures to house them, and new materials and types of construction have made these buildings possible. Let us examine a few which have either been developed or changed by the social system of our day.

TRANSPORTATION has perhaps exerted more influence upon our architecture than any of the other manifestations of our activities. It not only has made possible the carrying of all kinds of building materials from one end of the earth to the other but it also has created structures unknown a few generations ago. The automobile has made necessary the garages, filling stations, and bus terminals of today, besides rendering almost obsolete our narrow streets designed for the horse and buggy. Efficiency and beauty of line in the present-day automobile have created a new respect for the same qualities in our architecture and also in our articles of business and commerce. The airplane has brought about the development of airports, while new types of steamships with increased tonnage have given added importance to docks and warehouses. The expansion of the railroads has created the magnificent passenger and freight terminals and has made possible our large industrial centres.

COMMERCE. The great commercial buildings of today are so conspicuous that we need do little more than mention them here. Business has needed a place in which to house its activities, but it also has wished to point with pride to this material expression of its achievements. Our tall buildings are appropriate monuments to American commerce.

EDUCATION. One of the outstanding characteristics of the century in this country is mass education. Schools and colleges are scientifically planned, and their functions are numerous and involved. Their buildings dot the land, and though their architectural expression sometimes is based upon precedent and tradition, still the motivating spirit of progress in learning is present. However, education is not limited to centres of academic training. The newspaper is a powerful agency in the attempt to keep people informed upon the current affairs of the nations, and libraries and museums offer unlimited facilities to those who would read and study. The museum is even now undergoing a revision of arrangement and function. When the revolutionists of France took over the government from the hands of Louis XVI, they found the royal palaces filled with much of the art of Europe. It seemed logical to preserve it within the walls of these buildings, and thus the palaces and châteaux became the museums of the people. Later when new museums were built, the older buildings with their high ceilings, large windows, and grand staircases served as patterns. These early museums thus resembled palaces converted into storehouses for art objects, with little thought given to the education or comfort of the public. The modern museum is designed to display the art of the past and the present in order that it may be studied and applied to contemporary needs. Simplicity of arrangement, satisfactory lighting, and ease of circulation are primary requirements.

REHABILITATION. Labor-saving devices have brought about time for leisure and the need for recreation. There is a universal interest in sports and entertainment, both by spectators and participants. As a result, we have theatres and dance halls, arenas and ball parks, golf clubs and city clubs—all the outgrowth of an effort to get away from the cares of our exacting existence. Hospitals and clinics help us to recover from our absorption in both business and pleasure. The multiplicity of our interests has influenced our architecture.

Economic Conditions

The social life of a nation and the resulting architecture are linked closely with the economic conditions under which people live. The nature of trade, commerce, industry, and agriculture determines to a large extent the occupations and standards of living within a particular country. These factors influence the types of buildings erected and the materials used. As nations modify their basic economic institutions through changes in manufacture, transportation, and communication, new modes of living come into existence, and new architecture must be developed to conform to these customs. We are interested, therefore, in the economic status of individuals as they constitute a nation, and not in their private finances. People may effect certain economies in their daily purchases, but we are more concerned with the broader aspects of an economic existence. We are also interested in economy in architecture. Buildings may be so designed that there is economy of space, of movement, and of materials. These factors control to a large extent the cost of an architectural project.

A study of the economic conditions of past cultures will reveal the relationship which has existed between prosperity or poverty and the accompanying art and architecture. If a liberal-minded nation prospers, its art may flourish. Wealthy patrons are in a position to encourage artists with gifts and to offer them opportunities to express themselves with the brush, chisel, or pen. However, the creations of such a period are often ornate and sophisticated, because of the unlimited facilities which have been placed at the disposal of the artist. Frequently, on the other hand, during periods of enforced frugality, the most interesting results in architecture, music, and painting are produced. This may be due to the limitations of cost, which tend to eliminate the non-essentials, or it may come from the people's being less concerned with the superficial things of life.

During the present century the concentration of wealth in our cities has been responsible for our attitude toward certain types of architecture. Investments rule our lives, and the process of building must lend an attentive ear to the caprices of finance. We erect structures many stories in height, but mechanical devices render them obsolete in a few years and they must make way for those with later developments. This may not directly express economy in architecture, but it is related to the economics of business. Unfortunately, to the building or buying public, the word "economy" is often associated with the use of inferior materials and workmanship. Instead, true economy in architecture should consist in the omission of useless decoration and the inclusion of sensible planning. Simple materials used in a straightforward manner are more typical of an effort toward economy than substitution or imitation.

The foregoing remarks are insignificant in their importance when compared with a phase of economic evolution which we are now witnessing. Man's economic system remained unchanged for centuries—until the present industrial age. Previous to this age of machinery, power and energy were supplied by the hands of man or the backs of animals. Production was relatively slow, and the hours of labor were long. Now electrical or steam power is furnished in almost unlimited quantities, releasing man from the machine and creating new economic and social problems. Man can now work less and produce more.

In establishing a balance between man and the machine, new adjustments of human relations will be necessary. The future promises shorter hours of labor and longer hours of

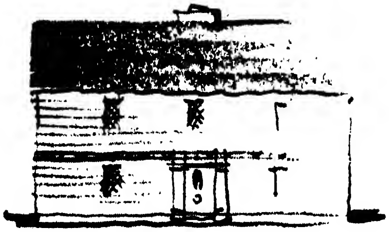


FIG. (A).—Seventeenth Century.

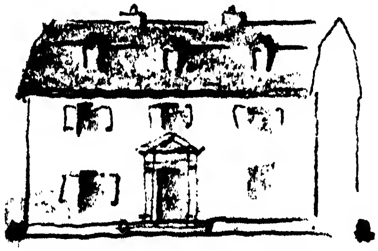


FIG. (B).—Colonial—gambrel roof.

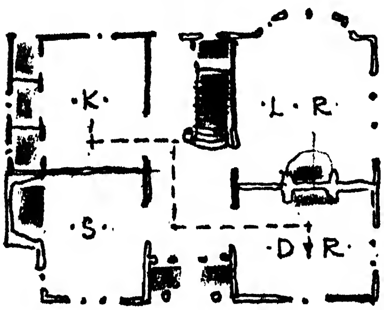


FIG. (C).—Wasted effort.

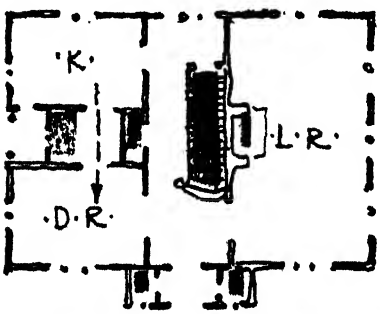


FIG. (D).—Economy of circulation.

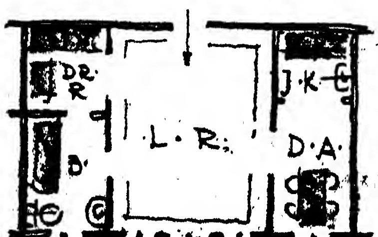


FIG. (E).—Efficiency apartment.

leisure. This increase in leisure suggests a changed mode of living. It will promote the erection of those buildings which have to do with recreation, relaxation, and education. More time will be devoted to the rehabilitation of the mind and body. This possible change in our economic structure may thus have a profound effect upon our social life and our architecture.

PERIODS. Reverting now to simpler and more concrete examples, let us again take four representative periods in the history of our country in an effort to trace the effect of economy of time, space, and money upon one phase of architecture, i.e., domestic.

EARLY AMERICAN. In the seventeenth century house an example of structural economy is seen in the use of the central chimney (Fig. 24 A). This arrangement enabled the builders to frame the house about a heavy vertical unit, with the resultant saving in construction. This chimney served all the fireplaces, and conservation of heat was aided by the low ceilings and small windows. (Figure 30 B.)

COLONIAL. The gambrel roof was the result of the economical desire to expand upward instead of in a horizontal direction. The third story thus added gave more space without raising the roof ridge. (See Fig. 24 B.) Economy of transportation dictated the use of local materials.

VICTORIAN. The period of prosperity accompanying the industrial expansion minimized the necessity of economy. The many rooms, high ceilings, and multiplicity of detail (Fig. 31 B) are indications of the new-found wealth.

CONTEMPORARY. This century has ushered in a period of affluence which, in spite of temporary reversals, has given this country its share of the wealth of the world. Despite this, there has been a demand of economies of all kinds. New materials and new types of construction have been developed in order that buildings may be more rapidly erected—economy of time. High land values and congestion in our large cities have led to economy of space. Again, expansion is vertical instead of horizontal. The efficiency apartment is more popular in some communities than the detached house, because it calls for the minimum amount of upkeep—economy of labor, Fig. 24 E.

Economy of labor has affected the relation of the kitchen and the dining room. Often in our earlier houses, and particularly in English homes, little effort was made to place the dining room adjacent to the kitchen (Fig. 24 C). It has been pleasant to retain a remnant of the custom which made a procession of the food from the kitchen to the great hall of the castle. In mediaeval days retainers were plentiful, and convenience in the matter of communication between the various parts of the dwelling was of secondary importance. In addition, the wide separation of the kitchen from the dining room removed the confusion and the odor of cooking from the rest of the house. Now there is a deliberate effort to make communication as direct as possible, since the servant problem is not so easily solved as it was in the earlier days in this country and England. If the housewife does not depend entirely upon domestics, she is interested in saving herself as many steps as possible during her day's work. Figure 24 D represents a common arrangement of these previously mentioned plan elements, as exemplified by American practice.

If we now look at economy from a more general point of view, we shall see a number of significant changes which have taken place in recent years. It has been shown that it is more economical and convenient to let some outside agencies take over many of the functions which at one time belonged to the home. Our children are educated almost entirely in schools, and the sick are efficiently cared for in hospitals. Much of our food is prepared outside the home by specialists, and commercialized entertainment and relaxation are offered in an almost unlimited variety by clubs and theatres. The spacious homes of an earlier generation are, regrettably, being replaced by smaller ones which reflect the desire for ease of maintenance. Thus economy reaches into many phases of our daily existence and of our architecture.

PART TWO

THE ELEMENTS OF ARCHITECTURE

Chapter IV

THE EVOLUTION OF FORMS

In previous chapters we have surveyed the motivating influences behind architecture. We should now approach the study of design by inquiring into the nature of the component parts of buildings. A consideration of the major principles governing creative work should be reached as quickly as possible, but elementary sources and origins must not be neglected. We must build slowly and well. A structure is only as strong as its foundations. The ability to design depends upon a knowledge, either conscious or intuitive, of fundamental influences, derivations, and principles.

Function and History

The buildings of the past were developed because of definite and tangible needs. The functions of the various structures determined their plan, shape, and treatment. The materials and types of construction influenced their appearance, but the purposes of the buildings were the controlling factors in their general design. Before attempting any study of present-day functional architecture, it is desirable for us to analyze the attempts of past generations to develop buildings expressive of their use.

A study of past achievements should, therefore, preface an effort to solve today's problems. The present should not be divorced from the ages which have preceded it. The English language is the result of the blendings of nations and tongues. The architecture of today is the outcome of the experiments of the builders of countless generations. We shall, therefore, approach the present through the past. If there is a lesson to be learned from the efforts of the Greeks, the Romans, the French, or the Italians, it must be through a study of the reasons for the buildings which were erected by these peoples. Each country had favorite materials which it used in typical ways. Each country had a science, a religion, a philosophy which demanded that their stories should be told in stone or brick. It is only with an understanding of these influences that we can profit by the achievements of the past and proceed to a consideration of the needs of the present. We must face toward the future but keep an attentive eye upon that which is already history.

Each period of historic development was once "modern." The use of the true arch by the Romans was an innovation which would have seemed strange to the Greeks. In turn, the builders of the Middle Ages erected structures so unlike those of preceding periods that they were doubtless regarded as daringly new. Contemporary designers in the so-called functional manner may be paving the way for another style, but they are not the first "modernists" in the evolution of architecture.

As we scrutinize the various historic styles we should search for the structural scheme.

Instead of looking for façade decorations—pilasters and cornices—we should attempt to find the reasons for the development of the post and lintel, the round arch, and the pointed arch. These causes, and the basic principles of design thereby evolved, are the fundamental influences behind architectural movements.

But all of the past cannot be accepted indiscriminately. Any age produces both the fine and the mediocre. Art and architecture go through three very definitely recognized phases in the course of their development. The first period is the ARCHAIC, illustrating the groping of the untried hand in an attempt to master new problems and new mediums, an effort to find an expression for a new material. The results—whether in architecture, sculpture, or painting—are likely to be rather primitive but direct and refreshing. The second period is that of MASTERY. The buildings or art produced during this time show that the designer or artist has discovered how to control his medium and is sure of his technique and performance. This is the height of the development. It is now that the most finished and often the most satisfactory results are obtained. After this the artist becomes too sure of himself and begins to take liberties with his materials. His designs are less structural and are likely to be too ornate. This is the third or the period of DECADENCE. It heralds the decline and is the beginning of the end. Thus all that belongs to the stylistic past is not necessarily good. The designer must choose between merit and mediocrity. An active choice is far more desirable than a passive acceptance.

One type of architectural philosophy says that a student may design and acquire a vocabulary and a familiarity with mediums of expression simultaneously—that, if given an opportunity, he will create and learn forms as he creates. Another system demands that much time be spent studying the architecture of the past and of the present, in the hope that the student may absorb principles and theories. A talented student will probably succeed under either system, but it seems that an approach which combines the desirable qualities of each should produce the most satisfactory results. However, a child learns words before it uses sentences—it acquires a vocabulary. It is necessary that a student of architecture develop a vocabulary of architectural motifs and a knowledge of their application. The acquisition of this ability to speak the language may be left to the ingenuity of the student or to the guiding hand of the teacher, but the ability is essential. There is always the necessity of proceeding from the known to the unknown. The architecture of the past and the principles of composition therein exemplified are known; the developments of the future are unknown.

European Precedents

PERIODS. The architecture which preceded the Classical period must concern us little here. The heavy, massive buildings of the Egyptians had considerable influence upon those of the Greeks, but the architecture of the Babylonians and Assyrians has had little direct effect upon the structures of today. Also for the sake of brevity, and on account of their resemblance to other styles, we must omit the Early Christian and the Byzantine. These movements borrowed forms and details from Roman architecture and, while the ensuing buildings were interesting, their contribution to later styles was often not pronounced. Our classification of the various historic styles, together with approximate dates, will be made upon the basis of whether they are structural and creative or decorative and imitative, as follows:

1. STRUCTURAL STYLES (creative).
   a. TRABEATED (post and lintel) ARCHITECTURE.
      Classical, seventh century B.C. to fifth century A.D., inclusive.
         Greek.
         Roman (with beginning of round arch).
   b. ARCUATED (arch and pier) ARCHITECTURE.
      Romanesque (round arch) sixth to twelfth centuries.
         Italian, French, English, German.
      Gothic (pointed arch) thirteenth to fifteenth centuries.
         French, English, German, Flemish, Italian, Spanish.
2. IMITATIVE STYLES (decorative).
   a. POST AND LINTEL AND ROUND ARCH.
      Renaissance, fifteenth to eighteenth centuries.
         Italian, French, English, German, Spanish, Flemish (American Colonial).

The different periods of historic styles ceased with the Renaissance, and since then architecture in Europe and America has consisted of the following:

1. REVIVALS, nineteenth century.
   Classical.
   Romanesque.
   Gothic.
   Renaissance.
2. ECLECTISM, first two decades of the twentieth century.
   This is the electing to work in any of the styles of historic development, depending upon the type of building and the inclinations of the architect and the client.
3. CONTEMPORARY MOVEMENT, since *circa* 1920.
   Here is an architecture based upon the desire to allow function and materials to dictate form and "style." If from this approach a new style is evolved, it will be as an expression of steel and concrete—new materials interpreted in new ways.

The foregoing outline is sufficient to show that the architecture of the past with which this age is most familiar has had its major developments related to a few countries of Europe. These are the countries whose climatic conditions have fostered the growth of familiar governments, arts, sciences, and civilizations. The bond between Europe and America is not accidental; it is the result of the forces of nature working through the activities of man.

The countries which have seen the greatest development in architecture, according to present standards, are those which have contributed most to the cosmopolitan nature of the population of the United States. We have drawn from Greece and Italy for the Classical, and from Italy, France, England, and Germany for the Romanesque. The Gothic has come to us from France and England; the Renaissance was born in Italy, and spread to the other countries of Europe, which in turn have all sent their various national flavors to season the architecture of our three centuries of existence.

A more complete survey of the various architectural movements from the Classical period to the present day reveals the following characteristics:

GREEK. The architecture of Greece was one of temples and theatres. The temples were used only as shrines, and the exteriors received the attention which was necessary to impress the populace worshiping from without. The Greeks used heavy stone walls to enclose their buildings and spanned their openings with the lintel supported upon walls or columns. The proportions of their architecture were so satisfactory that they have served as an inspiration to the builders of the succeeding centuries. Greek architecture stresses refinement of line and simplicity of detail. It has clarity, strength, and repose.

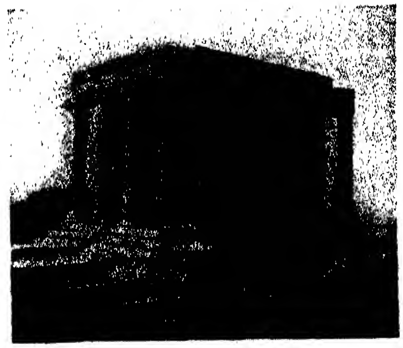


FIG. (A).—Niké Apteros, Athens.

ROMAN. Where the appeal of Greek architecture is spiritual, that of the Romans is often pretentious. The builders of the Roman empire are now regarded as having been engineers rather than architects. They copied the temples and theatres of the Greeks and, in addition, built ornate palaces and baths. They developed the round arch and pier, and enclosed the large halls of their secular buildings with vaults. They achieved a more richly decorative, but less fundamental, type of architecture than that which came from the Greek civilization.

FIG. (B).—The Pantheon, Rome.

ROMANESQUE. The Early Christian era which accompanied the downfall of the Roman empire witnessed the use of Classical remains as sources of inspiration and of building materials. As these old forms ceased to meet the needs of the people, and as their architectural ability developed, the Romanesque style came into existence. Instead of depending upon stability imparted by sheer mass, it employed the round arch and vault in such a manner as to give equilibrium by the adjustment of thrusts. Romanesque architecture is one of churches. It is honest in its use of brick and stone; direct and vigorous in its arrangement of mass and detail.

FIG. (C).—S. Ambrogio, Milan.

GOTHIC. The activity of the Gothic age was the result of intense religious fervor—the spiritual urge which found an outlet in the consummation of the soaring, vertical quality of the cathedrals. In solving the problem of concentrating the vault thrusts, pointed arches, slender piers, and flying buttresses, together with stained-glass windows, were substituted for thick walls. Gothic architecture was a system of construction, a religion, and a philosophy.

FIG. (D).—Reims Cathedral.

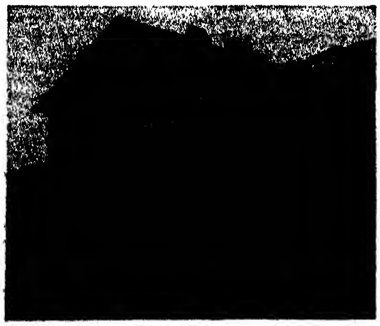


FIG (A).—Palazzo Pandolfini Florence.

FIG. (B).—Capen house, Topsfield, Mass.

FIG. (C).—Ropes house, Salem, Mass.

FIG. (D).—Courthouse, Winchester, Ky

RENAISSANCE. Italy was the birthplace of the Renaissance movement. There the remains of Classical architecture and civilization were near at hand and the Gothic had never taken a firm root. Then, too, the mediaeval style with its multiplicity of detail had been unsuited to the brilliant sunshine of this peninsula. Renaissance designers did not always copy Roman forms. Rather they adapted them to their own needs. In spite of the freshness and originality which often resulted, it was nevertheless the least creative of the styles. Palaces, churches, and villas, usually formal in their arrangements, were the chief contributions of the Italian phase of the development. The other countries of Europe allowed their national characteristics to impart to the style qualities which are easily recognized as being typically French, English, or Spanish.

Reflections in the United States

SEVENTEENTH CENTURY. The early houses built in this country were based upon English traditions of timber framing. The clapboards which covered these structural members gave an appearance somewhat different from that of the buildings of the mother country, but did not succeed in removing the mediaeval character. Overhanging second stories, beamed ceilings, and narrow windows contributed to the informality of this period.

COLONIAL. The Renaissance movement reached the eastern Colonies through the Georgian style by the way of England. The carpenter with his hand books, and later the amateur architect, succeeded in developing a simple, symmetrical architecture which combined refined, delicate mouldings with slender, graceful columns. In the Southwest, the Spanish colonists brought to this country their interpretation of the Renaissance, which, on account of the use of slave labor unskilled in the execution of details, became simplified into the Mission style (Fig. 257 A).

GREEK REVIVAL. This was the first of the revivals of the historic styles, and it lasted during the first half of the nineteenth century. Greek forms and details were applied to all types of buildings, and, even though the results were usually pleasing to the eye, they were often quite illogical in regard to function. The style was too inflexible to permit an easy adaptation. As was typical of most of the revivals, it became an architecture of façade arrangements.

GOTHIC REVIVAL. Before the Greek revival had run its course, people began to tire of the formality of this style and turned to the informality of the Gothic. Churches, public buildings, and homes alike received the attention of those who preferred the picturesqueness of the mediaeval. Unfortunately, many of these efforts were unsuccessful because knowledge of the Gothic was superficial and the spirit of the style was not captured. The resulting structures were rather cold and hard, and lacked the flexible quality of European buildings.

VICTORIAN. This was the name given to the attempt during the 'seventies and 'eighties to bring romance, through the medium of architecture and interior decoration, into the lives of those who lived during this depressing period of industrialism. In order to give beauty to a building, it seemed necessary to load it with meaningless turrets, gables, and jig-saw ornaments. It was an architecture with no structural sense and was exemplified by the so-called "Eastlake" style and the Victorian Gothic.

ROMANESQUE REVIVAL. The introduction of the Romanesque style into the United States was due to the inspiration and courage of one man, H. H. Richardson, who died in 1886. Even though trained in the École des Beaux-Arts, he rebelled against its academic influence and chose to work in the bold, massive manner of the Romanesque. Libraries, churches, and domestic buildings executed in this vigorous way are the result of Richardson's dynamic personality—a personality which is missing in the less successful attempts of his followers.

RENAISSANCE REVIVAL. Late in the last century, young architectural students began going in larger numbers to Paris for study. At that time a florid, rusticated type of French Renaissance was in vogue, and it was natural that it should have been reflected in this country in the public buildings of our cities. Another phase of French architecture, that based upon the châteaux of the Loire valley, also influenced the design of the mansions of the wealthy. However, it was that mother-architecture of the Renaissance, the Classical, which rescued this country from the artistic depths in which it had been floundering for half a century. The Columbian Exposition in Chicago, in 1893, with its Classical structures, showed what logical planning and a scholarly approach toward architecture could do in producing orderly results and beauty of form.

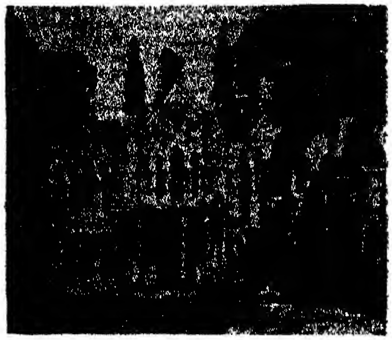


FIG. (A).—Gothic Revival house

FIG. (B).—Victorian house.

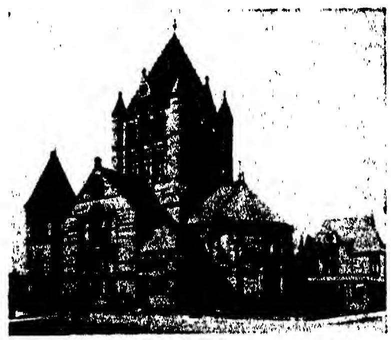


FIG. (C).—Trinity Church, Boston.

FIG. (D).—Federal Bldg., Cincinnati.

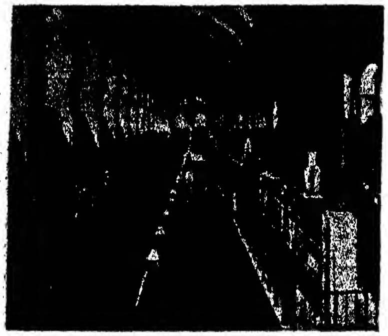


Fig. (A).—Ste. Génevieve, Paris.

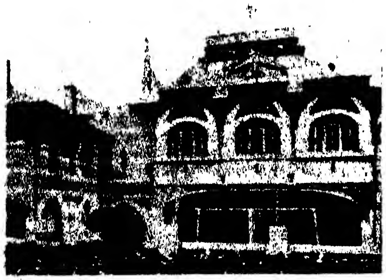


Fig. (B).—L'Art Nouveau house, Paris.

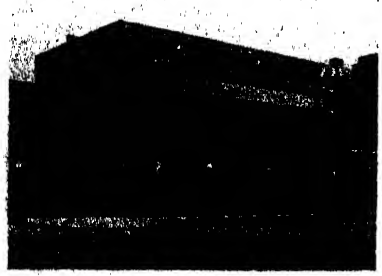


Fig. (C).—Bank by Louis Sullivan.

Fig. (D).—House by Frank Lloyd Wright.

Antecedents of the Contemporary

STEEL. Although the so-called modern movement burst forth in all its vigor after the World War, still there were isolated rumblings of its approach at intervals during the preceding century. As far back as 1850, when the library of Ste. Génevieve was built in Paris, there was an indication that a new building material and a new type of construction would some day revolutionize the character of architectural design. In this building barrel vaults were supported by exposed iron columns. This rather novel idea was repeated in the Bibliothèque Nationale, in which the reading room was spanned by domes of tile on an iron skeleton framework supported by slender metal piers. These early attempts to use metal frankly and allow it to be conspicuous in the finished design have led, in this country, to the concourses of the Pennsylvania station in New York City, and the Union Station in Chicago (Fig. 192 A).

L'ART NOUVEAU. Those who believe that the present movement in architecture is the first "modern" one of this century must not overlook L'Art Nouveau, or the New Art, which began in Europe about 1900 and lasted for a few short years. It is not to be compared, however, with the upheaval which is now taking place, for it was decorative and not structural. It was based on the romantic theory that curved natural forms of flowers and animals were more satisfactory than straight lines and abstract designs. Instead of function or use governing the design, as in contemporary architecture, the lines of the building were distorted to fit the theory of curved surfaces. The idea did not develop into a style because it was not fundamental.

THE EARLY MODERNISTS. In the last decade of the nineteenth century when construction was hidden behind façades of traditional forms, there appeared upon the scene one who rebelled against the restrictions of the past. This was Louis Sullivan, who saw the relationship between architecture and engineering and who sought to reveal the structural scheme of the building. His student and follower, Frank Lloyd Wright, waged a lonely fight to keep alive the independent spirit of Sullivan. His original use of forms and materials gave him an early recognition in Europe but a rather late and, until recently, a reluctant one in this country.

Contemporary Reflections

The first three decades of this century saw a great activity in building construction. Until about 1920 most of the architects followed traditional precedents in matters of exterior design, and our cities are filled with Greek banks and Gothic churches. Significant movements growing out of the activities of man usually have a definite relation to influences outside the movement itself. A trend in social conditions is started or interrupted by catastrophes—a war, flood, plague, or earthquake. A war alters the social and economic structure of a nation. After each world war, new adjustments are necessary, and these are given impetus by the agencies of the machine age—the automobile, airplane, and radio. The efficient character of these mechanical things has been reflected in certain phases of our architecture, in degrees varying with the courage of the architect and the client.


Fig. (a).—Traditional Eclecticism.


Fig. (b).—Traditional Modernism

TRADITIONAL ECLECTICS. The contemporary movement can be said to be made up of three attitudes of mind reflected in their representative structures. The first is represented by the Traditional Eclectics, but it is doubtful whether they should be included in the modern movement. They work in any style of the past, and their development is only in the direction of the use of traditional motifs. They may be Classicists, preferring formality and purity of form, or Romanticists, clinging to the picturesqueness of the mediaeval.

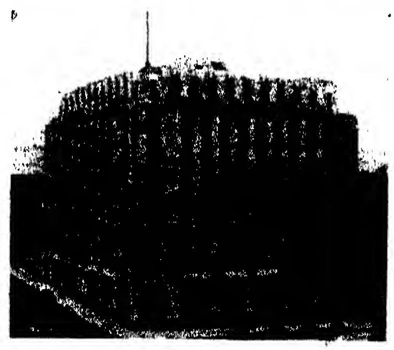


Fig. (c).—Non-Traditional Modernism.

TRADITIONAL MODERNISTS. These are those who give first consideration to the use of the building but who use a historic style as the basis for the design. Their efforts may have the flavor of the Classical or the Gothic, but traditional motifs are modified to suit modern materials. The spirit of the old and of the new are merged to produce an architecture expressive of this age.


Fig. (d).—Non-Traditional Modernism.

NON-TRADITIONAL MODERNISTS. Those who may be so classified believe that "form follows function," that the use of the building and the characteristics of materials should influence the appearance of the structure. Traditional forms are not employed; instead "style" comes from interesting massing and from color, texture, and decoration which are inherent in stone, brick, metal, and glass. This group includes the conservatives and the liberalists, distinguished by their attitude toward functionalism.

The foregoing classification of twentieth century architectural movements is an arbitrary one. The terms selected seem to describe the various phases of a transitional period in the development of an architecture. However, these assigned names will gradually lose their significance as a definite style emerges from this period of change and development. We shall look back on this second quarter of the twentieth century and remember it simply as a time when traditional elements were losing their importance and were being merged with non-traditional forms. We shall then realize that a new and different style of architecture is now being developed. It may even lose its non-traditional character and may take its place with the Classical, Romanesque, Gothic and Renaissance simply as one of the definite phases in man's attempt to house his activities. No doubt it will be succeeded by another non-traditional movement. This, in turn, will take its place with those styles which have preceded it. These names may lose their significance as social and economic conditions change and the resulting architecture takes on new characteristics.

CHAPTER V

PLAN AND VOLUME

Literature is the outgrowth of the desire of a people to express their thoughts in an understandable manner by means of the written or spoken word. Poetry and prose, truth and fiction, are composed of the elements of words and sentences—some structural, others decorative—arranged in a graceful or awkward style according to the ability of the narrator. In a like manner, a study of the developments of the past and of the present shows that architecture is the result of striving to satisfy the needs of a people for shelter, through the combination of recognized architectural elements.

These elements may be identified as horizontal-plan areas and space-enclosing surfaces. Their combination results in the creation of useful volumes, through the development of walls, columns, doors, and windows. Architecture itself is volume, but it has its beginnings in the plan. Before we study the visible shell of the building, it is necessary to examine the basic two-dimensional arrangement from which the three-dimensional form emerges.

THE NATURE OF THE PLAN

In the study of a problem in architectural design, it is necessary to divide the building into elements which may be represented by two-dimensional drawings. This is due to the desire to show various parts of the structure in order to compare relations and to present accurate information regarding the building. In spite of the necessity of this procedure, the fundamental conception of architecture should not be in terms of the separate drawings of the plan, section, and elevation, but should be based upon the entirety as represented by enclosed space, or volume. The designer should arrive as soon as possible at a visualization of the completed structure. He should be concerned with cubic relations. The plan and elevation are simply conventionalized drawings which assist in interpreting in masonry, wood, or steel the ideas of the architect.

The first step toward the solution of a problem is a consideration of the plan. The plan in an architectural composition is the graphic projection of the volume of the building upon a horizontal plane. The plan is a two-dimensional arrangement of areas. Or, proceeding in the opposite direction, surfaces which are projected in a vertical manner from the plan combine with floors and roofs to create three-dimensional volume. Plan is necessary before mass can develop. It is the pattern, dictated by the requirements of the building, from which the elements of the elevation and section emerge.

REPRESENTED PLAN, drawn upon paper, is seen as a horizontal section taken at the level of the windows or openings. Plan is easy to visualize if we imagine a model of the completed building cut through with a knife parallel with the ground and the top removed, so that the remaining wall sections are indicated by the solids and the openings by the voids. If we look directly down upon this cut section, we see the arrangement which is called the plan.

Represented plan may be considered from two points of view: (1) the arrangement of units according to practical requirements, determined by the size, shape, and use of rooms; (2) the arrangement according to the rules of abstract design. A good plan should express both these qualities, each playing a part in its own particular manner and degree. A plan must, first of all, function in a logical manner. If the rooms are poorly related to each other from the standpoint of use, beautiful composition will not correct the fault. If the plan meets the requirements of a museum when the client wants a railroad station, the building is a failure. If the program calls for a public library, there should be ample lobbies for circulation and isolated reading rooms for quiet meditation. If an office building is desired, the space for offices on the various floors must be well lighted, close to vertical circulation, and flexible in arrangement so that combinations may be developed to meet the space requirements of succeeding tenants. The consideration of practical design comes first in the analysis of a program, but a good plan does not necessarily result from the meeting of this requirement. The quality of organic interest, which grows from a well-composed grouping of parts, must be given to the design.

Abstract design in plan adjustment involves an understanding of the principles of composition and the methods of securing contrast, balance, and unity. (See Chapter XIV.) The abstract quality in a represented plan has to do with the pattern created by the combination of geometrical areas enclosed by represented walls. These shapes, together with the tones, textures, and contrasts caused by the poché (see page 320), and the mosaics or floor treatment, in proper combination, give an interesting and pleasing design. This design is more apparent in a drawing but it can be observed by a trip through the building itself. If the individual goes from long, narrow corridors into large rooms, and if the floor, wall, and ceiling treatment in each unit is in harmony with the size and character of that unit, he is aware of interesting variety. The changing impressions received are thus stimulating and prevent a feeling of monotony.

In the study of an architectural problem the plan assumes an importance which is due to its effect upon the elevation and section—the exterior and interior—or its influence upon space relations. It is the pattern upon which the exterior is based; the foundation upon which the walls are built. The elevations express the plan, because breaks in contour, or changes in direction, in the plan, should be indicated upon the façade. One who has been trained to read a plan can tell at a glance whether or not the resulting elevations will be satisfactory. If the projections in plan are too violent, the elevation will be restless. If the divisions in plan are equal, the elevation will lack decision and consequently unity (see Unity, page 262). The units of major importance in plan call for volumes of equal importance upon the exterior. Minor elements in the plan and elevation should fall into place in an easy and convincing manner and assist with the composition of the various masses. Stairways with windows at different levels should, if compatible with good design, find an expression upon the exterior. Large rooms which require ample side light should make their presence known by the use of large windows, while small rooms naturally call for smaller openings. There is an axiom to the effect that "form follows function," and another which says that "the elevation is the external expression of internal function." These are both fundamental truths in architectural design and hence merit the serious consideration of the student.

If a plan is satisfactory in all its arrangements, its honest expression upon the exterior is sound in principle and simple of achievement. If, however, the plan has major or even minor faults, their presence will make themselves felt upon the external treatment. Or to put it in the reverse manner, if the designer is encountering difficulty with the various elevations, it is possible that the poor composition of the plan is proving a handicap to the development of the design. It is necessary, therefore, that the plan be scrutinized very carefully in order to see that each part has the right scale and the correct relation to the remainder of the composition. The exterior should develop from the plan, but only from one which is well organized. An organic plan should mean a well-composed elevation.

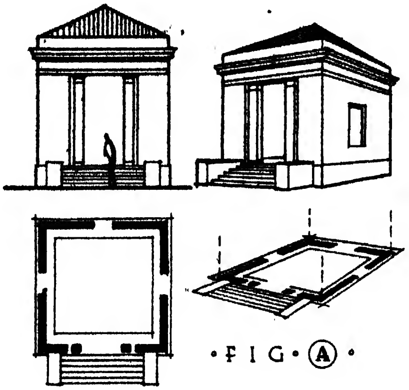
The Growth of Volume

It is unfortunate, in some respects, that, in the process of the study of architecture, drawings must be made of buildings. As we already know, a structure is usually represented by a plan, a section, and an elevation of the principal façade. This practice has been so common that, with the less astute designer, architecture is often thought of in terms of these drawings. The latter are necessary, of course, in order that the architect may arrive at a solution, even though there is a tendency to supplement these representations with models which show more clearly the mass or volume of the building. When the completed structure is seen, it is as a combination of materials enclosing space, and not as a dissected plan, section, and elevation. Since in illustrating a discussion of this kind we are usually limited to two-dimensional graphic representations, it seems expedient to use the drawn plan as a basis from which to proceed to the developed building. In this connection, it is necessary to keep in mind the fact that the drawings are simply a means to the end, and that the latter is represented in the completed structure. We shall then progress from the two-dimensional plan to the three-dimensional volume.

The drawings on page 38 show four buildings ranging in type from the simple one-unit, square plan to the more complex combinations of varying sizes and shapes. Figure 38 A illustrates one of the most elementary plans and its accompanying direct elevation. The individual who is trained in reading such efforts can interpret their meanings at a glance and can understand the relation which exists between the two drawings. But the plan and exterior in perspective convey a much clearer message to both the architectural designer and the layman. They give the impression of the third dimension, which is so necessary to a thorough understanding of the probable appearance of the completed structure.

In Fig. 38 B a step away from the square plan has been taken. Instead of a square, there is a simple rectangular area with a definite axial arrangement which was not so conspicuous in the preceding example. Again the plan and elevation are drawn at the same scale and placed in such close proximity to each other that one can readily see how the exterior is developed from the horizontal disposition of the single unit. But the importance of the perspective is once more evident when it is observed how much realism is present in this method of delineation. A perspective is the best means of visualization, other than a model of the building or the structure itself.

In the remaining illustrations on page 38 a comparison has been made between a symmetrical and an unsymmetrical plan and the ways in which their component parts may be expressed upon the exterior. The building in Fig. 38 C consists of square, rectangular, and semicircular plan units, all developed into masses composed about the dominant accent of the tower. In elevation it will be seen how the longer element to the left tends



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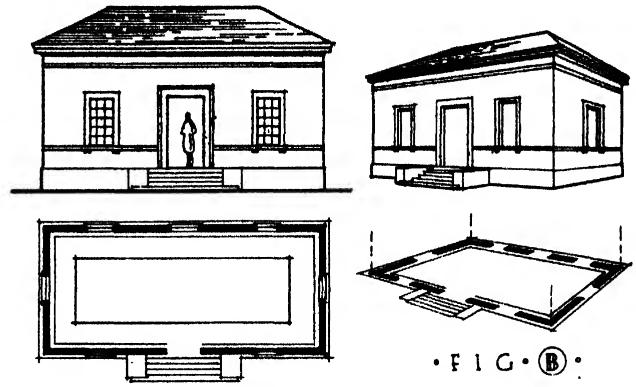

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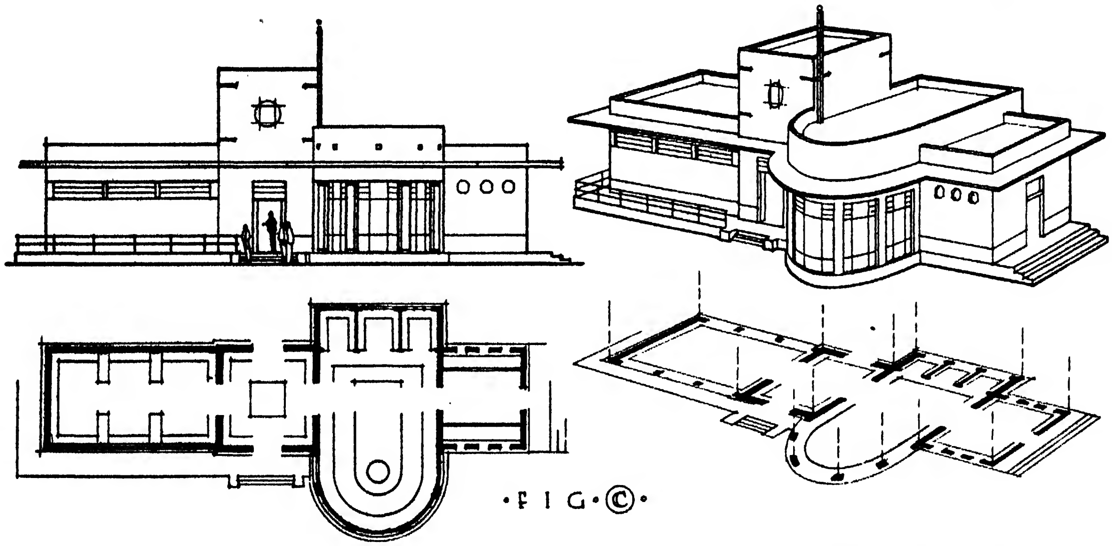

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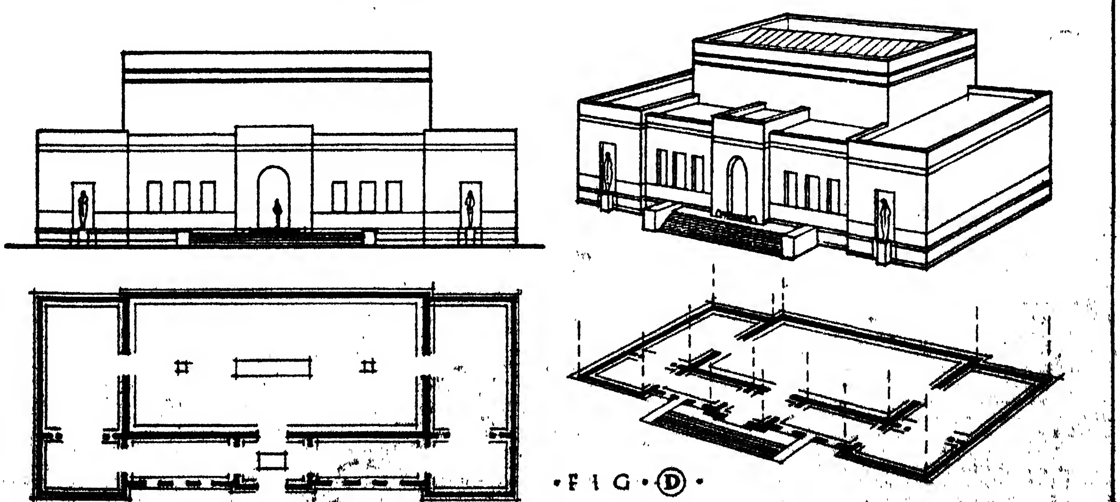


·FIG·Ⓓ·

to balance the heavier unit on the right which is placed in its correct position near the centre of gravity of the composition (see Balance, page 252). The length of the long element is reflected in the horizontal direction of the windows in this wing and in the metal balustrade or railing surrounding this portion of the building. The curved projection of the large room adds to the feeling of variety, and the verticality of the piers recalls the direction of the tower and prevents the composition from becoming monotonous in its horizontality.

Special attention should be given to the interpretation of plan elements in terms of the perspective. Here the relation between plan and volume is most easily recognized. Here is shown how different in appearance the exterior mass of a building becomes when viewed from a station point other than that used for the direct elevation. At the best, an elevation is only a makeshift. It is only a conventionalized method of representing a building, for no entire structure can ever be seen in elevation. A point at the level of the eye and directly in front of the observer may present an elevation, but the eye sees all other parts of the building in perspective. The use of the perspectives in Figs. 38 C and 38 D gives an indication of the upward projection of the exterior enveloping shell from the plan itself. The buildings seem to grow from the plans, as if they had sprung from the foundations below, the first in an informal manner and the second in a symmetrical and formal way. Mass, or volume, and its relation to plan is thus revealed.

Plan Types

In studying the relationship which exists between two-dimensional plans and three-dimensional volumes, it is evident that buildings may be grouped according to the shape and complexity of their plans. A survey of the various kinds of plans does not constitute a study of plan analysis or plan composition, but it is essential that a student of architecture should be familiar with fundamental types. The drawings on pages 41, 43, 45, and 46 show a number of plans, based upon the elementary geometric shapes, together with their accompanying sections and elevations. These typical examples are not intended to serve as a dictionary of compositions but rather as an exposition of a satisfactory use of these simple forms. In studying these illustrations, the manner in which the plans have been expressed in the elevation should be observed, and special attention should be given to the use of doors, windows, mouldings—those elements which combine with walls to form exteriors. Most of the examples are small, isolated buildings of one unit, and the majority are executed in the Classical or Renaissance style. These examples were chosen because of the basic importance of the architecture of these periods. The styles of the past were developed in masonry just as simplified contemporary forms have been evolved from new modes of construction and new types of materials.

The Square Plan

The square plan is perhaps the simplest one with which the student of architecture may be confronted, but it offers many variations in treatment in spite of its simplicity. It may be entirely open, with columns or piers supporting a roof. Or it may be enclosed, either completely or partially, as are the examples on page 41. It is possible for one side to be emphasized by the entrance (Fig. 41 A), or it may be symmetrical about a central, vertical axis and present four sides which are identical in their treatment, as in Fig. 41 B. Buildings with square plans may have simple walls, or these walls may be adorned with pilasters or engaged columns. Or the walls may almost entirely disappear, leaving only the arcade or the colonnade to define the vertical outlines of the structure. Only the limitations of materials and the ingenuity of past and present designers govern the possibilities which may arise in a study of the elementary plan types.

The roofing of a composition often presents to the student more of a stumbling block than any other feature of the problem. (See Roofs, page 84). There are roofs which are typical of the various types of plans, and the hipped roof is offered as the sloping roof which is best suited for and most expressive of the square plan. The roof planes slope toward the four sides of the building, and their intersections form diagonals which meet at the apex of the pyramid giving an accent which reflects the unity of the structure. This is illustrated in Fig. 41 A. Sometimes pediments or gables and a ridge are used as a crowning and covering feature of a square plan, but these elements are not so characteristic as the hipped or flat roof. The gable and ridge should be reserved for use with a rectangular plan where an expression of direction is desired. Small buildings with square plans may also be covered by domes, but, in spite of the frequent use of domes in this connection, they seem to develop more logically from circular plans.

Figure 41 A shows a building with a square plan, a hipped roof, and a doorway framed by Doric pilasters and a pediment. The pediment used in this connection is not so functional as when employed as a termination of the roofing element. However, the door is an exterior one, and the slope given to its crowning feature sheds the water away from the entrance. In addition, the slight amount of direction which is suggested by the axis of the pediment emphasizes the major axis of the building. An inspection of the section reveals the use of a flat ceiling with a modified repetition of the exterior cornice.

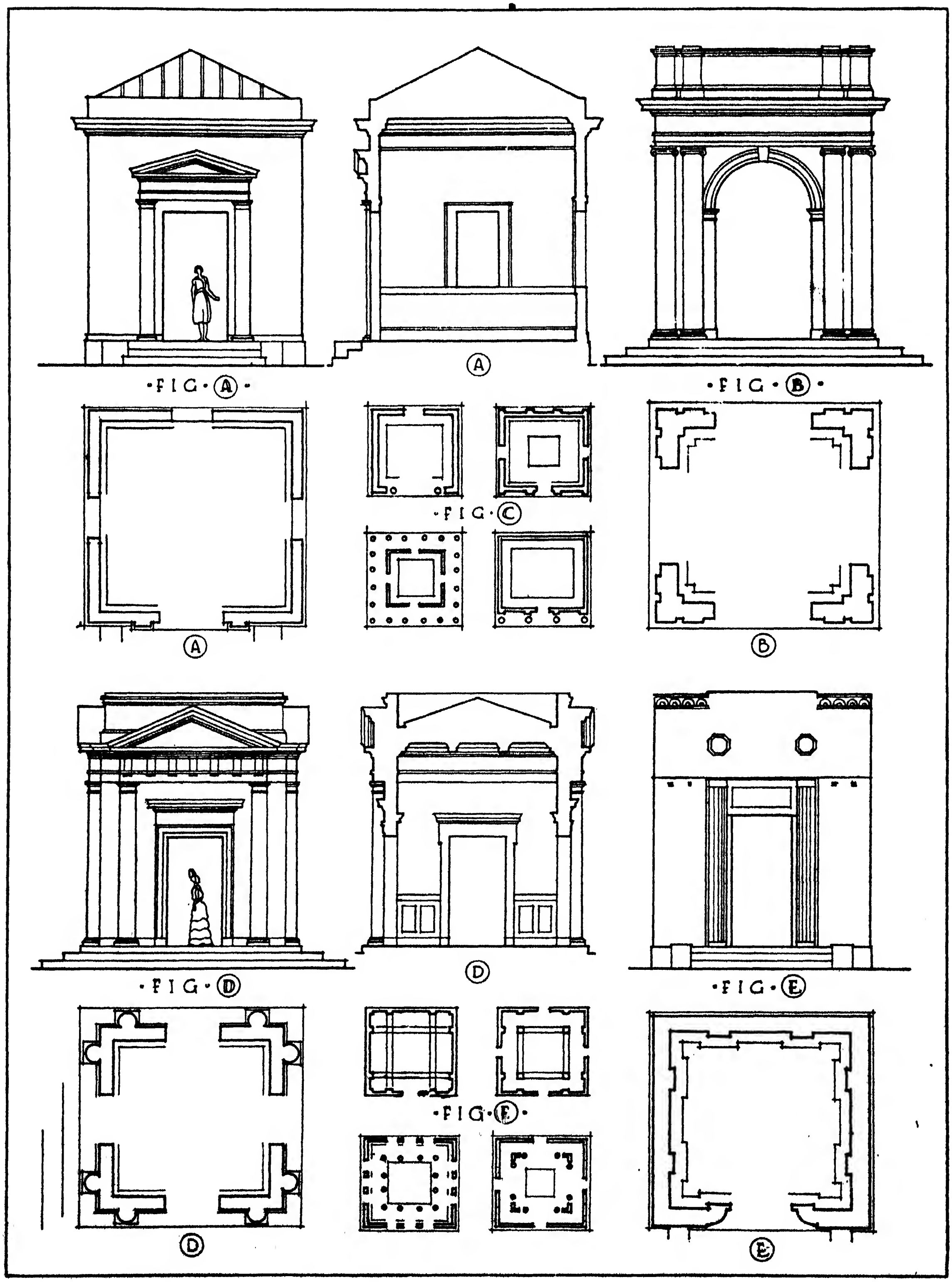
During the Renaissance movement in Italy, France, and England, many small structures which might be classed under the head of garden architecture were erected. A typical example is illustrated in Fig. 41 B, where a building which might qualify as a park shelter employs arches and coupled pilasters to create architectural motifs. This results in an open symmetrical treatment such as might terminate an important vista in a formal garden. The balustrade or parapet course above the entablature conceals the roof, which may be flat or of a low-hipped type.

The building shown in Fig. 41 D is still of the square variety in spite of the engaged columns and the pediments. Stripped of these decorative elements, it is similar to the preceding example, except that the rectangular opening has been substituted for the arch and pier. The interior shows a ceiling which is coffered or broken up into square panels by the use of beams, the mouldings of which member with those of the interior cornice.

The contemporary movement in architecture is reflected in the design of the building in Fig. 41 E, but the source of inspiration is still Classic. None of the cornices which are identified with the architecture of Athens and Rome are present, but there is a feeling of simplicity which is characteristic of the Greek temple. The quarter columns, in the jambs of the door, though decorative, recall the fluted shafts of the Greek Doric, and the massive quality of that style is seen in the simple, unadorned walls of this building. Figures 41 C and F suggest other types of treatment which may be used in connection with the simple square plan.

The Octagonal Plan

As the number of sides of the polygon increases, its perimeter approaches the circle. The creation of the octagon is one of the first moves away from the area with four equal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sides and angles, thus the octagonal plan is one of the steps in the development of the circular plan from the square. Standing by itself as a detached building, the octagonal arrangement forms an interesting and pleasing shape. When used in combination with other geometrical areas, it gives a definite accent to a plan and should be reserved for this use, or as a radial device or a point of intersection between two or more rectangular elements.

As is characteristic of any of the simple structures, the building with the octagonal plan may be entirely open (Fig. 43 A) and offer only shelter, or it may be enclosed (Fig. 43 B), affording more complete protection. An octagon may be covered by a dome, but the eight-sided roof recalling the shape of the plan is a more fundamental expression of the plan. This roof may consist of segments which may be curved or straight in their cross section, as in Figs. 43 B and 43 E, or a series of steps may constitute the terminating element of the building as shown in Fig. 43 D.

The Renaissance style again serves as the source from which these buildings are developed, with the exception of the one in Fig. 43 E, which is based upon the Romanesque. The patterns of brickwork which take the place of the Classical cornice, and the round arches with the brick piers and simple stone capitals, are typical of this phase of mediaeval architecture. Other variations of the octagonal plan, with columns, niches, etc., arranged to enhance either the interior or exterior, are shown in the small illustrations in Figs. 43 C and F.

The Circular Plan

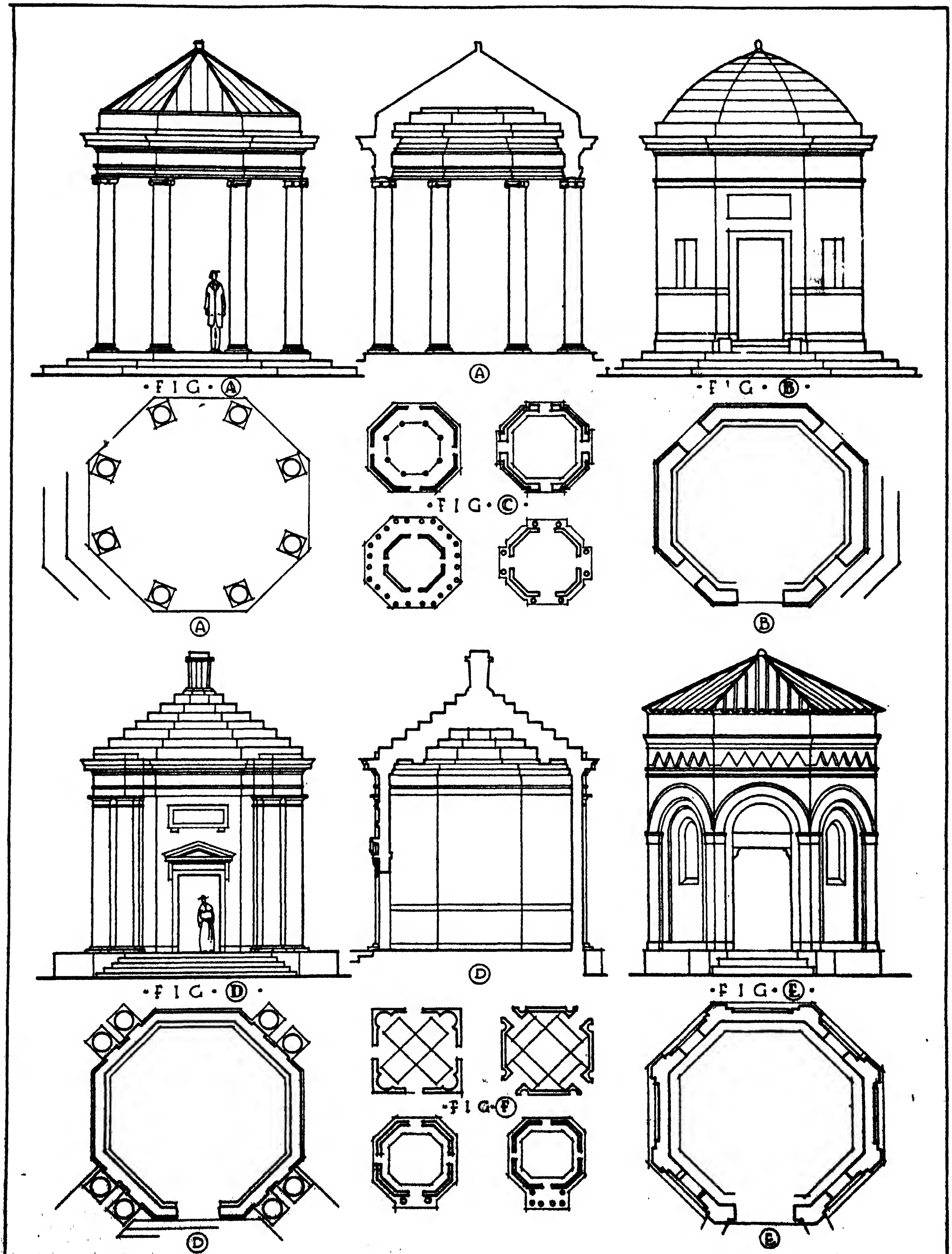
The isolated circular plan forms the basis for a graceful and beautiful building. Its curving wall catches the light in a brilliant or subdued manner, depending upon the material of which it is composed. The ever-changing shadows on its surface are intriguing in their elusiveness. If the structure is open, as in Fig. 45 A, the spacing of the columns, in perspective, offers interesting arrangements and proportions when viewed from various positions.

The dome is the logical covering of the circular plan. Its shape reflects the curvature of the walls, and the pendentives which unite the circular plan of the dome with a square plan are not necessary in a building of this type. The dome may be set directly upon the cornice itself, as in Fig. 45 B, or it may be raised upon a cylindrical drum, as in Fig. 45 D. The dome may be concealed on the exterior by a conical roof, or the latter itself may form the only covering of the building, as in Fig. 45 E.

Circular plans may be enclosed by a simple wall with doors and windows affording light, air, and circulation. If a more decorative quality is desired, these walls may be surrounded by a peristyle, or a circle of columns, illustrated in Fig. 45 D. If a sense of direction is advisable, a definite axis may be established by the introduction of a projecting entrance motif. Figure 45 E shows a feature of this kind. Again the small figures on page 45 show additional methods of treating the circular plan from the standpoint of internal and external effect.

The Rectangular Plan

On page 46 are shown only two rectangular plans, but they are so different in their treatment that they will be sufficient to illustrate many of the characteristics of build-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D
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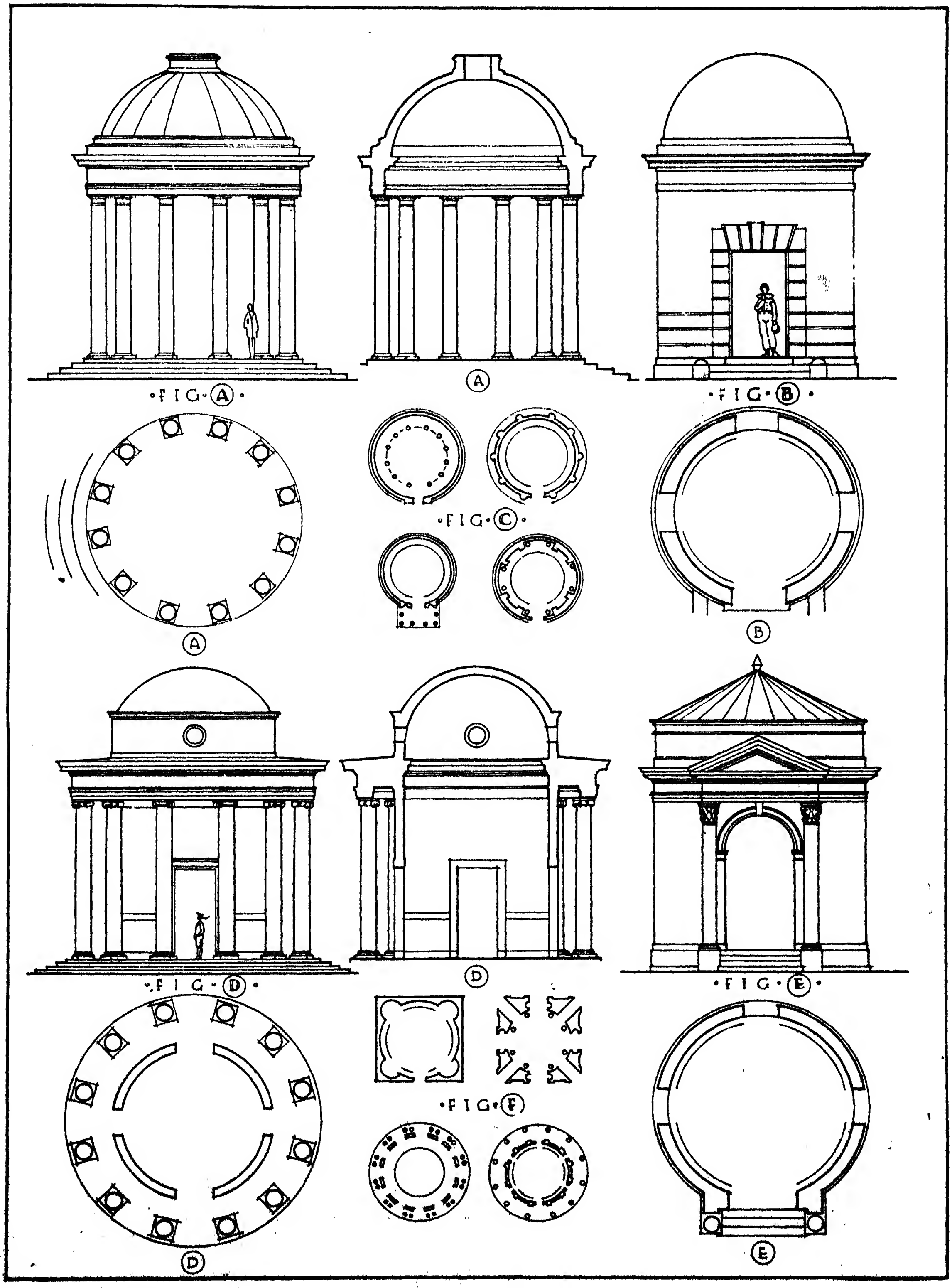
E
·FIG·F

ings based upon this geometric shape. The first, Fig. 46 A, is an open loggia, or pavilion, which is typical of the garden and market structures of the Renaissance period in Italy. Piers with decorative pilasters combine with arches to support the entablature, and a sloping tile roof acts as a covering for the building. In this latter connection it will be observed that the ridge of the roof is parallel with the longer direction of the plan, a necessary condition which is often overlooked by beginners in the study of design. One of the most common mistakes made by the inexperienced is to cover a rectangular plan with a roof which has an apex rather than a ridge or to fail to indicate the longitudinal dimension of the building with the ridge of the roof. In plan, the intersections of the roof planes should bisect the angles formed by the walls of the building, thus maintaining equal pitches and equal projections for all the various slopes. There may be times when this will not be possible, but it is a desirable goal toward which one should work, and one which should be attained if at all compatible with the other related requirements.

Another feature which is typical of formal architecture of this kind is also seen in Fig. 46 A. When the same motifs are to be repeated on all four sides of the building, as in the manner herewith illustrated, it is desirable to have the return around the corner on the ends of the building similar to the treatment adjacent to the corner on the front. Some variation is permissible, but a marked difference is usually too pronounced and is not sympathetic with the spirit of the style. For this reason, the width of the building is rather definitely fixed in a loggia of this type, being limited, in this case, to the use of two pairs of coupled pilasters connected with a single arched opening. The ratios of one opening to three, or of three to five, offer combinations which will usually lead to satisfactory proportions.

The other building, shown in Fig. 46 C, is quite different from the preceding Renaissance example. The rectangular shape of the plan is their only common characteristic. The first is symmetrical; the last is unsymmetrical. One depends upon the pleasing proportions of the Ionic Order for its decorative effect, whereas the other represents the contemporary tendency to eliminate projecting members and to rely for interest upon surface decoration applied to an informal arrangement of openings and wall areas. The Renaissance example has a pitched roof; the other is enclosed with a flat roof which expresses the capabilities of concrete as a covering material. The absence of columns and pilasters permits a free use of windows, a freedom which may be disturbing to those accustomed to the limitations of masonry construction. It will thus be seen that these two buildings, based upon rectangular plans, present solutions which differ greatly in their final characters. One is traditional; the other is "modern." One is open; the other is enclosed. Their functions are different; their interpretations of these requirements are unlike. Any attempt to judge their respective merits must be based upon the success with which they have met the demands of the building program and those of good composition. Any decision affecting the preeminence of one method of treatment over the other must depend upon personal taste. We are living too close to the contemporary movement to judge it accurately or to be able to see what effect it will ultimately have upon architectural development. Materials and social conditions should influence design. One should avoid a conscious effort to create something novel and bizarre just for the sake of being different. Fundamental principles of composition are more important than stylistic forms or decorations.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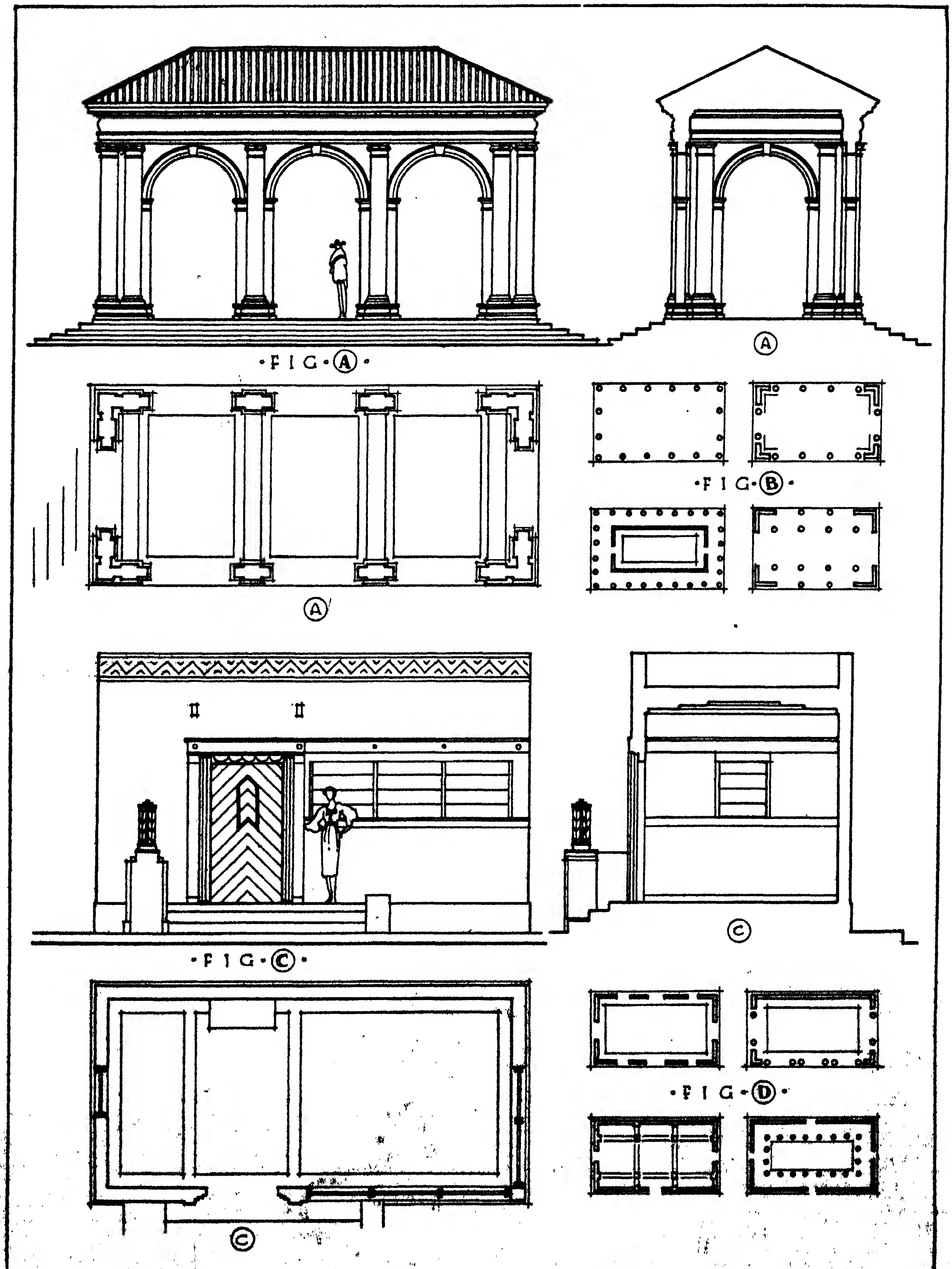

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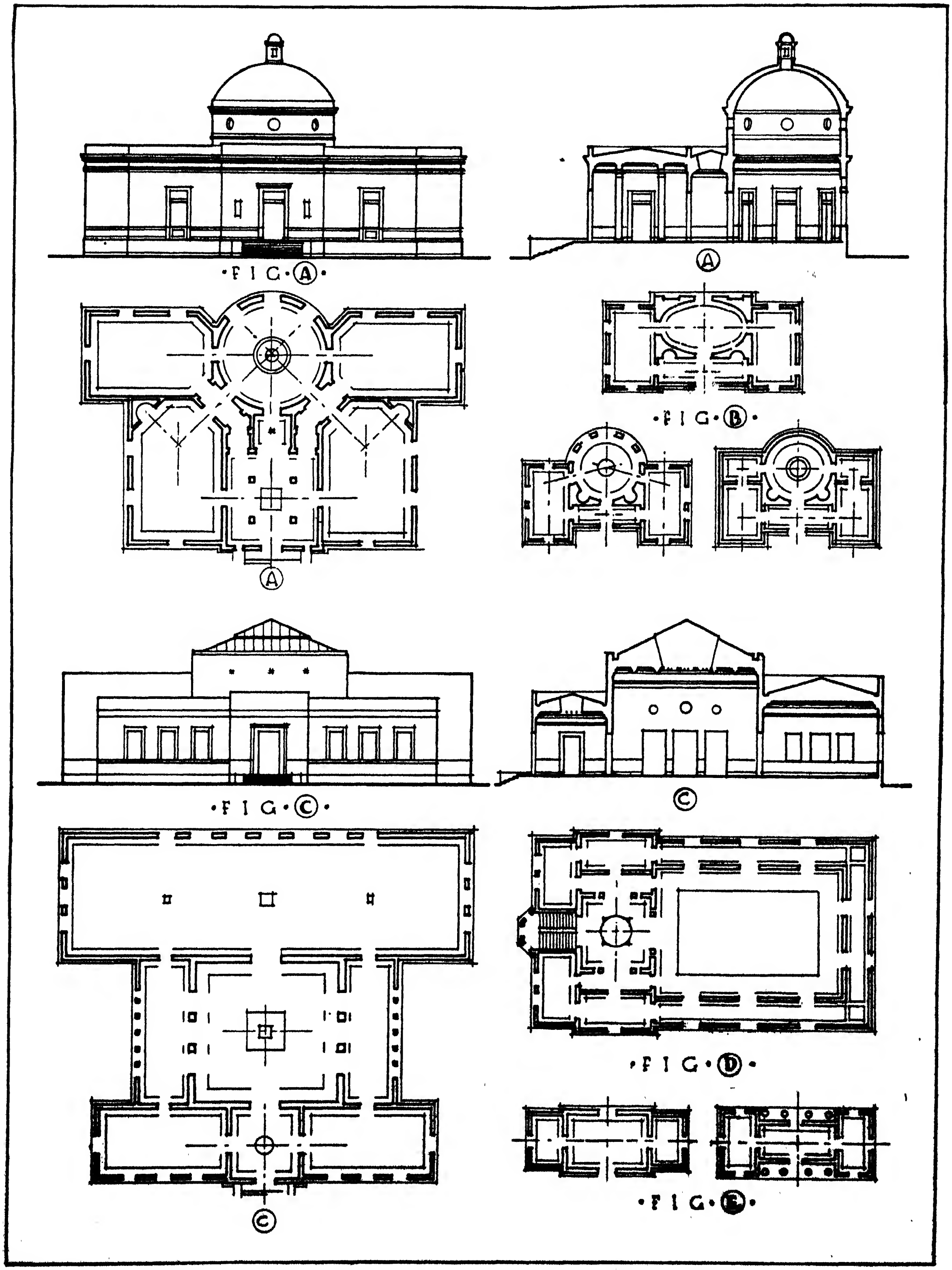
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·FIG·E·

COMBINATIONS

Although the beginning student may be concerned with small buildings of one or two units, the majority of existing examples of architecture are composed of several or many rooms of varying sizes and shapes. Planning involves the arrangement of these elements in such a manner that the activities housed in the building may function in an efficient manner and that the resulting composition may meet the demands of aesthetic design. Simplicity in planning is more desirable than complexity, and organization is infinitely better than confusion. If the first step is to be taken toward a successful solution of a problem, the principles governing the use of axes should be followed. The relative importance of the various plan units should be established, and the units should then be allowed to fall into place upon intelligently disposed lines which will give an organic quality to the design.

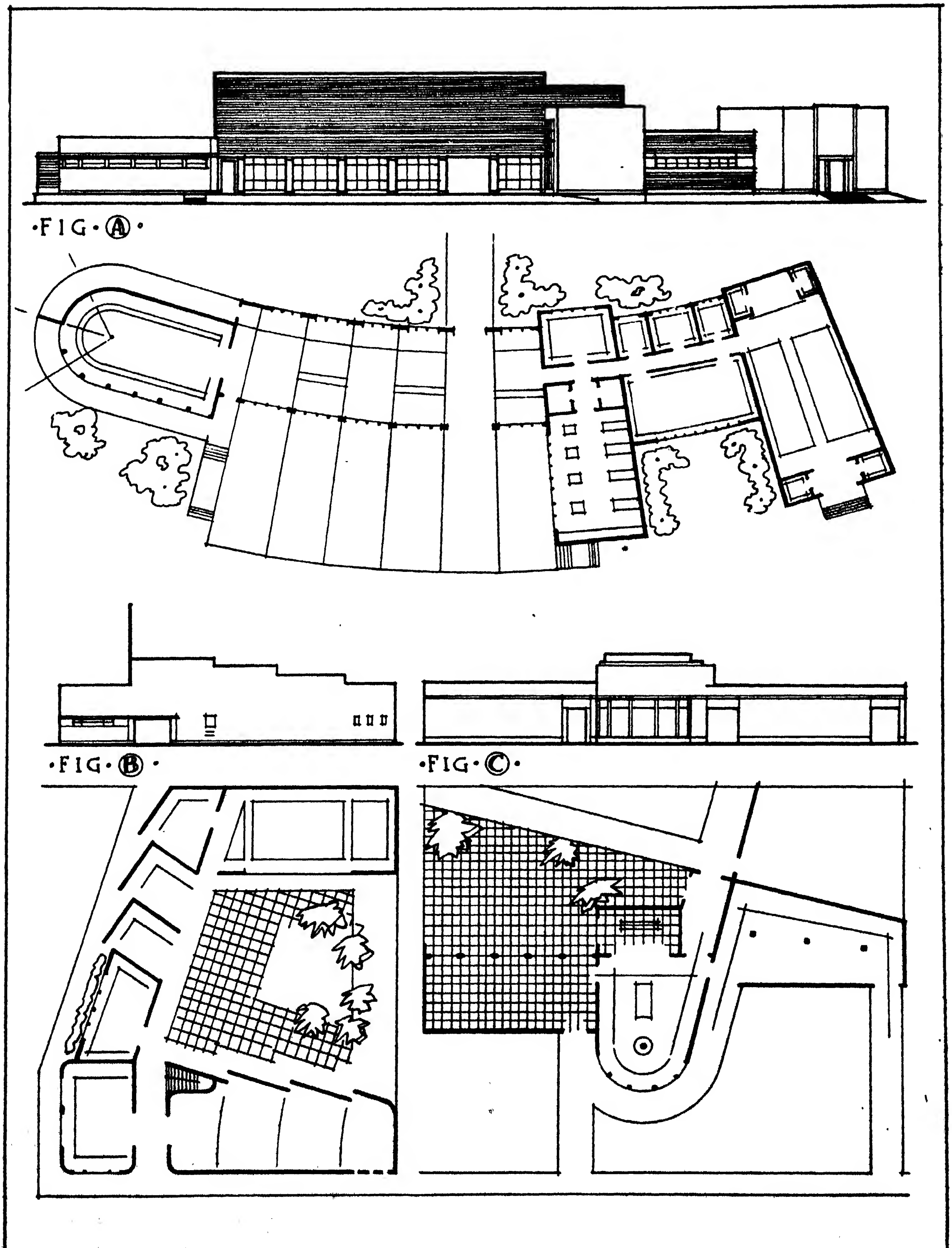
The drawings on the upper half of the plate on page 47 show several ways in which circular and elliptical shapes may be combined with rectangular areas. It will be seen that curved elements form dominant accents in a plan, and care should be taken to see that their positions warrant this importance. A circle or ellipse is the point from which the axes radiate. It controls the situation and acts as the directing genius of the organization. If the designer feels that curved forms are necessary to the solution of the problem, he must give considerable thought to the proper combination of the resulting areas.

It will also be noticed that the circle is seldom used as a basis for plan development in strictly utilitarian buildings, unless one insists upon mentioning grain elevators or water tanks and towers. The circular rotunda with its domical covering or the elliptical room with its segmental ceiling does not usually lend itself to the needs of industry and business. These volumes are more decorative in their appeal and find a congruous place in buildings catering to the emotional rather than the material needs of man.

If we turn now to the examples on the lower half of page 47, a symmetrical combination of square and rectangular shapes will be observed in Fig. 47 C. The shape and position of the square, central hall insure its prominence, both in plan and elevation. The rooms which surround it on the front and sides carry around upon the exterior at a lower level, while the mass of the large space at the rear forms a background for the hall and the elements which precede it. The section, showing the interior treatment, indicates the importance of the various rooms, and illustrates how the changes in ceiling heights supply the necessary quality of contrast. Figure 47 D is also an arrangement of square and rectangular areas, but in this case, an unsymmetrical composition is the result. The two small plans in Fig. 47 E show other combinations of simple forms.

The plans shown on page 49 are characteristic of the informality of contemporary architecture. The irregular shapes and areas contrast with the formal arrangements of the heavier and more masonry-like buildings illustrated on page 47. The contemporary structures demonstrate the influence of use, site, and materials on architecture. They are light, open, and dynamic—not heavy, enclosed, and static.

The plans and their accompanying exteriors, shown on preceding pages, illustrate the importance of the horizontal arrangement of units and the manner in which the visible building grows from this plan pattern. We are now ready to proceed to an analysis of the exterior elements of buildings.


·FIG·Ⓐ·
·FIG·Ⓑ·
·FIG·Ⓒ·

Chapter VI

THE ELEMENTS OF THE VISIBLE STRUCTURE

In the preceding chapter we have seen how volume develops from plan and is identified by the elements which are visible in the completed structure. For many years these parts were called "the elements of architecture," an emphasis and a nomenclature at the same time both accurate and inaccurate. They were accurate if one considered the mistaken importance of such stylistic forms as columns, cornices, pedimented windows, and monumental doorways. They were inaccurate if they were intended to include all the architectural elements, for they embraced only the space-enclosing units. The element of plan arrangement must not be omitted. Rather, it should precede any study of the growth of volume, as in the present discussion.

For the purpose of analysis, it is possible to arrange these visible elements according to their function or use in the completed building. They may, thus, be STRUCTURAL, PROTECTIVE, CIRCULATORY, or DECORATIVE. If we wish to be very exact in our interpretation of this classification, we might say that there are only two divisions—a major one furnishing protection and a minor one supplying decoration. The primary purpose of most architecture is to provide shelter. If a structure is reduced to its bare essentials, it may be true that all its major component parts are protective in their function. However, this is not representative of the broader aspect of architecture, and we may return to our original grouping of the elements and analyze them in the order previously mentioned.

Structural Elements

WALLS are the simplest and the most direct of the structural elements. They suggest an architecture of masonry and a treatment of surface depending upon the stone or brick which is used. For this reason we shall reserve much of our discussion of walls for Part Three, dealing with the nature of the materials of architecture. (See page 145.) We shall simply call attention to the fact that walls are now becoming less and less structural and more and more protective. In the days of true masonry construction, the walls actually carried the loads of the floors and roofs, but in modern work they are often hung on the steel or concrete skeleton in the form of thin veneers. The appearance of the wall depends upon the climate, the construction, and the character of the building. Walls may be monumental or utilitarian, plain or decorated. They may be composed of the traditional materials of stone and brick, or of the newer forms of metal and glass.

COLUMNS. Even the simplest and the most enclosed of buildings require openings. The early doorways were spanned by a single block of stone which limited their size. As buildings became more open, as the desire for light and air increased, it was necessary to raise isolated sections of the wall to form vertical supports for the horizontal lintels. These primitive piers soon received the attention of skilled hands, and they became columns with beautiful proportions and interesting details. These refinements did not detract from the structural quality of the columns of the early Classical period. In a like manner the piers of the Romanesque and the Gothic contributed directly to the organic construction of the churches of those ages. The fact that the column later, during the Renaissance, lost much of its significance and became decorative does not detract from its original function and beauty.

The column held its place as one of the most important of the structural elements until the demand for larger openings and the absence of lintels of sufficient length brought about the development of the arch and of arcuated architecture. In the latter, the arch is substituted for the lintel and the pier usually takes the place of the column. The arch was used in varying ways by the civilizations which followed the one that developed it. The Romanesque builders interpreted it in forms which were heavy and static; the Gothic builders used it in such a way that it became light and dynamic. Modern designers throw it across large spans with the aid of steel and concrete in a dazzling and daring manner. Thus, a study of the structural elements of architecture does not stop with a discussion of the Classical columns, entablatures, and arches. It must be continued so that it will include other forms of the past and present. It must keep abreast with the times; it must even abandon old restrictions and add steel and concrete to the list of materials which formerly included only stone, wood, and brick. The past offers suggestions—the future holds forth inducements and encouragement.

THE CLASSICAL STYLE. The buildings of the Greek and Roman empires consisted of temples, theatres, and baths, but the student of today too often thinks of the architecture of antiquity in terms of the so-called Orders of Architecture. The various column types and their accompanying entablatures have been reduced to a convention which has made their use simple and easy. They have formed the inspiration for the design of many of the buildings of the past and the present. Until modern steel construction divorced architecture from the restrictions of masonry as expressed by the thick wall and the column and entablature, these Orders, with frequent ventures into the Romanesque and Gothic styles, embodied the fundamentals of architectural design. But even with the present tendency to minimize the importance of the traditional column in contemporary design, it is still desirable to analyze the proportions of Classical architecture and to discover the reason for its logic and beauty. Much of the work of the present decade of the twentieth century retains the simplicity and refinement of the architecture of the Greeks. It is necessary, therefore, that we should understand the past before we allow it to influence the present.

The Orders of Architecture may be divided according to the period in which they were used, i.e., the Greek Orders, the Roman Orders, and the Renaissance Orders. Much of our knowledge of Classical architecture comes to us by a rather devious route—through the eye of Renaissance scholars who interpreted the Roman Orders in a theoretical manner. Palladio and Vignola were Italian architects who lived in the sixteenth century and who formulated their own variations of Classical elements. They drew upon the remains of Roman work for their information and created designs which were based as closely as possible upon the examples which they found at hand. Although their drawings retain to a considerable extent the spirit of Roman architecture, they are at the best only averages or compromises, often representing a composite picture of the most desirable proportions of many examples. These architects worked out systems of measurement in terms of the diameter of the column at the base. These systems, though suggested by Vitruvius of

Roman times, were not a part of the mental processes of Greek builders, who depended upon their own good taste and discerning eye to secure beautiful proportions and delicate refinements. It was not until the advent of the Roman empire that the facility with which the columns and entablatures were employed led to a similarity of treatment and a loss of individuality and interest.

Although the designers of the Renaissance themselves often used the Orders in a refreshing manner, nevertheless the Roman Classic or the Renaissance Classic Orders which they have left for us may be regarded simply as conventional types. They offer a safe and short cut to the use of Classical details, but the results tend toward standardization and lack the character of specific examples. The rules of proportion which they exemplify, if followed, are capable of producing satisfactory results. However, unless they are used intelligently by a questioning mind, their application does little toward teaching the principles of design. An analysis of the Orders should be supplemented by the study of drawings of actual Greek and Roman examples with particular attention paid to the relation of the Order to the remainder of the structure. This should be accompanied by an understanding of the conditions under which the architecture was produced and of the materials which were used.

Continuing our discussion in a direction contrary to chronology, or going from the Renaissance to the Roman, it is observed that the Romans, by their ascendancy over Greece, inherited a fully developed type of architecture. Their philosophy of life, however, was different from that of the Greeks, and the buildings which they subsequently erected were of a changed character. Their architecture became more luxuriant and theatrical. Love for display and ostentation was more characteristic than desire for refinement and quiet elegance. The buildings were more florid in their design, and the Orders were used in a less structural way. The arch was developed, and the column was occasionally placed upon a pedestal, a practice which led Vignola to endow the Roman Classical Orders with this third member. The Romans did, however, make use of the superimposed Order. If the Greeks wanted to secure greater height, they did it by the use of a single, gigantic column, but the Romans carried one Order above the other, forming stories of Doric, Ionic, and Corinthian columns and entablatures. This was a practice which later became very typical of Renaissance buildings.

Greek architecture, however, shows the widest variation in types, and the highest development and greatest beauty of column and entablature. The simple and refined architectural forms of this period were produced by the vitality of the creative impulse of the Greek people rather than by standardized rules and insensitive facility. Their love and respect for the beauty of the human body are reflected in the subtle curves of the Greek vase and the mouldings of the Greek capital. Their versatility is illustrated by their ability to create the massiveness of the Doric, the grace of the Ionic, and the richness of the Corinthian.

With these remarks in mind, let us now study briefly a few typical examples of the various periods. In the past the emphasis has often been upon proportions which are concerned with the smallest moulding of the entablature—an intricacy of study which has often led to confusion and an incorrect impression of the importance of mathematical precision. This may be avoided by devoting one's attention primarily to a consideration of major proportions and to the correct scale and relationships which exist between the various parts. We shall, however, follow the usual practice of using illustrations which are not always based upon specific examples but which sometimes represent types that retain as much as possible the spirit of the works of antiquity. Since in an abbreviated discussion of this kind it is necessary to make a choice, we have selected those Orders which seem to have had the most influence upon succeeding architectures. They are as follows: Greek Doric, Roman Doric, Roman Ionic, and Roman Corinthian. An example of a Renaissance interpretation of the Corinthian is also shown later in this chapter. It will be seen, by reference to the drawings on pages 55, 57, 59, and 61, that a Classical Order is composed of two major parts, the column and the entablature, or the post and the lintel. These in turn—with the exception of the Greek Doric, where the stylobate takes the place of the column base—are divided into three parts. The column is composed of the base, the shaft, and the capital, and the divisions of the entablature are called the architrave, frieze, and cornice.

In order that our terminology may apply equally well to the elements of architecture in all of the periods of development which we have chosen—the Classical, Romanesque, Gothic, Renaissance, and contemporary—let us designate the two major parts similarly and classify them according to the function which they perform. The wall, the column, and the pier are vertical in their direction—they support. The shaft of the column or pier is terminated by its crowning member, the capital, and by its load-distributing member, the base. The column and pier carry a load which is transmitted to these isolated supports by means of distance-spanning members. These spanning members may be identified in trabeated architecture as the lintel or entablature of the Greek, Roman, and Renaissance periods, or in arcuated architecture as the round arch of the Roman, Romanesque, and Renaissance, or the pointed arch of the Gothic. The structural elements of the various periods of architectural development then resolve themselves into those divisions based upon function. They may support, or they may span the distance between the supports and thus carry the superimposed loads to these vertical units. In contemporary architecture the intricacy of the design and the complex nature of the construction may cause us to lose sight of the use of the various structural members. Whether supporting or spanning, the steel, concrete, and stone of this modern age only express in a different manner the desire of man for shelter.

Before we take up a detailed discussion of the Orders of Architecture, let us make one more comparison of them which will indicate their general proportions. The unit of measurement most generally used is the diameter of the column at the base. In spite of the many variations in the relation of the heights of the columns to their diameters, as illustrated by Classical buildings, it has been found that the average proportions of columns compare as follows: Greek Doric, five and one-half diameters high; Roman Doric, eight diameters high; Roman Ionic, nine diameters high; Roman Corinthian, ten diameters high. Thus the Orders presented range from the sturdy Doric of the Greeks to the more slender Corinthian of the Romans. It will be noticed in the following drawings that the diameter of the column is not divided into the customary two modules of thirty parts each. If a facsimile reproduction is desired, it is necessary to use this intricate system of measurement, but the present-day approach to Classical architecture should be through its spirit rather than by way of the mechanical use of its elements. The eye, instead of the hand, should calculate scale. Freshness of interpretation is desirable after an understanding of sources and origins.

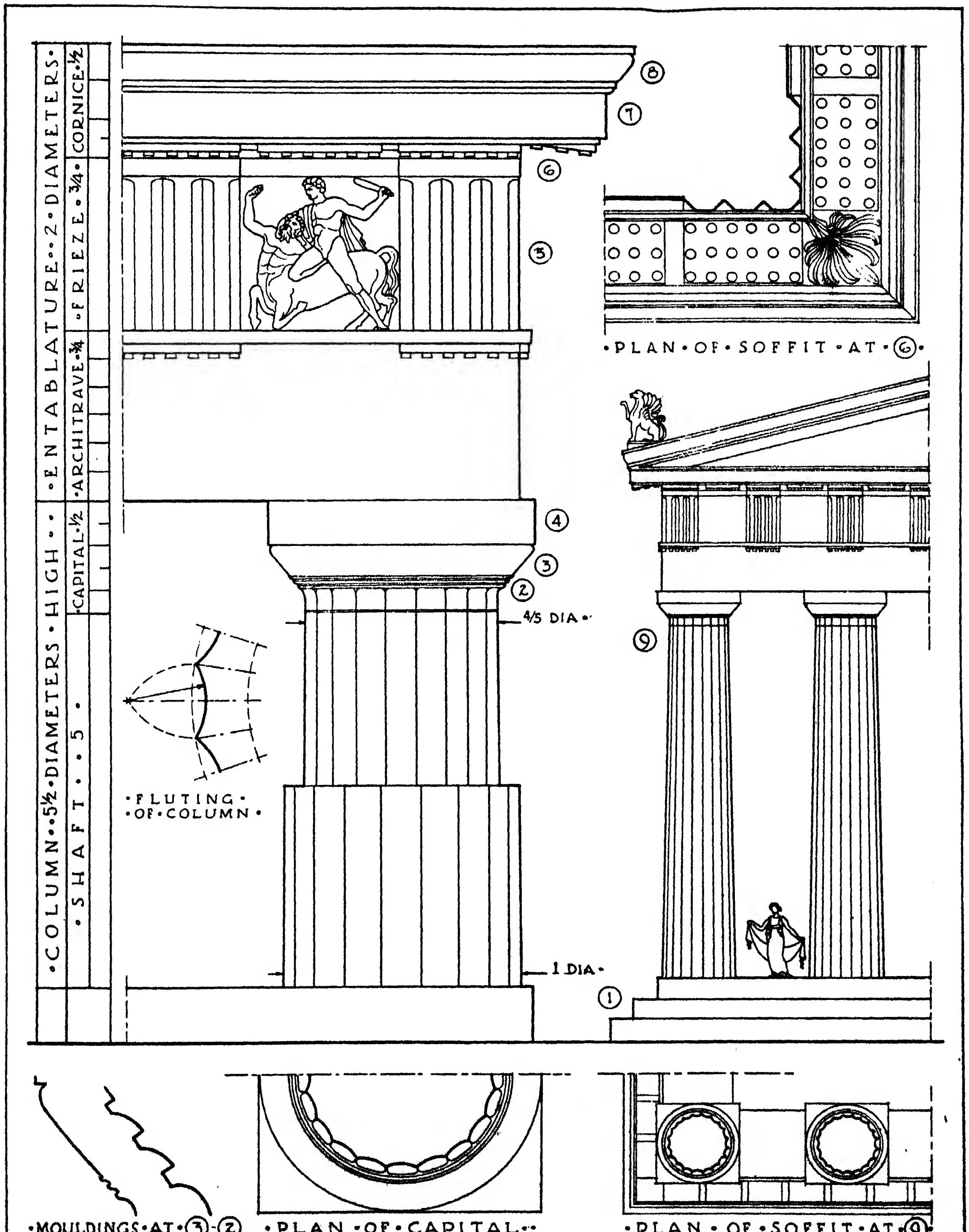
THE GREEK DORIC is the most sturdy and robust of the Greek Orders. Along with its strength goes a refinement of line and detail which places it in a foremost position from the standpoint of beauty of design. Greek architecture never became standardized, as did the Roman. It was ever developing and improving. In the early examples the columns were short and heavy and the capitals had widely projecting echini. Later the column became more slender, changing from four to six diameters high, while the capital echinus grew higher and had less spread.

There are several theories for the derivation of the Doric Order—one of the most plausible being concerned with wooden construction. Vitruvius, the architectural authority of antiquity, believed that, as stone was substituted for wood, the different parts of the Order retained their former characteristic shapes. The stone column replaced the wooden post which was supported upon a sill. From the latter the base was developed, while the capital grew from the block which rested on top of the post and reinforced the joist. The triglyphs suggest the ends of the ceiling beams, and the roof rafters are reflected in the mutules and dentils which give support to the cornice.

In the early examples of the Order, when the designers were not so sure of their materials, the architrave was high and the span was short, a single block of stone, of course, resting upon the columns. Later the architrave became lighter as the architecture became less massive—all in keeping with the desire to satisfy the eye of the beholder. The profiles of the echini were very subtle freehand curves, as contrasted with the mechanical ones of the Romans; the long horizontal lines of the temples were curved upward slightly in the centre to prevent the optical illusion of sagging. Another evidence of the attention paid to detail is the slight inclination of the corner column of a temple toward the centre of the building, and its increased weight, which give a feeling of greater stability to the structure. This effect is heightened by the placing of the corner column closer to those adjacent. This is necessary because the beginning triglyph is not over the centre of the column and because it is not desirable to make the first metope larger than the others of the frieze.

The Order on page 55 is based largely upon the Parthenon, which was built in Athens in the first half of the fifth century B.C. and represents the apex of the art of the Periclean age. The Pentelic marble which was used permitted the subtle refinement of detail which is so characteristic of much of Greek work.

Referring directly to the drawing on the opposite page, it will be seen that the shaft or supporting member rests directly upon the steps or stylobate (1). The fluting of the shaft probably represents the chamfering off of the corners of a square pier and the continuing of this process until a many-sided polygon resulted. The upper diameter of the shaft is smaller than the lower diameter, and the middle part of the profile is usually given a slight outward curve, or entasis, to prevent a concave appearance. However, for the sake of ease in representation, the two diameters are more often jointed by straight lines. The plain abacus at (4) and the echinus moulding (3) and annulets (2) constitute the capital. The architrave, as part of the spanning member, is a plain lintel resting upon the columns, while the frieze receives the decoration of the rectangular, channeled triglyphs (5) and the sculptured metopes between. The cornice is composed of two major parts, the most important being the corona at (7) which tends to protect the rest of the entablature. The cyma, or crowning member, at (8), terminates the composition.



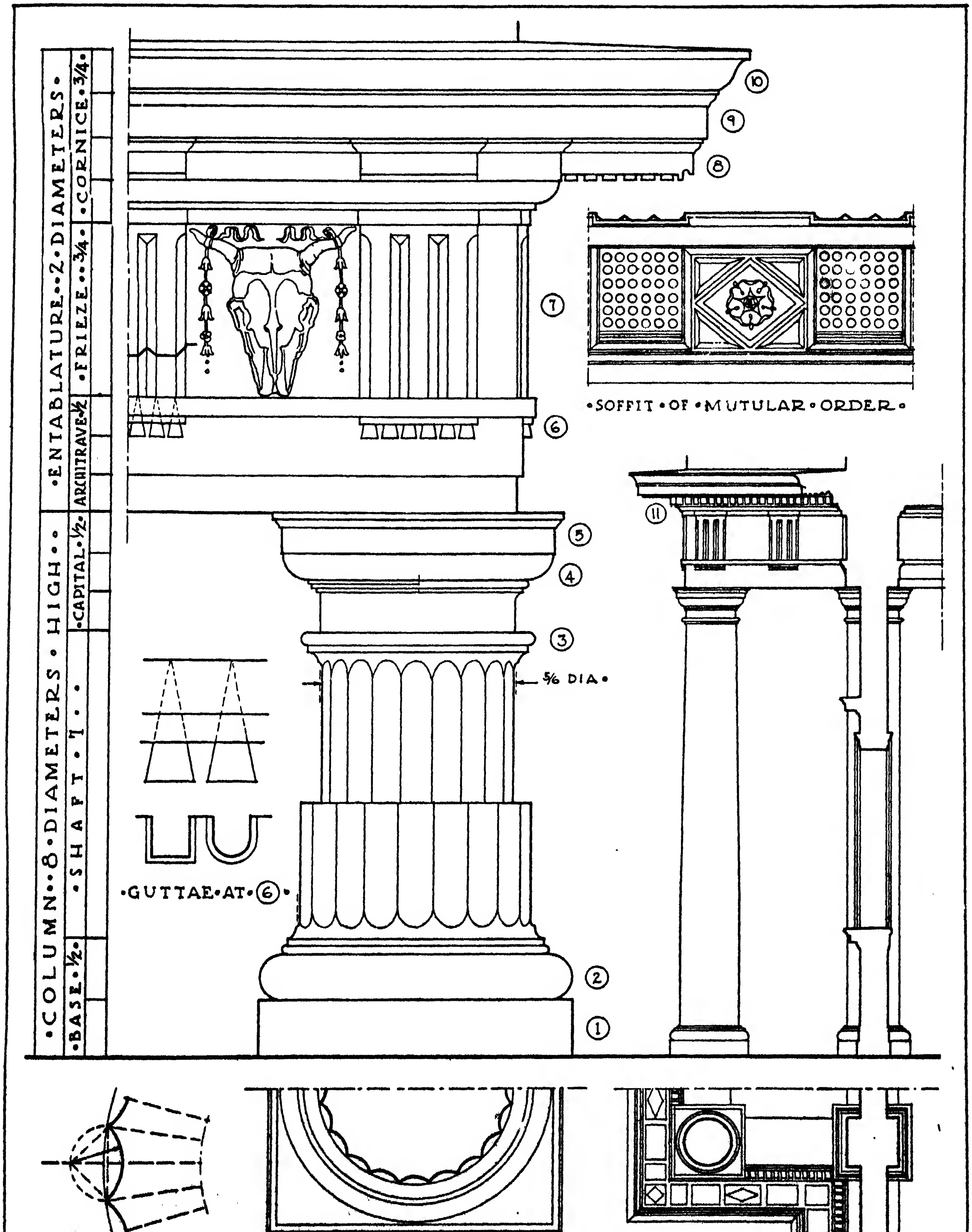
• FIG • A • DETAILS • OF • THE • ORDER •

• FIG • B • COMPLETE • ORDER •

THE ROMAN DORIC is quite dissimilar from the Greek Doric and is more closely related to the Roman Ionic. One reason for this is the homogeneous nature of Roman architecture. The creative spark was not so bright, and it was too easy to draw upon Greek sources of inspiration—all of which led to a more uniform effort and resulting development. However, the Romans were responsible for certain innovations which, although related to construction, affected the character of their architecture. From the Etruscans they borrowed the principle of the arch with its voussoirs of stone and developed it until the post and lintel no longer had to be depended upon as a means of supporting and spanning. But the simple arcade of piers and arches, such as was used in their aqueducts, no doubt proved uninteresting. In order to overcome this condition, an engaged column was placed against the pier to carry the decorative entablature above the arched opening. This engaging of the column, or the inclusion of approximately one-third of its diameter within the wall, together with the use of the arch and vault for spanning larger distances, caused the Roman column to become less structural than were the Greek examples. This, together with the reduction of the Orders to standardized rules of proportion, brought about a loss of aesthetic appreciation for sturdy qualities and subtle refinements. The curved mouldings became more regular and less interesting in their contours. Uniformity of treatment resulted in a sacrifice of individuality. The flutings of the columns often lost their sharpness, either through poor design or faulty workmanship, while a tendency toward multiplicity of detail detracted from the structural unity of the Order.

The small or Denticular Order shown on the opposite page is based upon the one developed by Vignola, who in turn drew upon the parts and proportions of the Theatre of Marcellus for his inspiration. In this latter example, however, there is no base to the columns so that Vignola has added the Tuscan base for the sake of completeness. This example is located in Rome and dates from about 23 B.C. The large Order on page 57 differs from Fig. 57 B in the treatment of the cornice. Here mutules, or projecting brackets, have been substituted under the soffit for the block-like dentils of the Denticular Order. This Order is also by Vignola.

In a detailed study of the various parts of the Order it is seen that the base, which is usually one-half a diameter high, is composed of a simple plinth, or block, at (1), square in plan, together with the torus at (2) which is circular in plan and semicircular in profile. Above the torus is the smaller bead moulding. The shaft of the column diminishes in size in an upward direction. A conventional representation consists of making the column diameter uniform for the lower third of its length and then tapering it to the smaller dimension at the top. The astragal and fillet, at (3), terminate the shaft and separate it from the neck of the capital. Above the neck are the small fillets or annulets, the ovolo or echinus (4), the vertical facia, and the cyma reversa and fillet at (5). The shafts of Roman columns were usually monolithic, in contrast with those of the Greeks which were composed of several sections or drums. The entablature, which when measured by the customary methods is always one-fourth the height of the column, is composed of the usual three parts. The architrave consists of two planes, the upper one receiving the taenia and the guttae (6). The frieze is made up of triglyphs (7)—the corner one over the centre of the column—and the square metopes. The cornice contains either the mutules (8) or the dentils (11), and the strongly accented corona (9) with its terminating small cyma reversa and its larger cyma recta at (10).



•FIG•A• DETAILS•OF•THE•MUTULAR•ORDER• •FIG•B•DENTICULAR•ORDER•

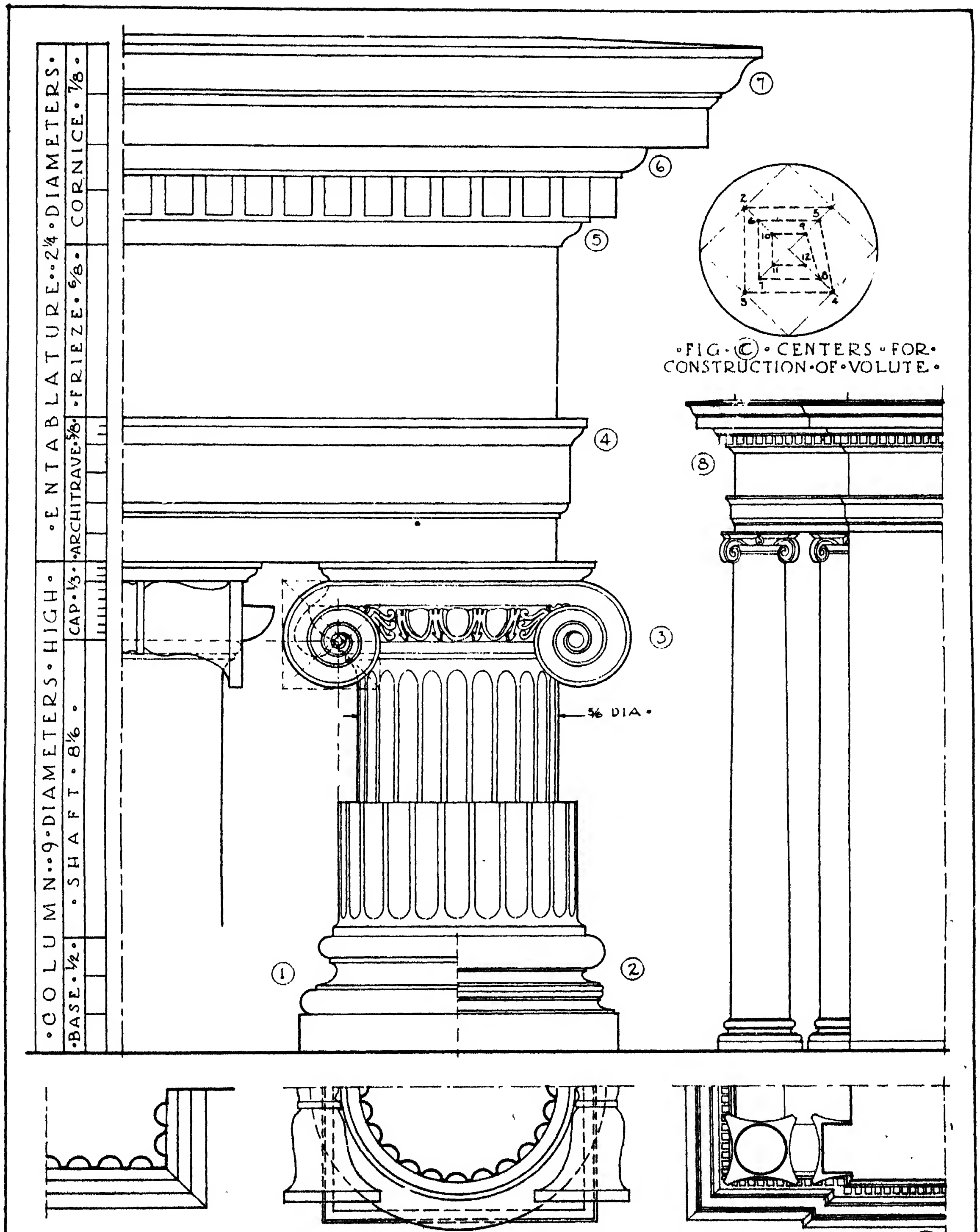
THE ROMAN IONIC is rather reluctantly substituted for the Greek Ionic, chiefly on account of the favor which the former found with Renaissance designers and its subsequent influence upon the revivals of this movement. The graceful curves of the Greek Ionic capital (Fig. 173 D) and the simplicity of its entablature recommend it for consideration in contemporary design, but the widely prevalent Roman Ionic derivations offer a more readily adapted treatment.

Many comparisons have been drawn between the character of the Doric and the Ionic. Their proportions have been personified. The sturdy qualities of the Doric represent the masculinity of man, while the more slender and graceful elements of the Ionic reflect the femininity of woman. The Doric is reserved for the first story of the superimposed Order and for positions where strength is required. The Ionic is used where a greater feeling of grace and refinement is desired.

The volute of the capital is the most distinguishing part of this Order. Perhaps nothing surpasses the beautiful, rhythmic form of this spiral. Of its origin we can only surmise. There are many similar shapes in nature, one of the most conspicuous being that of the spiral of certain shells of the sea. The ever-changing direction and spacing of the motif give it a preeminent position as a decorative form. One reason, perhaps, for the popularity of the Roman Ionic is the mechanical way in which its volute may be constructed, as in Fig. 59 C. The Roman volute may be drawn with a compass by using the centres, with diminishing diameters, in the order indicated. The construction of the Greek volute, more elusive and subtle, does not lend itself to any such method of reproduction. Again, the eye rather than the hand dictated proportions.

The Ionic Order shown on page 59 is also based upon one developed by Vignola, with the exception of the treatment of the architrave, which has two planes instead of three. The Attic base of Palladio has also been substituted on the left half of the drawing at (1) for the more unusual one of Vignola, which is shown on the right at (2). The base of Palladio consists of the usual plinth surmounted by two convex tori between which is a concave scotia. The flutes of the shaft are now separated by narrow strips or sections of the perimeter of the column instead of the sharp edges or intersections of the Doric. The capital has its distinctive features, the scrolls (3), which usually show on two sides only, together with its egg and dart moulding. The composition is surmounted by the small cymatium, or cyma reversa, which, by the direction of its profile, gives the impression of exerting an upward thrust and separates the graceful spirals from the heavy architrave.

The entablature, or spanning member, presents more richly decorated surfaces than in the Greek interpretation of the Order. The cyma reversa of the architrave (4) often receives a carved decoration with an acanthus motif, while the frieze itself sometimes holds sculptured forms of griffons, garlands, and human figures. The cyma reversa (5) under the dentil course is usually enriched with some variation of the leaf and tongue ornament. The surface of the quarter round moulding, or echinus (6), under the corona, receives the customary egg and dart decoration. The cyma recta (7) again acts as the crowning member. A more ornate type of Ionic capital is shown in the small Order in Fig. 59 B. By reference to the plan it will be seen that volute scrolls are presented on all four faces of the capital. This allows a symmetrical treatment about the corner of a building but is perhaps a less satisfactory arrangement than the one with the scrolls parallel to the entablature. Scamozzi is credited with the development of this type of capital.



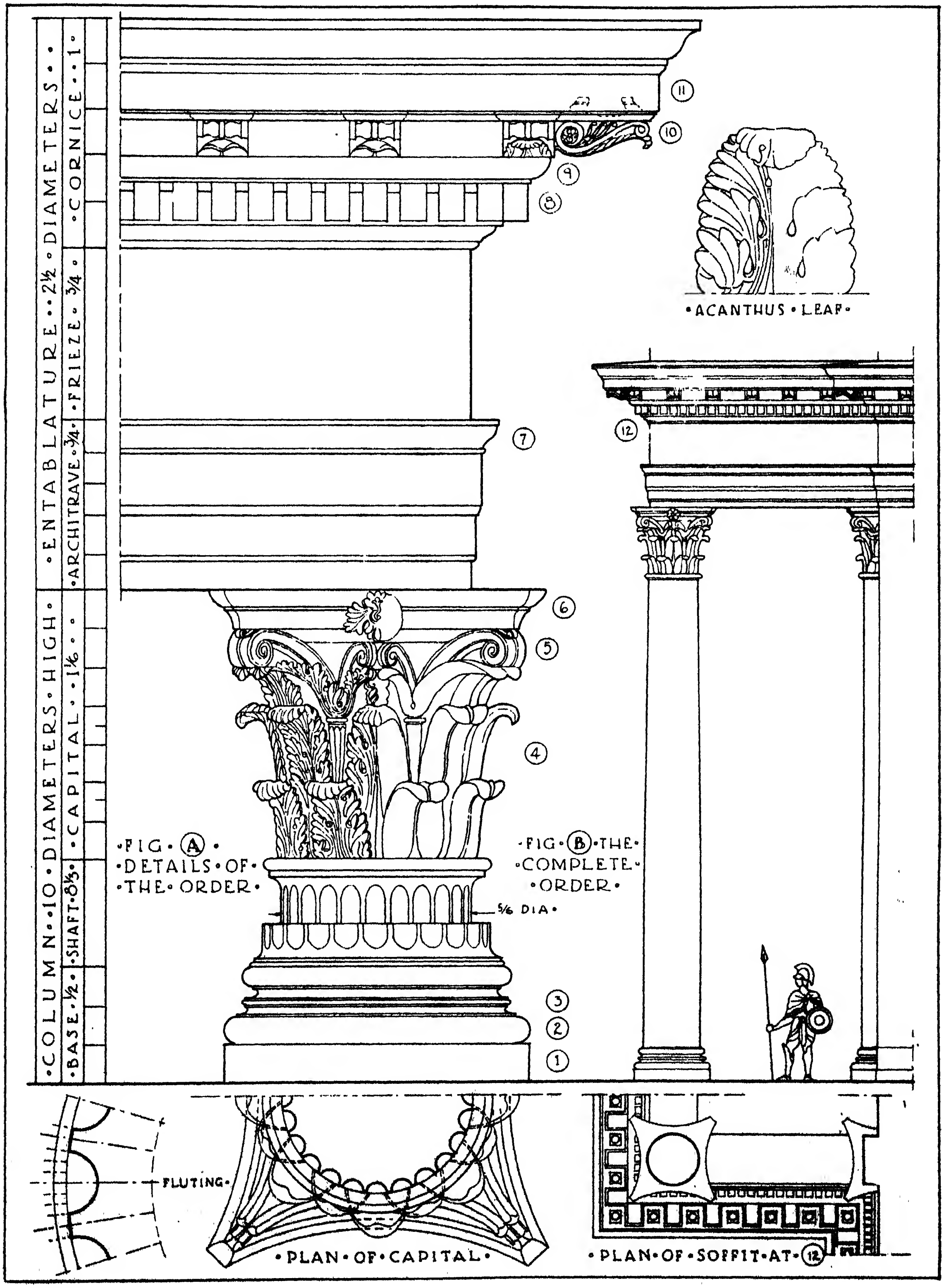
••FIG•A•••DETAILS•OF•THE•ORDER• •FIG•B•COMPLETE•ORDER•

THE ROMAN CORINTHIAN is the last of the Orders, unless we include the Composite, which is a later, richer, and slightly decadent form of the Corinthian. There is more evidence of the Corinthian in the architecture of the Roman empire than of any of the other Orders. Perhaps this is due to the fact that the ornateness of the Corinthian was most truly representative of the luxury-loving court and people of Rome, just as the Greek Doric was most typical of the robust simplicity of the inhabitants of the islands of Greece. The temple, the forum, the bath, and the basilica were decorated with some form of the Corinthian. Its multiplicity of detail was in keeping with the profusion of the statuary, paintings, and ornament which extravagantly embellished the buildings of the Roman Emperors.

The example shown on page 61 is based upon the version developed by Vignola. Again the capital is the distinguishing feature of the Order. It is the most ornate of all thus far seen and is composed of rows of leaves (4) surrounding the bell or basket. Corner scrolls reminiscent of the Ionic (5), and an abacus, or moulded member (6), complete the composition. Tradition offers several suggestions as to the possible derivation of the Corinthian capital. The most common and the most romantic tells us that, according to Vitruvius, an early artisan secured the inspiration from seeing, on the grave of a maiden of Corinth, a basket which was covered with a tile and surrounded by acanthus leaves. At least, the resulting form resembles conventionalized acanthus leaves arranged in this traditional position. The shaft of this Order is either fluted or plain; the base consists of the usual plinth (1) and the tori (2) separated by the scotia and astragals (3).

The entablature reflects the same richness of treatment which is to be found in the capital. The architrave has three fasciae separated by ornamental mouldings (7). The surface of the frieze is frequently carved with acanthus scrolls or bas-reliefs of human and animal forms. The cornice has the usual dentil course (8) and egg and dart moulding (9) with the addition of the row of modillions, or brackets (10), which give added interest to the composition of the entablature and provide a feeling of support for the corona above (11). Between the modillions are richly sculptured coffers which can be seen from below. In the version by Vignola, as well as in some of the actual examples, there is a definite relation between the spacing of the columns, the modillions, the dentils, and other decorative features.

By reference to the preceding pages it will be seen that the Orders have developed from the heavy Doric column with a height of five and one-half diameters to the tall Corinthian with ten diameters. We have proceeded from the simple to the ornate, from the early to the late. On the whole, the various parts of each Order have been in complete harmony with each other, the more embellished cornice accompanying the richly decorated column. If any lesson is to be learned from the study of the Classical Orders it will be through the close observation of the proportions of each and the reason for their use. The dignity of the Doric, the grace of the Ionic, and the luxuriant sophistication of the Corinthian have their place in contemporary design, but it is the spirit of the style, rather than the restricting limitations, which should govern the modern designer. However, care should be exercised in working with the Classical Orders. There were logical reasons for their development in the forms just shown, and any modifications should be made with an understanding of past and present influences and with a knowledge of the basic principles of composition.



•COLUMN•10•DIAMETERS•HIGH•
•ENTABLATURE••2½•DIAMETERS••
•BASE•½•
•SHAFT•8⅓•
•CAPITAL••1⅙••
•ARCHITRAVE•¾•
•FRIEZE•¾•
•CORNICE••1•
•ACANTHUS•LEAF•
•FIG•A•
•DETAILS•OF•
•THE•ORDER•
•FIG•B•THE•
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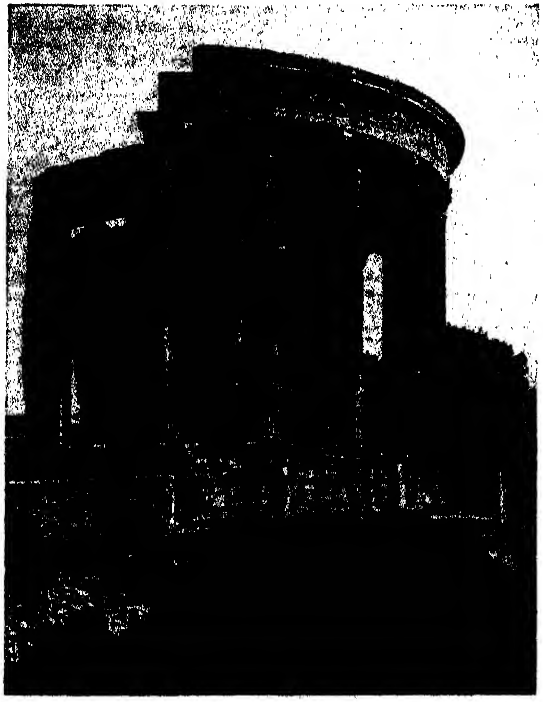
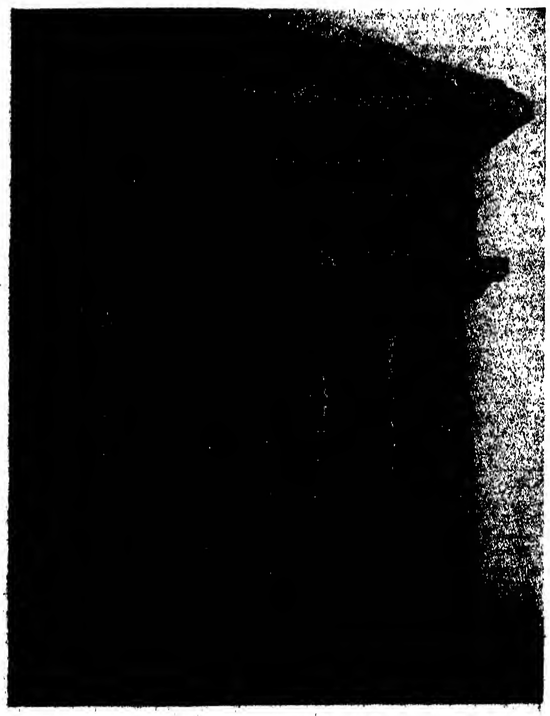




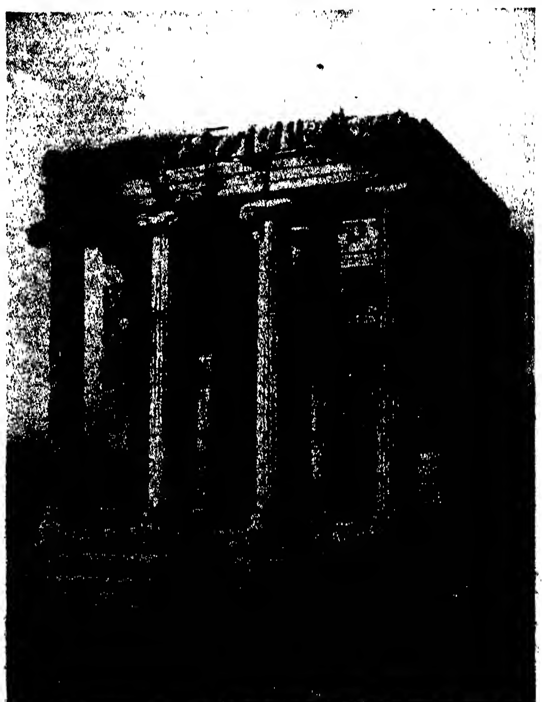
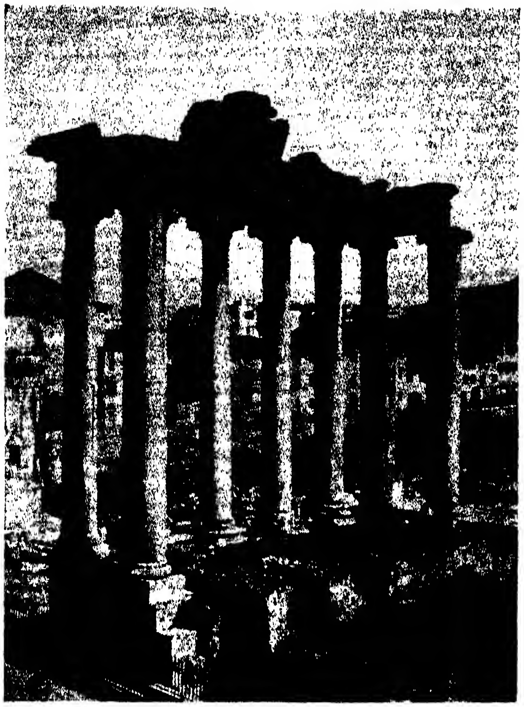


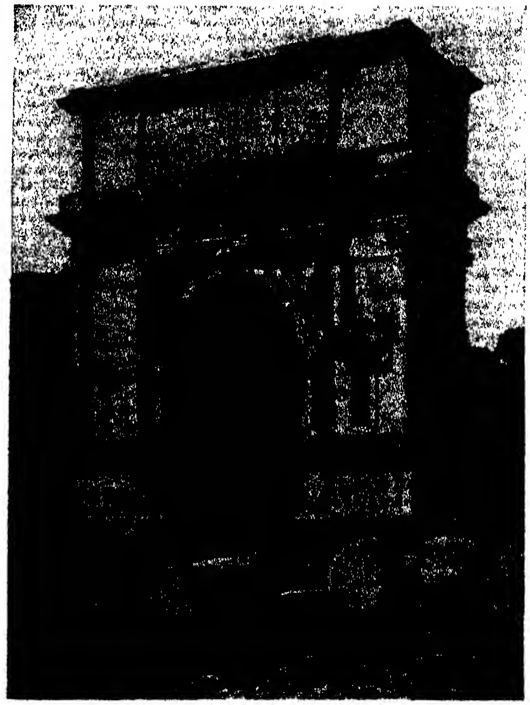
FIG. (A), above.—Temple of Sibyl, Tivoli. Peristyle of eighteen columns, 23 ft. 6 in. high. A sturdy type of Corinthian.

FIG. (C), below.—Temple of Poseidon, Paestum. Early Greek Doric. Column proportions are about 4½ to 1.

FIG. (B), above.—Tower of the Winds, Athens. Octagonal, 22 ft. 4 in. inside diameter. Two Corinthian entrance porticoes.

FIG. (D), below.—Temple of Niké Apteros, Athens. Ionic columns are 13 ft. 6 in. high, 1 ft. 9 in. dia., two diameters apart.





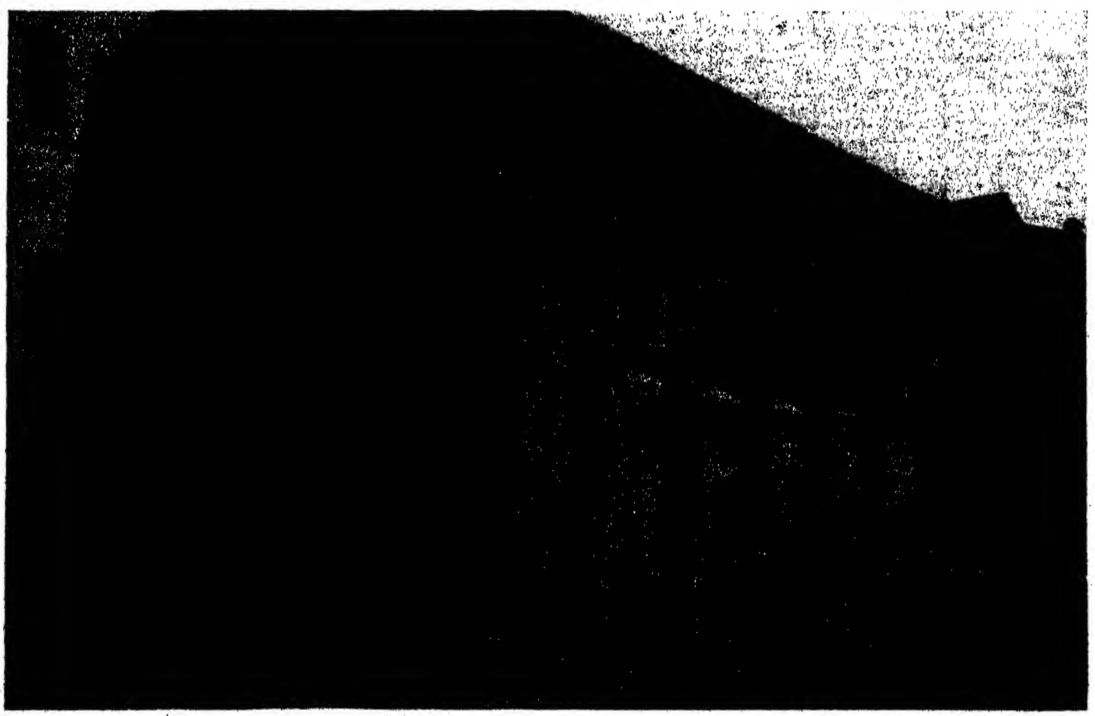


Fig. (a), above.—Temple of Saturn, Rome. Granite columns 30 ft. 4 in. high. Ionic capitals with angle volutes.

Fig. (b), above.—Arch of Titus, Rome. Earliest known example of Composite Order. Engaged columns, pedestal course, and arch.

Fig. (c), below.—Temple of Fortuna Virilis, Rome. Engaged Ionic columns against cella walls. Formerly with portico.

ROMANESQUE. In order to continue our study of the elements of architecture, it will be necessary to include those often-omitted styles which prevailed between the Classical and the Renaissance, namely, the Romanesque and the Gothic. It is true that they cannot be reduced to the same standardized proportions as the Orders, but they have contributed to the development of present-day architecture and may still serve as sources of inspiration. For these reasons, we shall make a classification of their structural, protective, circulatory, and decorative elements similar to that followed for Classical architecture.

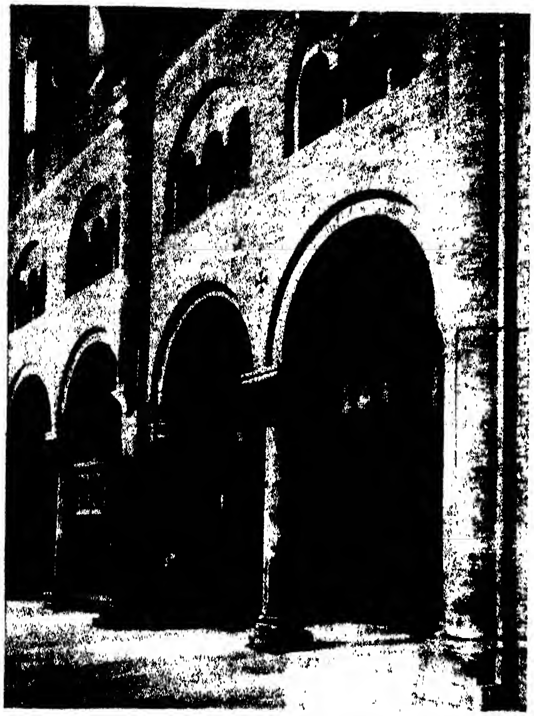
Romanesque architecture is essentially one of churches. Like all movements, it did not spring suddenly into existence, but grew gradually from earlier influences. The Early Christian style continued Roman traditions and details in its basilican churches. Byzantine architecture, contemporaneous with the Early Christian and the Romanesque, showed a similarity to both in the use of the round arch and of decorative elements, but contrasted with the vaulting of the Romanesque by its practice of covering a building with several domes. From the Roman, and influenced by the Early Christian and Byzantine, the Romanesque developed.

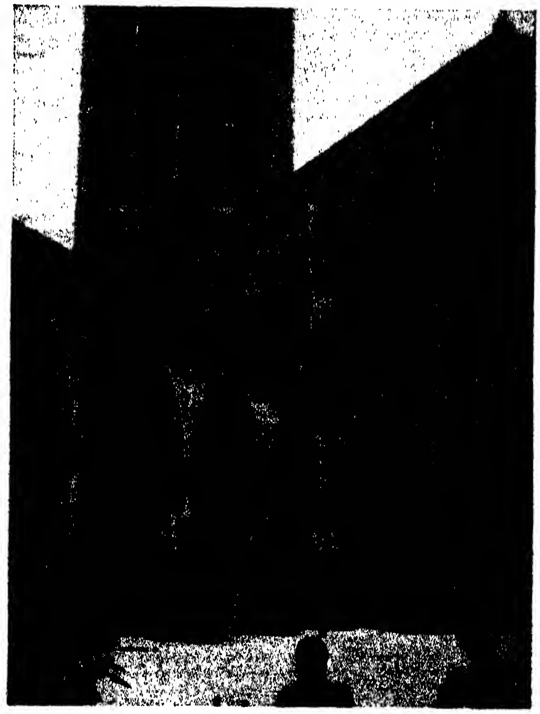
In the churches of the later phase of the Romanesque, from the tenth to the twelfth centuries, there is to be found a structural quality which differs from that employed by the builders of the Roman empire. The latter piled heavy stone upon stone, depending upon the sheer weight of the material to resist the thrust of the arches and vaults. The Romanesque principle of construction is based upon the securing of equilibrium by the use of lighter walls and the placing of buttresses at strategic points in order to counteract the stresses of loaded members. Romanesque architecture is thus not so heavy as the Classical but is more massive than the dynamic Gothic which was to follow.

Figure 66 A shows an elevation of a typical bay of the nave of the church of S. Ambrogio, Milan, dating from the twelfth century. As was often the case, the nave is divided into square bays by heavy piers and spanned by a series of simple, groined vaults. Intermediate piers divide each large bay into two smaller ones to form the nave arcade, and the treatment is repeated in the triforium gallery above. Brick and stone, typical of Northern Italy, are used on both the interior and the exterior (Fig. 65 B).

Referring now to page 67, it will be seen that mediaeval piers are composed of the usual three members, i.e., base, shaft, and capital. These piers, or supporting members, consist of a single square, octagonal, or cylindrical column, as in the English example in Fig. 67 B, or of engaged units as in Fig. 67 A, which is based upon French precedent. The terminating members of the piers, the crowning and the load-distributing or translating mouldings, retain the same characteristic sturdiness as the vertical elements. The mouldings of the base are usually awkward derivations of the Classical Attic type. The capitals vary greatly in the different countries, but the essential quality of Romanesque architecture usually prevails. The capitals range from the simple cushion type, Fig. 67 C, to those decorated with grotesque figures and animals or crudely copied acanthus leaves of the Corinthian Order, at (4).

The elements of the round arch, instead of the horizontal beam, now constitute the spanning members of Romanesque architecture. Smaller stones may be used and greater distances may be covered than with the Classical lintel. The mouldings of the Romanesque arch are simple semicircular or angular forms, as at (2) and (3).





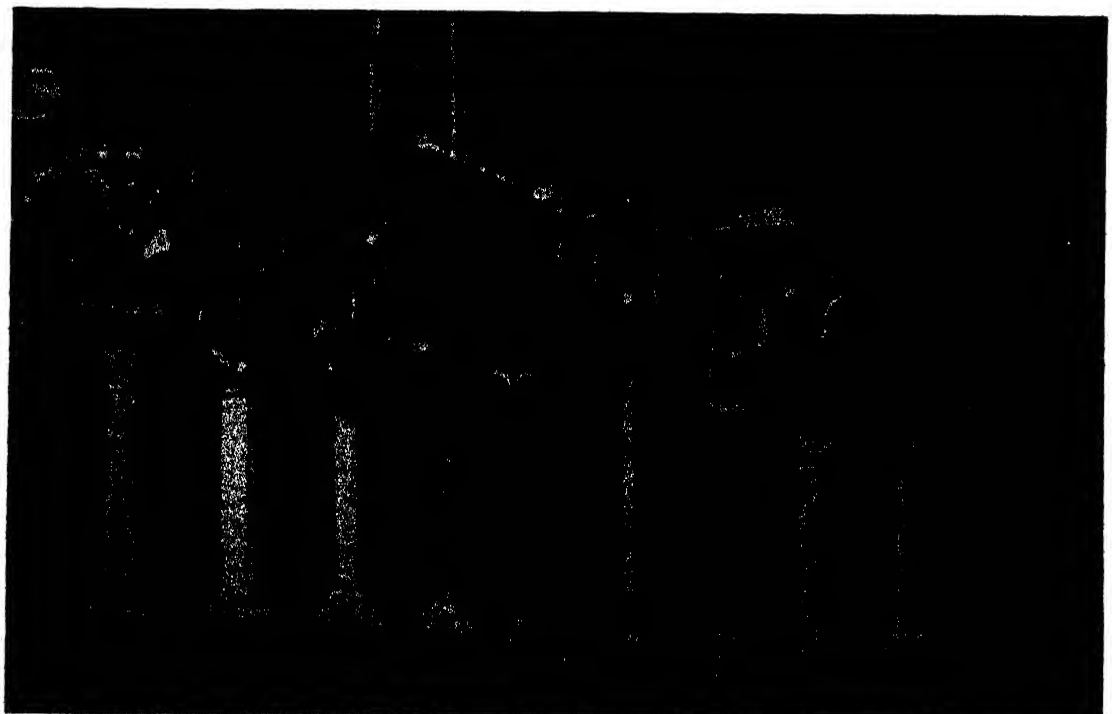
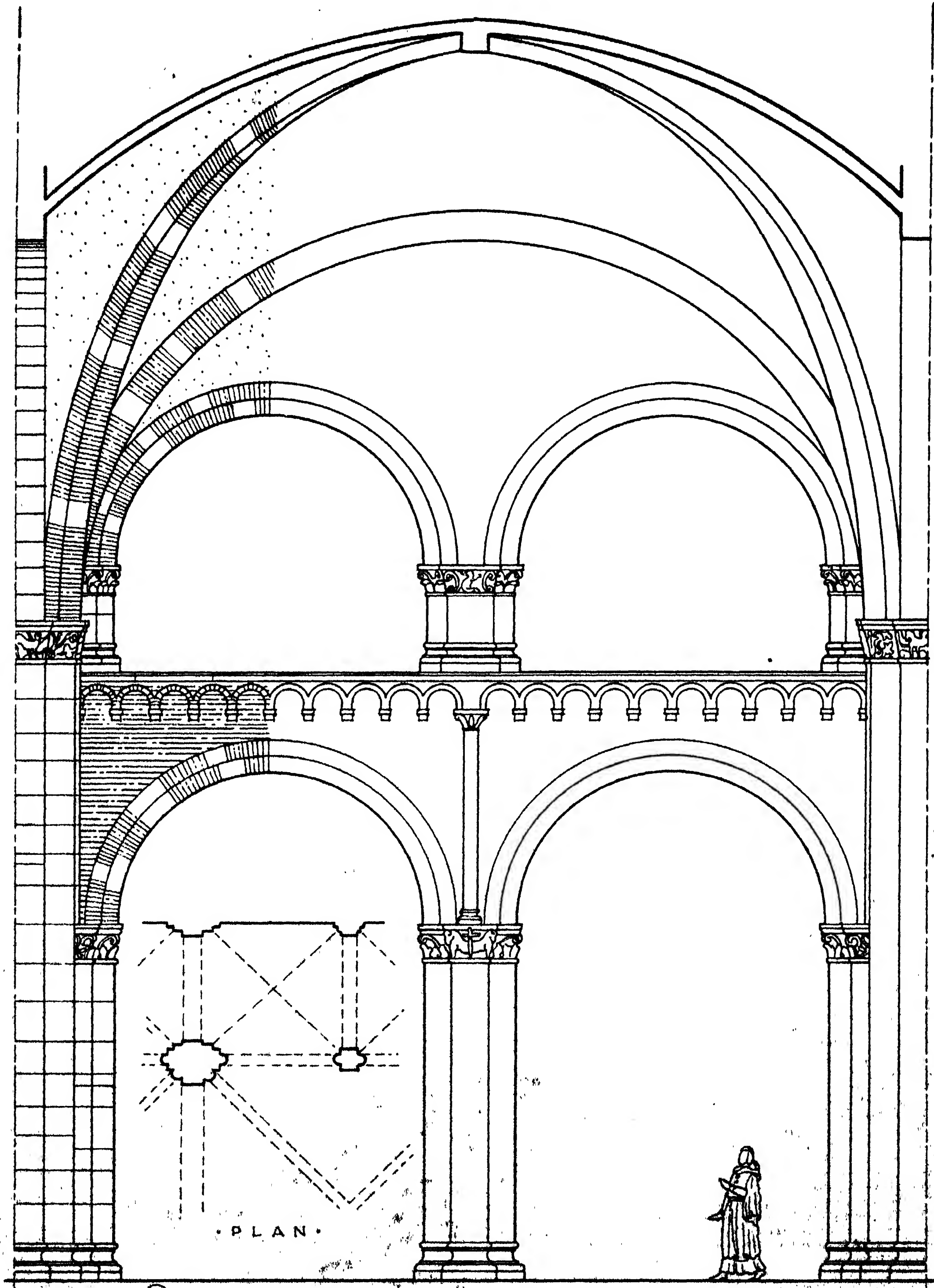


FIG. (A), above.—Interior S. Michele, Pavia. Stone columns and clustered piers of brick carry brick arches and vaults.

FIG. (B), above.—S. Ambrogio, Milan. View in atrium showing typical piers and round arches. See also Fig. 29 C.

FIG. (C), below.—Canterbury Cathedral. Exterior wall arcade with columns and interlaced arches. More decorative than structural.



• FIG • (A) • ELEVATION • OF • TYPICAL • BAY • OF • NAVE •
• THE • STRUCTURAL • SYSTEM • OF • AN • ITALIAN • ROMANESQUE • CHURCH •

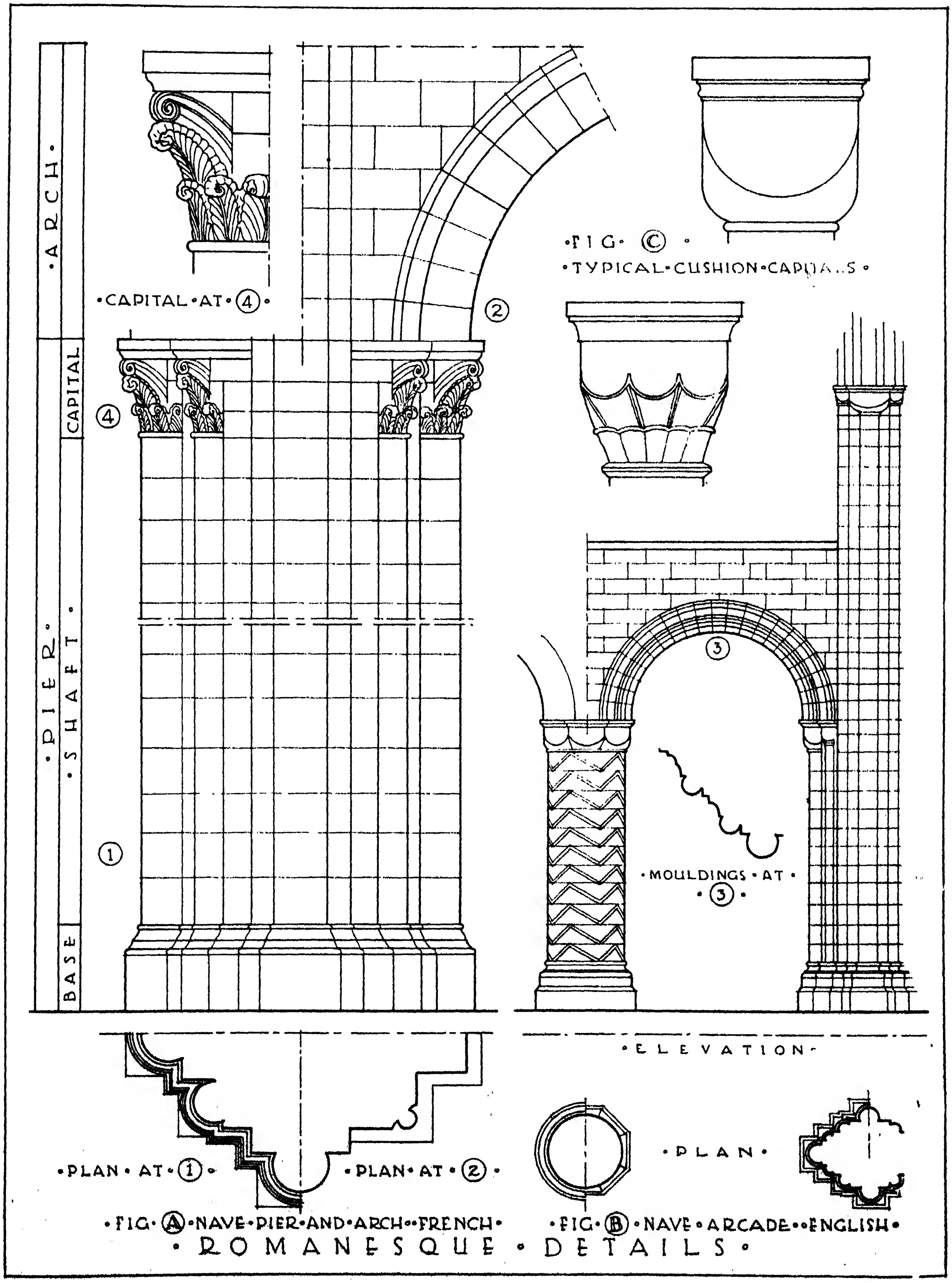


FIG. (A) NAVE PIER AND ARCH FRENCH — FIG. (B) NAVE ARCADE ENGLISH

ROMANESQUE DETAILS

GOTHIC. The name of this beautiful and inspiring style was originally used as a term of derision by the scholars of the Renaissance who did not understand the mysticism of the Middle Ages and who were not in sympathy with the complex architectural forms which were so unlike those of the Classical. The name has remained as one which includes the work following the Romanesque and preceding the Renaissance—an architecture which is based upon the use of pointed arches, ribbed vaults, and flying buttresses.

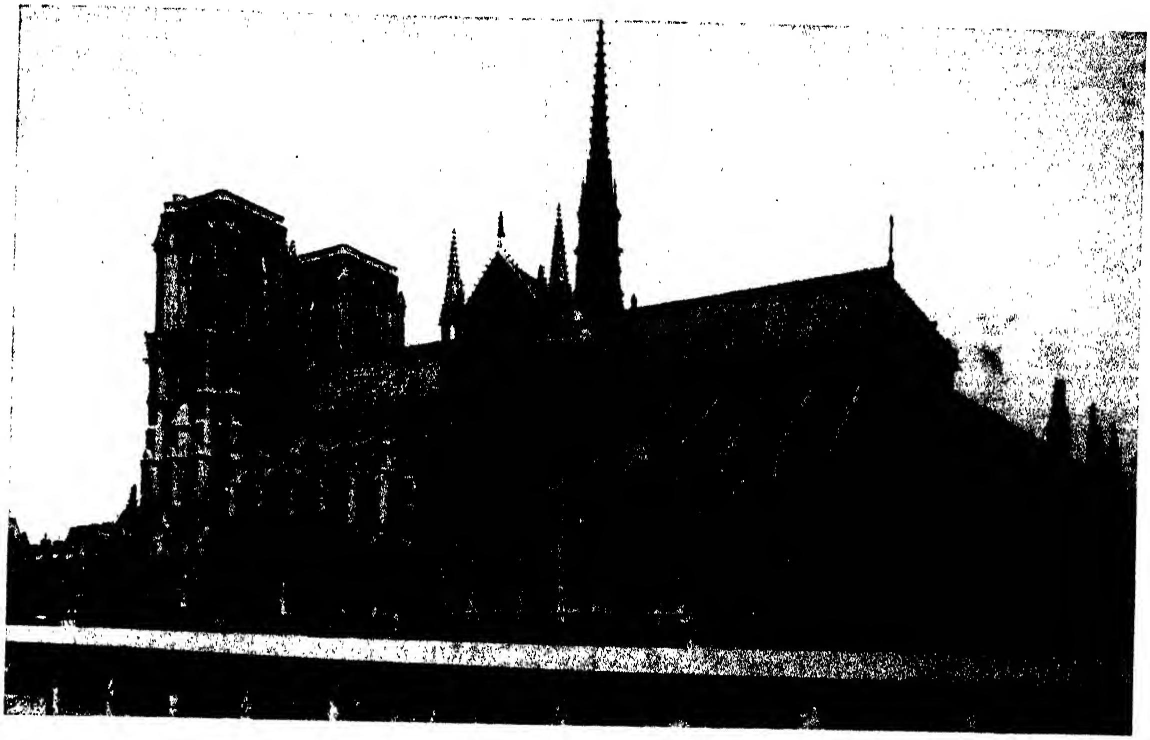
The Gothic was born in France and had its most complete expression there and in England. In the latter country it followed a more clearly defined course of development, and it is the English Gothic which finds a greater reflection and use in the United States. Even though the cathedrals of Europe illustrate the magnificence and variety of the style, it was not confined to ecclesiastical buildings. Secular structures, as well, display moulded pointed arches and buttressed walls. However, the highest development of the movement is to be found in the cathedrals, and it is to a typical example that we return for an analysis of this type of architecture.

The drawing in Fig. 70 A–B is based upon Reims Cathedral. It shows a bay of the nave, with its nave arcade, triforium gallery, and clearstory windows. It will be observed that the structural scheme of a Gothic church resembles more closely than that of any other style the present-day system of steel construction. The framework of the modern building reflects the character of the skeleton of the cathedral—the columns, buttresses, arches, and ribbed vaults all held in a state of equilibrium by an accurate adjustment of thrusts and counter-thrusts. The flexibility of the Gothic style led to great variety in the combining of the many parts, but there was a similarity in the use and character of the details.

With the load of the roof and vaulting carried to the piers, the walls lost much of their importance as structural members. Their chief function, as in contemporary architecture, became that of simply enclosing the building. The characteristic stained-glass windows occupied most of the space which would have been given over to masonry in any of the other historic styles. The columns or piers of the nave arcade showed much variety in treatment and appearance. They increased in complexity of plan as the style emerged from the influence of the Romanesque, until in the later examples (Fig. 69 C) the lines and sections of the vaulting ribs were carried down and repeated, or at least reflected, in the piers. This method was more satisfactory than the one followed in some French examples (Fig. 69 B) of bringing the colonettes carrying the ribs of the vault down only to the top of a single nave arcade pier. The extremes of pier treatment ranged from the simple cylindrical or octagonal member to those with clustered, engaged or detached shafts, as in Fig. 71 A.

The simplicity or complexity of the bases and capitals depended upon the character of the surrounding architecture. The bases were usually made up of a number of vertical and curved surfaces, with considerable undercutting and overhang to some of the moulded members in order to accent the shadows, as at (2) on page 71. The capitals varied from the simple moulded type at (4) to that richly carved with conventionalized or naturalistic foliage forms, as at (7). Crispness of carving and deep undercutting of the mouldings were typical of the Gothic expression in most phases of its development.

The spanning members, or arch mouldings, which carried the vaults or walls, were pointed when seen in elevation and composed of concave and convex sections when seen in plan. Undercutting, contrasting sizes and shapes, and infinite variety were outstanding characteristics.



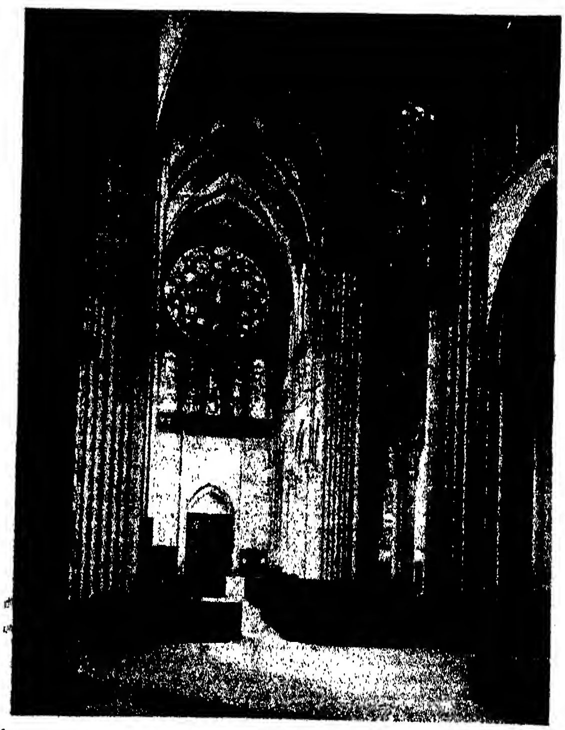
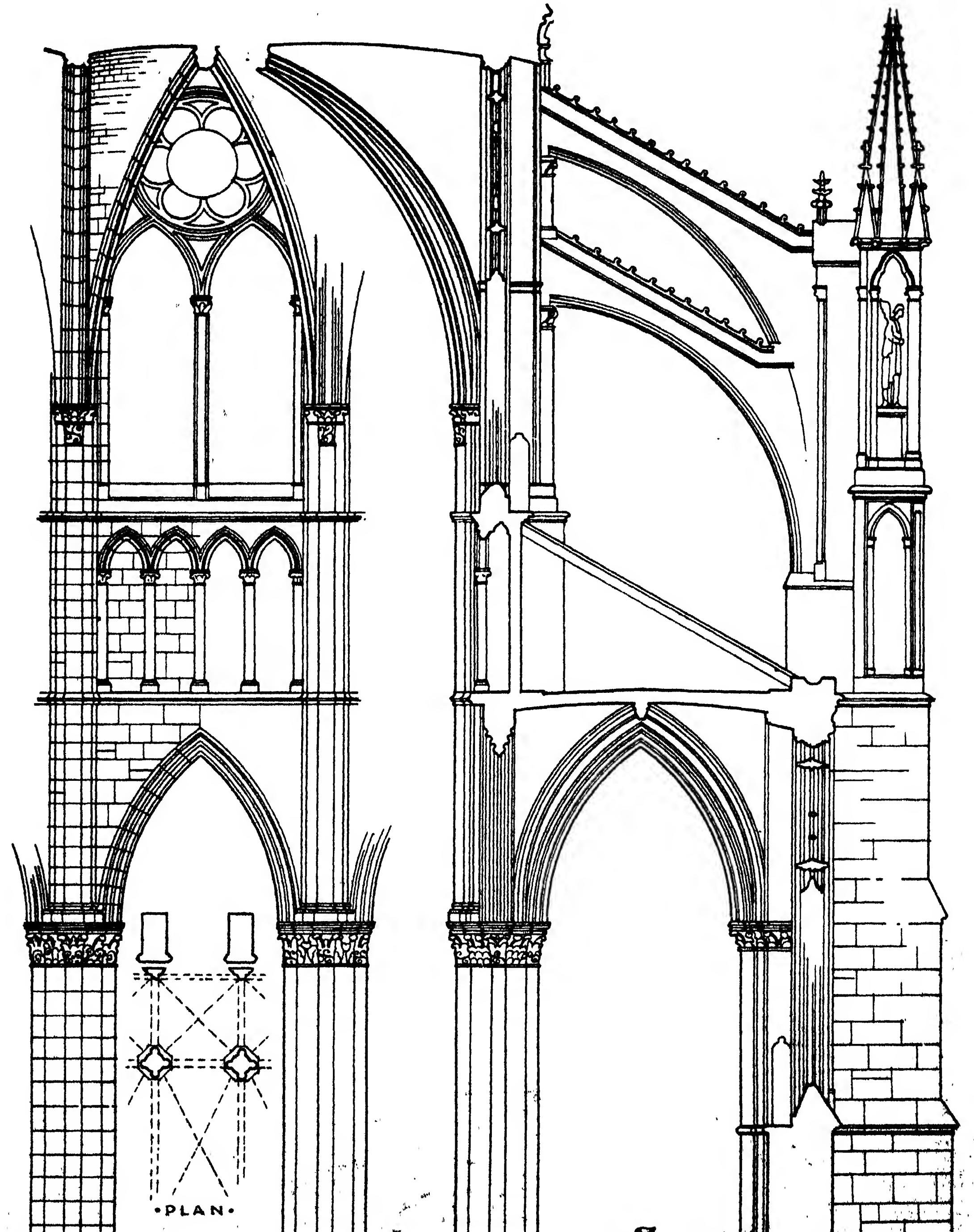


FIG. (A), above.—Notre Dame, Paris. External expression of the structural system of a French Gothic cathedral. Stone.

FIG. (B), below.—Interior of Fig. (A). More massive and less vertical effect than in c). Heavy, cylindrical nave piers.

FIG. (C), below.—Chartres Cathedral. Interior. Uninterrupted clustered piers. Slender verticality; dynamic structure.



•FIG•(A)•ELEVATION• •FIG•(B)•SECTION•

•THE•STRUCTURAL•SYSTEM•OF•A•FRENCH•GOTHIC•CATHEDRAL•

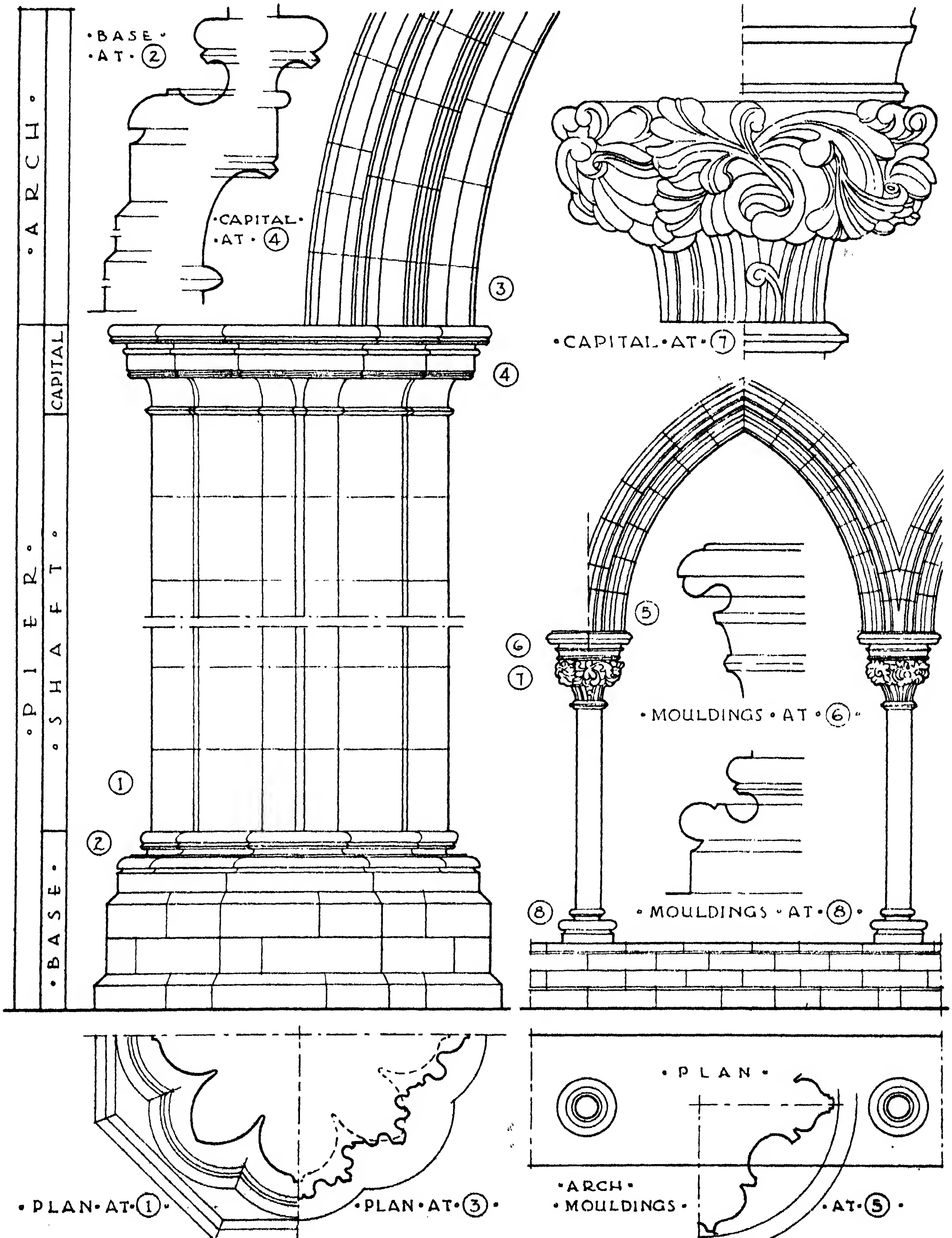


FIG. A. NAVE PIER AND ARCH. FIG. B. WALL ARCADE.
DETAILS OF ENGLISH GOTHIC.

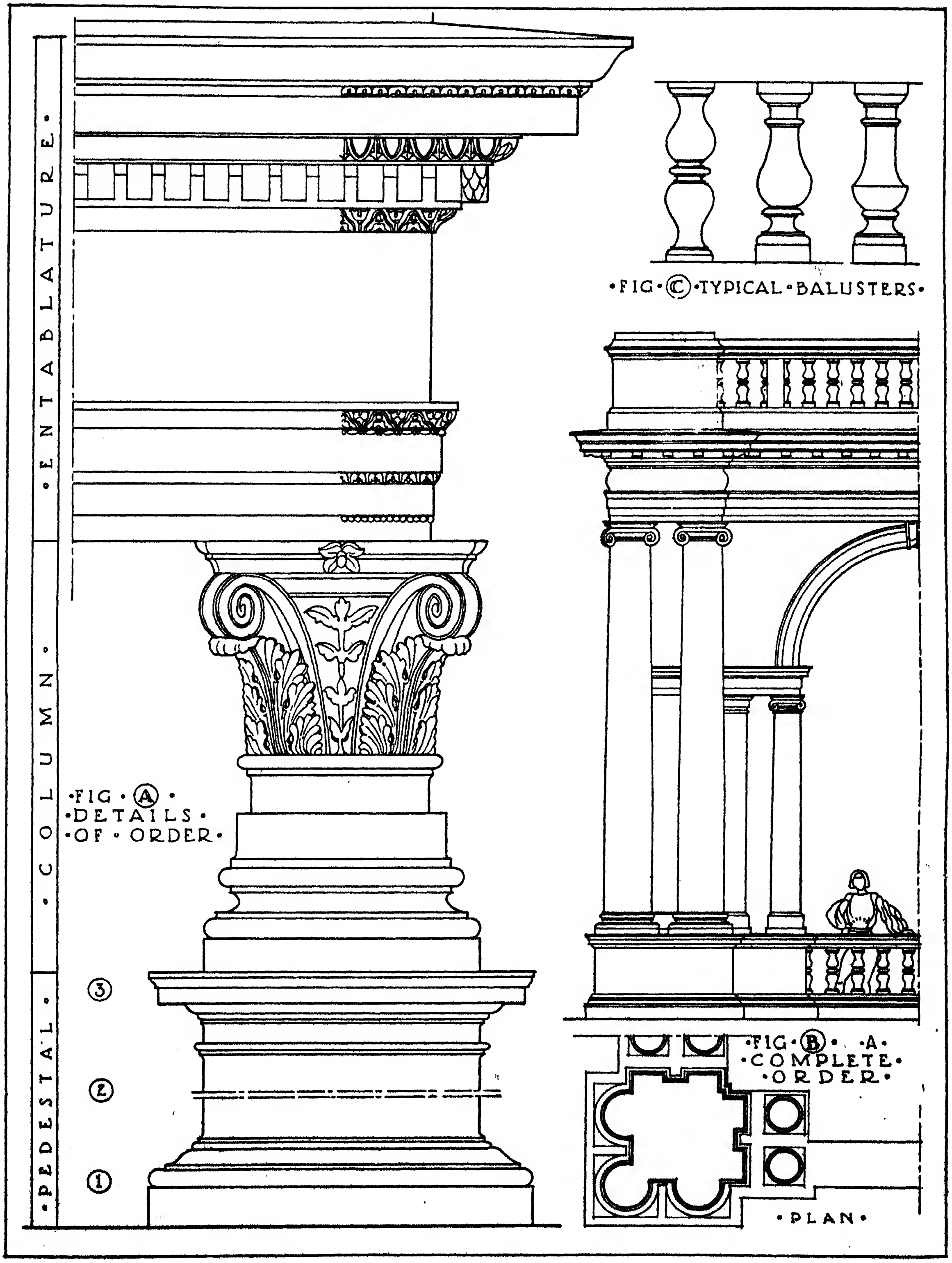
RENAISSANCE. After the mediaeval period, after the cathedrals, castles, and manor houses of the Middle Ages had been erected—there came a rebirth of Classical influence. Ancient literature, art, and science were scrutinized by Italian scholars, and Classical architecture regained the place which it had lost with the downfall of the Roman empire. The Orders were again employed, often in a fresh and invigorating, but still imitative, manner, and formed the basis of the Renaissance style in Italy, France, England, etc., and its later reflections in the United States.

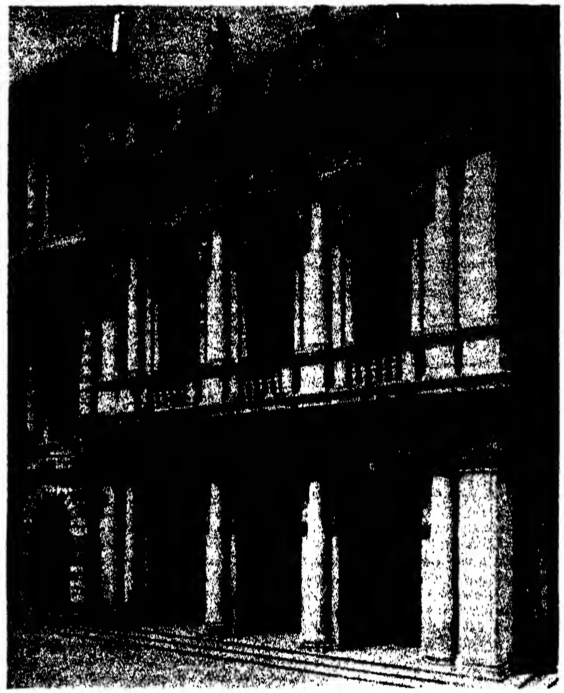
During the Renaissance in Italy all the arts flourished. Painters, sculptors, and workers in metal contributed to the glory of Rome, Florence, and Venice. Engaged columns, superimposed Orders, and rusticated wall surfaces were used upon the exteriors of the palaces and churches. The movement proceeded to develop from the early Renaissance with its graceful proportions and delicate carving to the Baroque, or late Renaissance, with its heavy proportions and exaggerated ornament. It is from the earlier period that we have drawn most of the illustrations of Renaissance work in this text. Although much interest and inspiration will be found elsewhere, still the refinement and good taste evident in the examples belonging to the fifteenth century offer much encouragement to contemporary designers. It is from this period that the Order in Fig. 73 A has been chosen, an Order which is not based upon any specific example but one which seems to combine the qualities of both the Classical and the Renaissance. Quite often the architects of this latter age followed rather closely the details of the near-by Roman examples. At other times they departed from these sources of inspiration and modified the decorative elements of the entablature or took liberties with the design of the capital. Figure 73 A illustrates the latter situation, the Corinthianesque capital having been reduced to a single row of leaves with strongly accented scrolls at the corners. The entablature follows the usual Roman method of divisions and decoration except for the omission of the row of modillions. A pedestal—with its three divisions of base, die, and cap which is so typical of the Renaissance—is shown in connection with the Order.

The Renaissance column and its accompanying entablature were usually much less structural than their counterparts of the Greek period. Sometimes they actually supported portions of the structure (Fig. 74 C), but more often they simply served to buttress the walls and afforded decoration and interest for the façade, as in Fig. 74 B. Twentieth-century Renaissance, with its steel skeleton behind the walls and in the hollow columns, can only be decorative. Modification, to permit the proper influence of new materials, new social conditions, and new building codes, is bound to result.

In Fig. 73 B a more mature type of Renaissance is shown. It is based upon the Ionic Order as used by Palladio in the Basilica, in Vicenza, which was built about the middle of the sixteenth century. The façade of this building consists of superimposed Doric and Ionic Orders in the form of arcades and engaged columns, the latter coupled at the corners to give added strength and stability. These engaged columns frame the arches which are carried upon smaller free-standing columns coupled in a direction perpendicular to the face of the wall. This arrangement of an Order, or a pier, supporting the arched opening, with a rectangular opening on either side, is known as the "Palladian motif" and since its development has been popular as a decorative feature.

Typical balusters (see page 90), which are related in design to the Orders, are shown in Fig. 73 C.


ENTABLATURE
COLUMN
PEDESTAL
3
2
1
FIG C TYPICAL BALUSTERS
FIG A DETAILS OF ORDER
FIG B A COMPLETE ORDER
PLAN



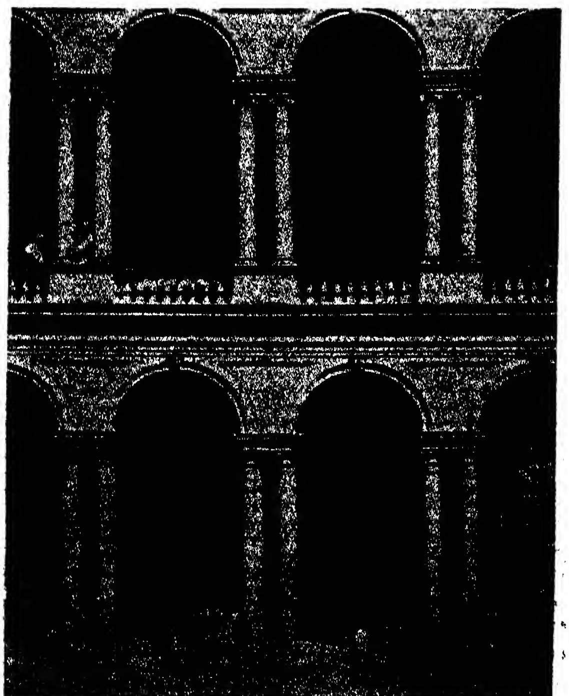
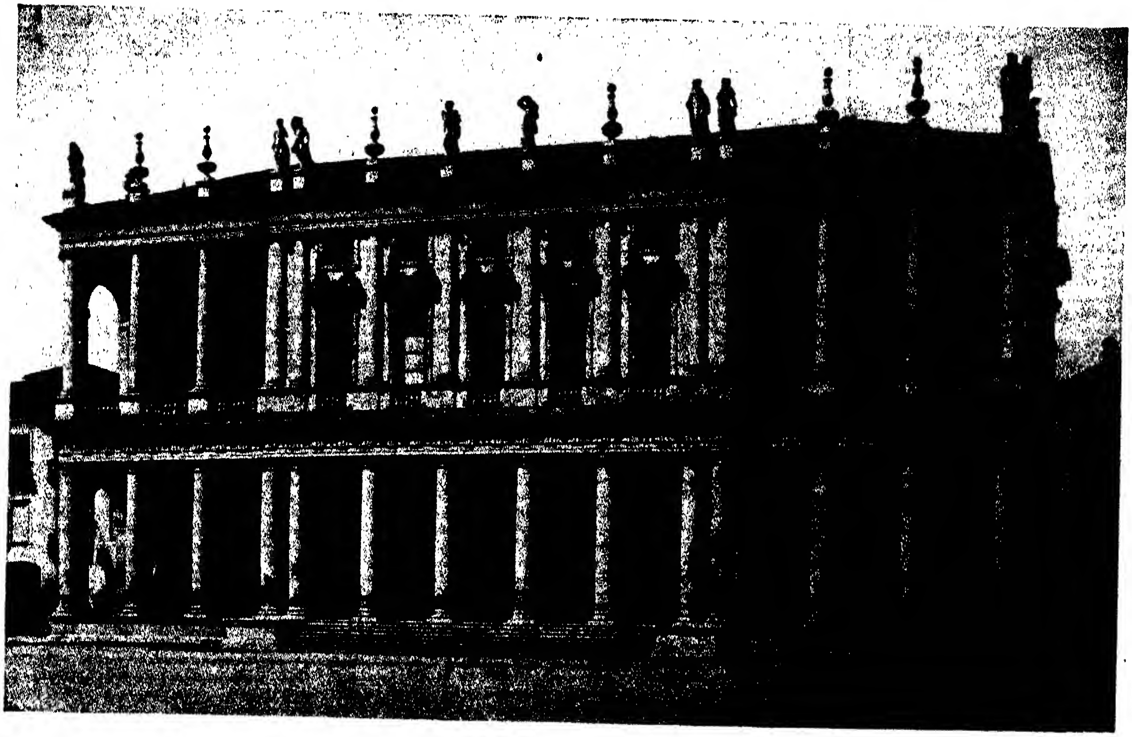


FIG. (A), above.—The Opera, Paris. Nineteenth century French Renaissance. Structural elements become richly decorative.

FIG. (C), below.—Palazzo Borghese, Rome. Superimposed arcades with coupled columns, Ionic above Doric.

FIG. (B), above.—Library of S. Mark, Venice. Doric arcade on first floor, Ionic on second supporting heavy entablature.

FIG. (D), below.—Palazzo Gondi, Florence. Arches carried directly upon columns without entablature as in (C). See Fig. 130 D.



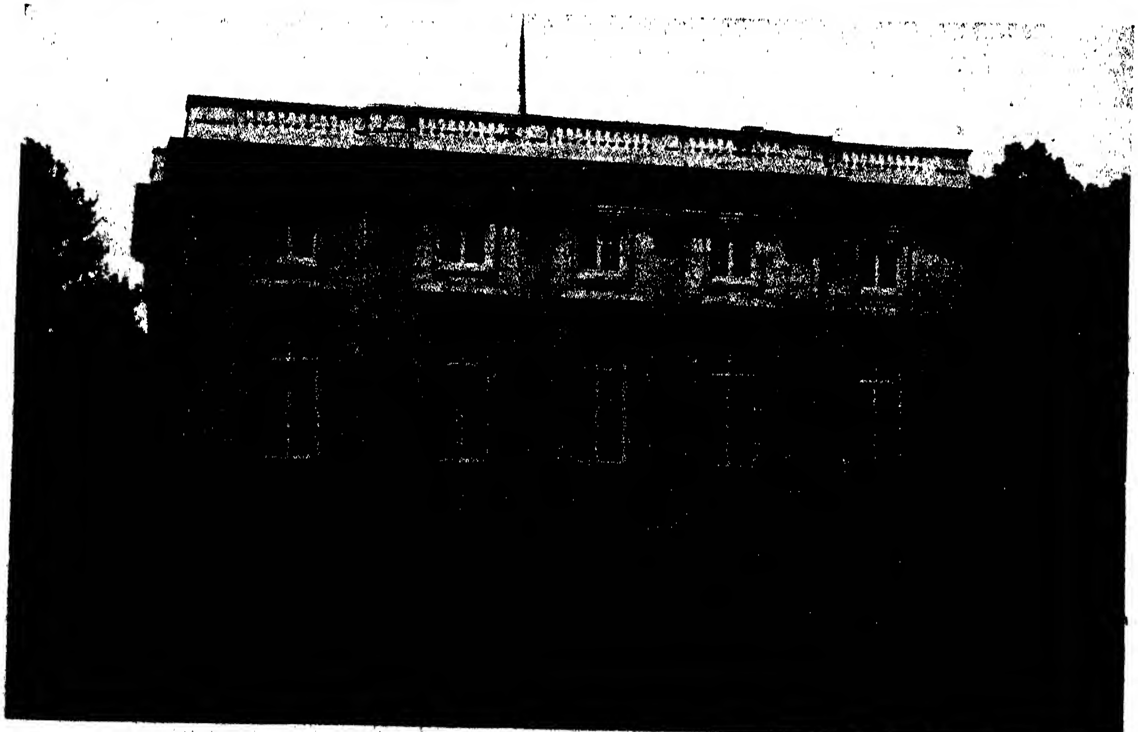


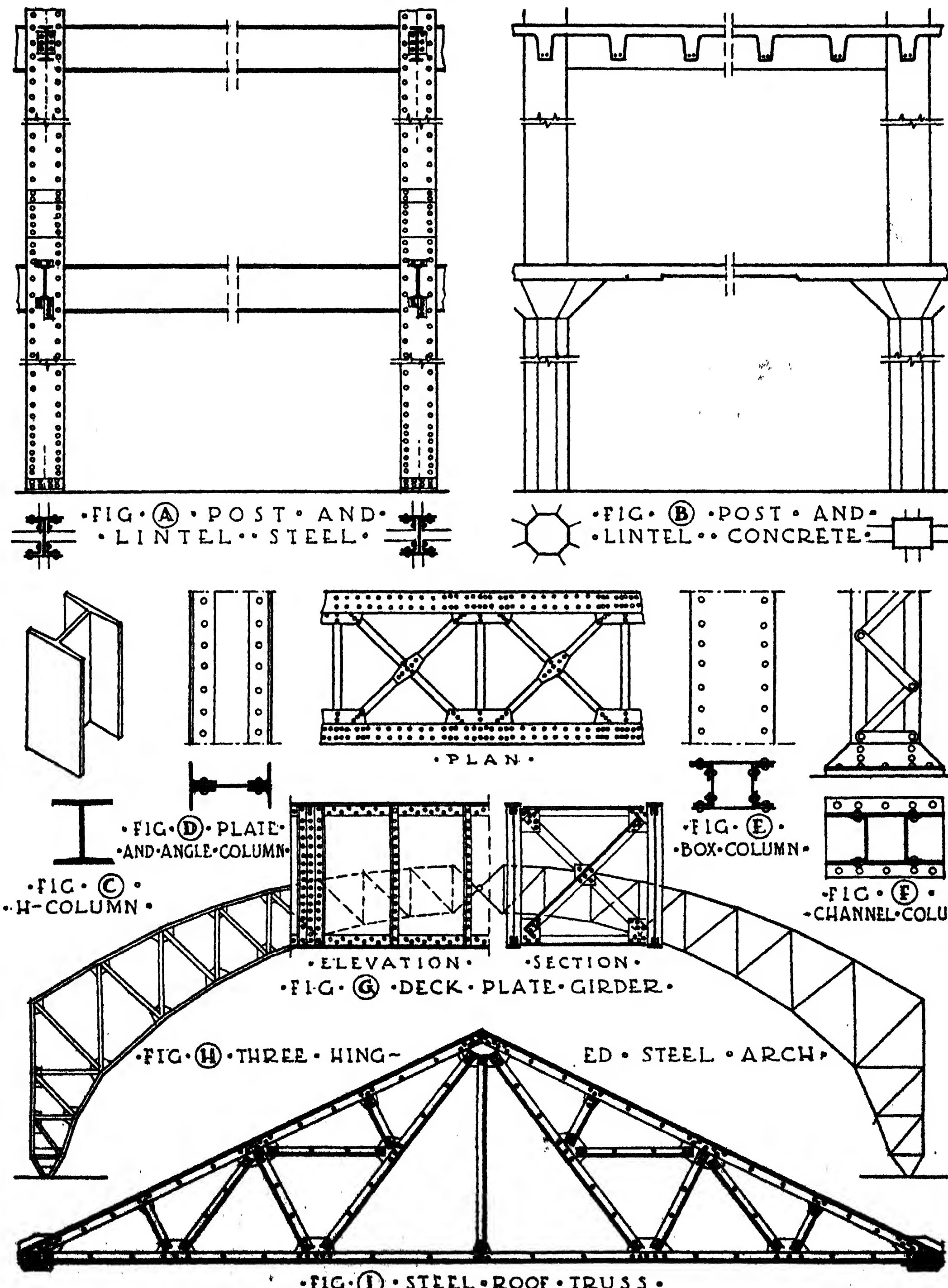
FIG. (A), above.—Palazzo Chieregati, Vicenza, by Palladio. Superimposed, structural and decorative Orders, graceful Ionic above sturdy Doric.
FIG. (B), below.—Petit Trianon, Versailles. Restrained type of French Renaissance. Rusticated basement walls. Upper floors included within one Order of decorative Corinthian pilasters.

CONTEMPORARY. The so-called periods of historic development began with the Egyptian and ended with the various manifestations of the Renaissance. After the termination of the Renaissance and until the present century, architecture consisted of a series of revivals or modifications of the different styles, some rather interesting and pleasing but none contributing much to the progress of architecture. Within the last few decades the discovery of new materials and the resulting new types of construction have given a significance to the contemporary movement which had been missing from architecture for several centuries. Unfortunately for those who would like to make prophecies, we are now living in the midst of this present trend. Histories should not be written until events have taken place. Architectural movements of the past have lasted for centuries—it is probable that decades may elapse before present tendencies are finally crystallized. It is possible only to indicate the direction of current movements.

As already pointed out, the column of the Renaissance was often employed merely as exterior treatment, losing much of its significance as an element of construction and becoming decorative in its application. When the Italian and French Renaissance came to this country in the nineteenth and first part of the twentieth centuries, they retained these same characteristics. The result was an architecture of façade arrangements rather than one of structural importance. This persisted even after the adoption of the steel skeleton, and the columns and pilasters which were hung on this metal framework were even more meaningless than during any previous period. The contemporary movement has finally effected a change in our conception of what constitutes the structural elements of modern architecture. The thick wall of masonry and the stone column, entablature, or arch were once regarded as the only means of supporting a weight and spanning a distance, We now realize that steel and concrete in the form of piers, beams, and arches constitute the real structure of the twentieth-century building. The steel members are usually concealed, in order to prevent corrosion, under sheaths of stone, brick, terra cotta, or glass, but the design often suggests the presence of the skeleton framework. Structural members now comprise fabricated vertical columns, horizontal girders, and curved trusses, as seen on pages 77 and 79, all designed to counteract the forces of tension and compression. We cannot escape completely from analogies, however, for the steel column and beam are but reflections of the post and lintel of the Greeks.

If the material used is concrete, we may again give the vertical and horizontal direction to our structural members in the form of the regularly spaced piers with their floor slabs and beams. Or the building may be constructed of monolithic concrete with the floors and walls cast together of one homogeneous material. However, one of the most satisfactory expressions of concrete seems to be found in the use of the parabolic arch and vault, as seen on page 188. These may reflect the spirit of Roman architecture, if we again care to make comparisons, because they may span great areas which were typical of the magnificent secular buildings of antiquity and employ a material which was used by the Romans.

Truth in design will be more quickly attained if the architect realizes that certain elements of a building are more important than others. As we have already indicated, and as we shall repeat from time to time, the structural members are fundamental whereas the decorative elements are secondary. Organic structure is more significant than surface ornament. Architecture may be (1) Basic. It may be directly related to the function of



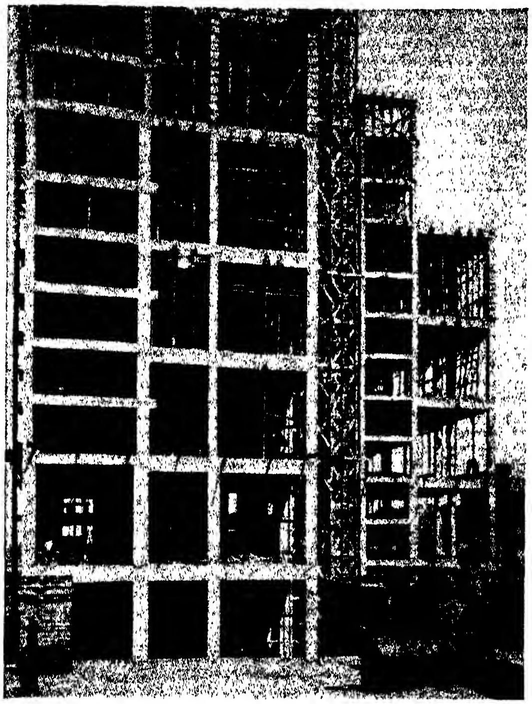
STRUCTURAL ELEMENTS

the building, growing out of necessary requirements. Architecture may be (2) APPLIED. It may consist of façade arrangements with little structural meaning. The architectural forms of the Greeks and mediaeval builders were basic. They began and ended with the simple post and lintel, or the pier and ribbed vault. The decoration did not detract from the structural qualities of these styles at their best. The architectural motifs of much of the Renaissance and of its revivals in this country were applied. The decorative effects secured by the use of columns, mouldings, and rustication were often more important than the scheme of construction or the function of the rooms behind the exteriors.

When Classical elements enter into the design of modern buildings they are usually modified to harmonize with the plain wall surfaces of contemporary architecture. The desire to express the efficiently trim lines of the machine age has changed the projections and contours of the mouldings. The proportions may be governed by the effect desired rather than by the rules of the Renaissance scholars. However, the designer should again keep in mind the fact that time has proved the worth of these historic examples and that changes should be made with a thorough knowledge of the principles of design. Contemporary columns, which are often entirely decorative, with steel supports carried down their hollow lengths, retain their cylindrical shapes, but new materials and the desire for new effects have modified their appearance (Fig. 81 A). Capitals and bases are reduced to simple surfaces and harmonize with the veneers of marble, glass, and metal with which the building may be enclosed. In fact, the column is fortunate to preserve its identity in any form. Often it becomes a pier or merges completely with the wall (Fig. 109 D), the conventionalized lines of its surface membering with the other structural and decorative lines of the building.

All this is the outgrowth of the break—either partial or complete—which the contemporary movement has made with many of the traditional forms of the past. Those which hinder progress should be abandoned; those which assist progress should be retained and modified where necessary to express their modern use. The contemporary movement in architecture is the result of two motivating influences which may be mentioned at this point. The first is the recognition that the romantic flavor of the revivals of the historic styles does not reflect the spirit of modern life. The architecture of the nineteenth century was one of sentiment—everyone wanted to live in a picturesque cottage of mediaeval England furnished with ornate and meaningless belongings. This attitude of mind is still delaying progress in domestic design and may prevent the home from being as efficient in its operation as some other types of buildings. The second and more important stimulating factor which is partly responsible for the rapid growth of this present movement is the desire to use new materials in an honest manner or to use old materials in a new way. A true expression of steel, concrete, metals, and glass has led to a type of design which has revolutionized our previous conceptions of beauty and utility. Contemporary architecture is thus supplied with a stimulating impulse and seemingly with unlimited resources for its realization.

This modern movement has been encouraged and influenced by a similar reflection in the allied arts of painting, sculpture, and literature. Upon these forms of expression there are not imposed the same practical limitations of cost, zoning, and human relations that are to be found in architecture. The creative urge is paramount in the artist, sculptor,



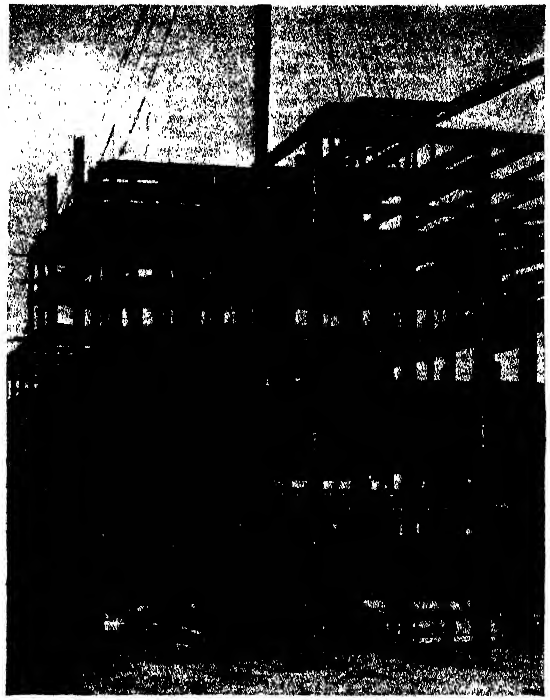


Fig. (a), above.—Structural system of a modern building. Concrete. Post and lintel to carry enveloping shell.

Fig. (b), above.—Steel skeleton, the sinews of contemporary architecture. Post and lintel: simple angularity.

Fig. (c), below.—Union Terminal, Cincinnati. The romance of steel; curved trusses flung daringly across large spaces. See Fig. 83 C.

or author, and their inclinations may develop unhampered by so many external restrictions. These arts have moved in the same direction as architecture. Literature has been stripped of the flowery, inverted language of England of the nineteenth century. Sculpture has been reduced to a few simple planes and has a quality which is truly emotional instead of simply sentimental. Painting has undergone a complete change, exhibiting forms which are often not understood by the layman but which encourage an attempt to appreciate the meaning of geometrical patterns. Conventionalization, rather than realism, is the outstanding new characteristic of the arts. These changes have become firmly entrenched in the consciousness of the people, and we are well on the way toward a new epoch in all forms of creative endeavor.

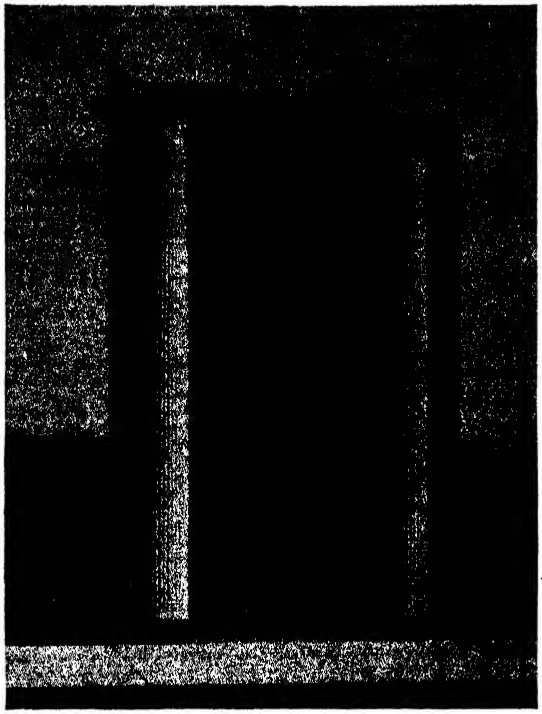
Modernism should not be a studied and deliberate attempt to do something different. It must be the outgrowth of new materials appreciated and new conditions realized. The business and social life of the nation today is unlike that of Europe centuries ago. Steel and concrete require a treatment different from that of stone. When the designer is working with any style of architecture or material of construction, he should approach the problem with a clear understanding of the purpose of the elements which are to be used. Style should really develop from materials. It should transcend the historic treatments and reveal the individuality of the designer and the characteristics of stone, brick, metal, and glass.

The contemporary movement is progressing along three courses which are closely related yet at the same time are widely separated. It is often difficult to tell where one leaves off and the other begins, although there is a marked difference between the extremes of the first and the last. The resulting development will probably be an architecture embodying the best qualities of each. What twentieth-century architecture will present to the succeeding century can only be surmised.

If we omit from this consideration the Traditional Eclectics, or those individuals who may be clinging tenaciously to all of the restricting forms of the styles, there still remain for consideration those who have already been called the Traditional Modernist and the Non-Traditional Modernist. It must be recognized that these terms are quite arbitrarily chosen, and that this or any other attempt at classification may soon be lost in the confusion of the past as progress is made and as there emerges from this state of flux an architecture which is truly typical of this modern age. These two groups of modernists use the structural elements in their own peculiar ways, and these uses are our immediate concern.

The Traditional Modernist approaches the solution of a problem by way of a primary consideration of function but with the reservation that a historic style must be used as the basis for the design. His wall treatment may be reminiscent of the Gothic, as in Fig. 81 B; his columns and entablatures may reflect the details and spirit of the Greek (Fig. 81 A). As a rule, the requirements of the building dictate the necessary modifications of stylistic examples.

If, at the risk of being too exact, we attempt further to classify those who belong to the Non-Traditional movement, we might group them as Decorative Functionalists and Pure Functionalists, depending upon the emphasis they place upon function in architectural design. The Decorative Functionalist begins with the influence of function and materials but he does not end there. He believes that decoration is essential, and that this



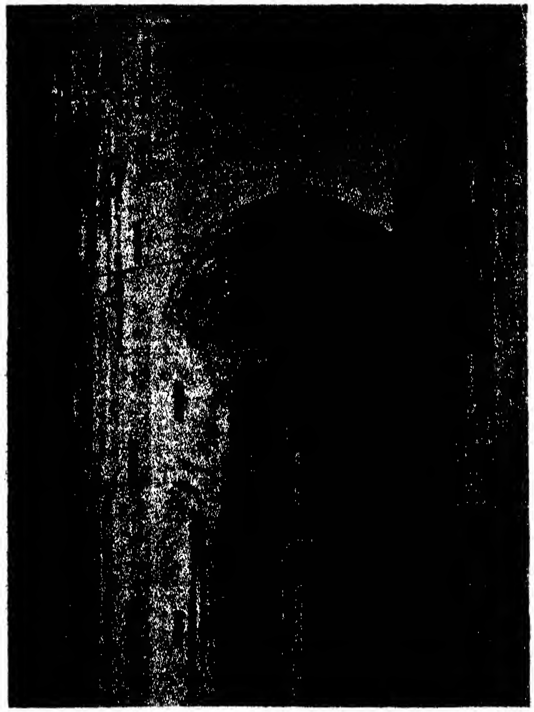
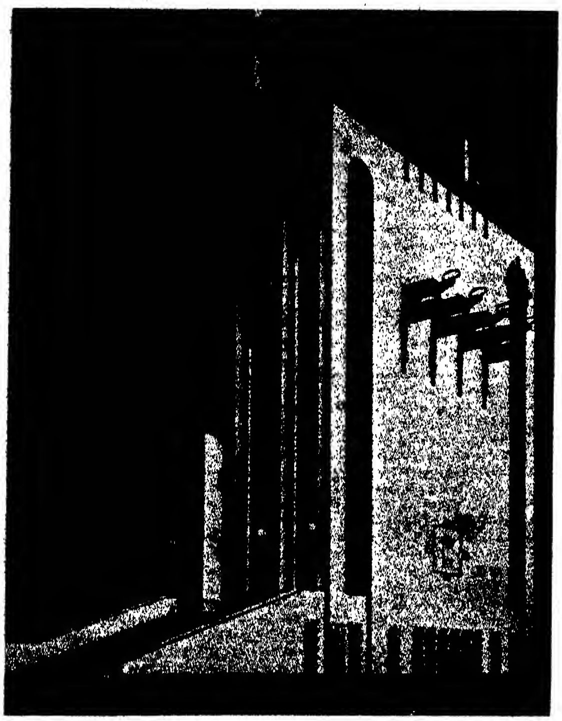


FIG. (A), above.—First National Bank, Hamilton, Ohio. Classical elements treated with freedom of interpretation. Graceful.

FIG. (B), above.—Masonic Temple, Scranton, Pa. Modified use of traditional Gothic forms. Limestone.

FIG. (C), below.—High School Auditorium, Long Island. Simplicity of Doric translated into brick and cast stone. Note simplified entablature.



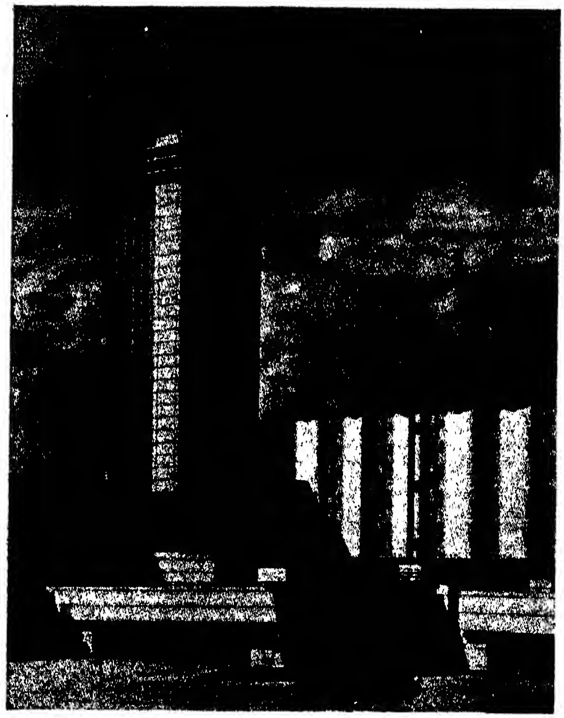
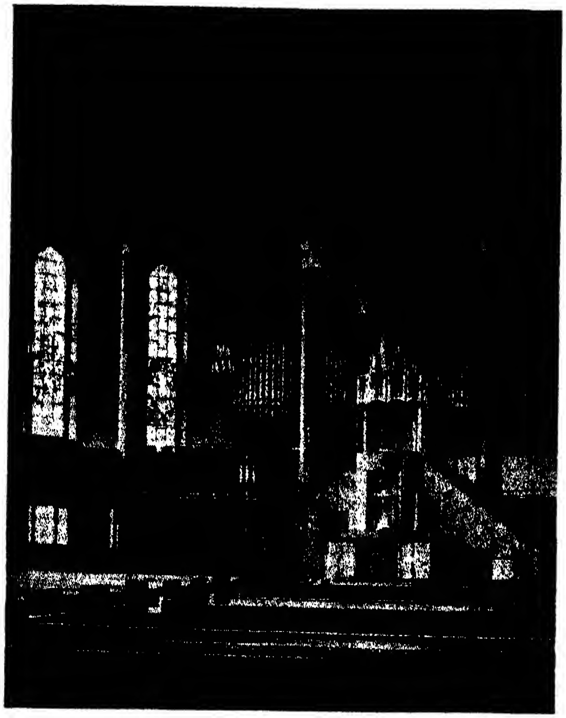
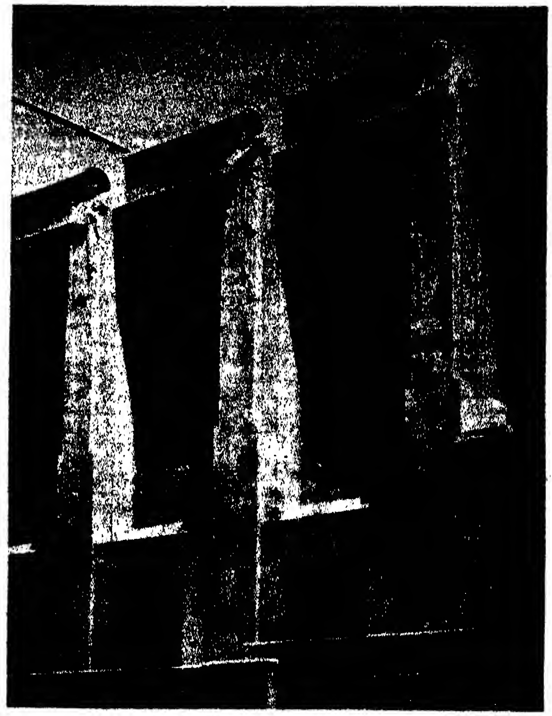


FIG. (A), above.—Church, Frankfurt, Germany. Style and structure growing from materials. Concrete. Simplicity.

FIG. (B), above.—Hall of Science, Chicago. Light steel structure carrying veneer of wall board. New materials expressed.

FIG. (C), below.—M. E. Church, Tulsa. Gothic verticality translated into new motifs; functionalism plus beauty. Limestone and terra cotta.





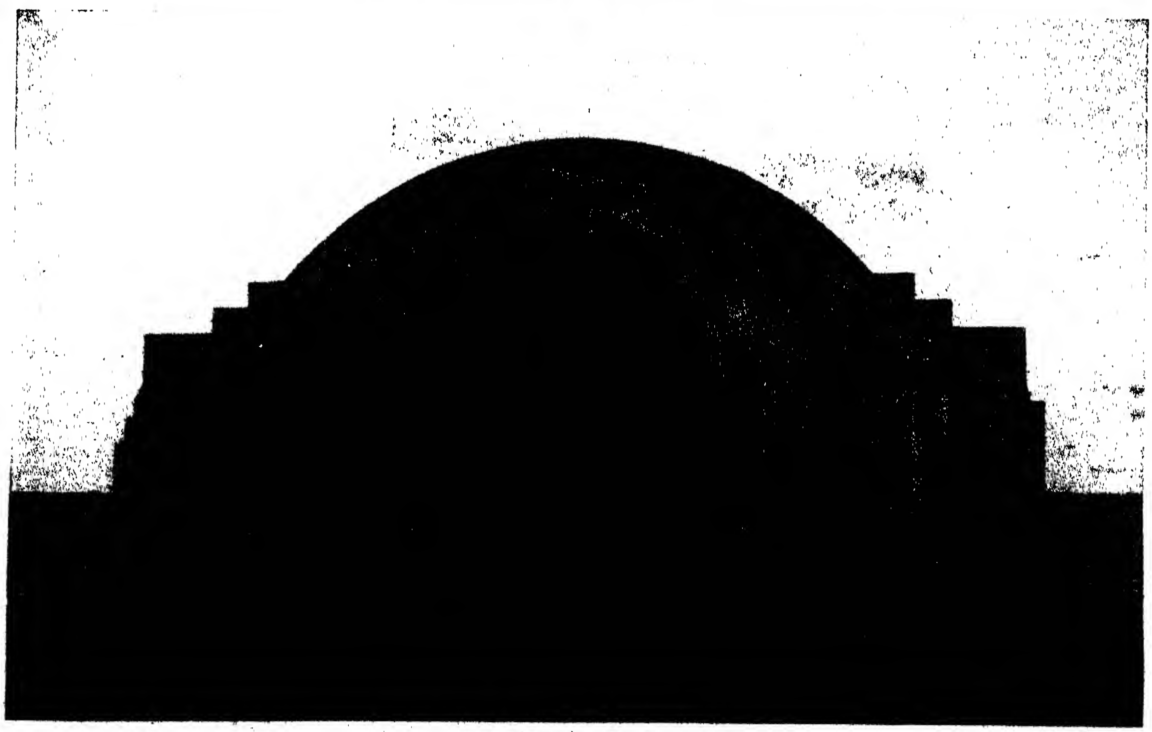


FIG. (A), above.—Church, Berlin. Slender, non-stylistic piers supporting faceted ceiling. See Fig. 275 D.

FIG. (B), above.—Los Angeles Public Library. Concrete cast into walls and piers. Beauty by mass and proportions.

FIG. (C), below.—Union Terminal, Cincinnati. The steel skeleton of Fig. 63 C covered with a limestone veneer. The arch.

decoration should grow from the structure in the form of vertical and horizontal elements, together with textures, colors, carving, and the rhythmic arrangement of accents. His structural elements will develop from the use of the building expressed in modern materials, as illustrated on page 82, not from styles of the past. The Decorative Functionalist believes in beauty in architecture, feeling that the latter is an art as well as a science

The Pure Functionalist approaches architecture through science. He believes in interpreting the machine age in a literal manner. Since the necessities, conveniences, and comforts of modern life are made possible by the machine, why should our buildings not express the precision of machinery? Apparently, for him, the function of the building alone governs its appearance. Economy of cost, speed in erection, efficiency of operation —all desirable in any architecture—are combined with the newest materials to produce a structure in which utility is paramount. The steel or concrete column and the simple veneered wall are his structural units. The enthusiasm of the Pure Functionalist often results in a simplification reduced to the barest essentials (Fig. 84 A). If the masses of these buildings are satisfactory and if there is a pleasing relation between the solids and voids, the architecture may be interesting and invigorating. If stark simplicity is maintained, it may be at the cost of beauty. The promise of the extreme functionalist movement appears to be in the influence it may have upon the more conservative of the modern approaches.

Regardless of the inclinations of the student or the architect, it is not possible to escape from contact with the basic elements of architecture or from the fundamental principles of design. Architecture must be based upon the correct use of structural members; of the post and lintel (and its later cousin, the cantilever), and of the round, segmental, pointed, and parabolic arch. As these are truthfully interpreted in building materials, style will grow into character expressing function and purpose in a logical and proper manner.

FIG. (A).—School, Stuttgart, Germany. Functionalism reducing architecture to its essentials; little applied decoration.

Protective Elements

In spite of the fact that most architectural structures and their constituent elements are protective in their use, certain of these elements serve more directly than others in the capacity of protection or shelter. These are the ones whose chief function is to cover, and this immediately includes roofs, domes, ceilings, and vaults. Another aspect of protection is represented by the use of the balustrade or parapet, which, even though often decorative, is designed primarily to prevent accidents which may come from sudden changes in grade or level. Roofs and domes are more fundamental than the other elements in this classification. Together with walls they enclose space, and simple architecture might begin and end with the combination of these forms. Roofs and domes are external coverings; vaults and ceilings only span the internal units of the plan under the protection of those first mentioned. Let us, therefore, proceed inward—by way of the exterior to the interior.

ROOFS should develop from the plan in a logical and straightforward manner. There are certain types of roofs which are fundamental, as on page 87, and from these simple shapes the more complex are developed. Each elementary plan has one or two accompanying methods of covering which are the most expressive of these particular areas and which should generally be used with them. The roof should agree in character with the building. It may be simple or ornate, formal or picturesque, utilitarian or decorative. If the historic styles are studied, it is seen that the roofs of the Classical, Romanesque, and the Italian Renaissance (Fig. 92 A) are comparatively flat and simple, playing little part in the composition of the buildings. On the other hand, the structures of the French, Flemish, and German Renaissance have roofs which are high and steep, and often decorative in their use of dormers and crestings. The Gothic cathedrals were covered with simple pitched roofs which were important on account of their steepness and the addition of the flèche, or spire, of the French examples. As the plans of the secular buildings of the Middle Ages grew in complexity, the roofs became more informal in their groupings and imparted picturesque outlines to the castles and manor houses of England and the continent (Fig. 92 B). The modern attitude toward the roof favors the simple and direct type, with a tendency toward flatness in order to provide terraces for relaxation and recreation, as shown in Fig. 92 D.

The flat roof is the simplest kind and (for wooden construction) presupposes a light load with short spans, or permits the use of heavy loads with columns and beams of steel or reinforced concrete. The flat roof is not for the spanning of large, uninterrupted areas. For these, the curved or pitched roof should be reserved. The pitched roof with two slopes meeting at a ridge parallel to the long axis of the building and with triangular gables at the ends is another elementary type, as shown in Fig. 87 D. The hipped, or four-sloped, covering is the next step in the development of the roof. This consists of slopes which should be equal to each other in pitch, forming hips, or intersections bisecting the corners, and terminating in a ridge or apex at the top, depending upon the shape of the plan (Fig. 87 E). The mansard roof of the French Renaissance, which has all sides divided into two slopes with the lower one steeper than the upper, is an ornate and decorative type. Except for its reflection in the gambrel roof, Fig. 87 B, which is popularly associated with the Dutch Colonial, it has little place in modern design. The conical roof over a circular plan, as in Fig. 87 C, and the roof which follows the upper profile of a curved truss offer examples of other variations in common use.

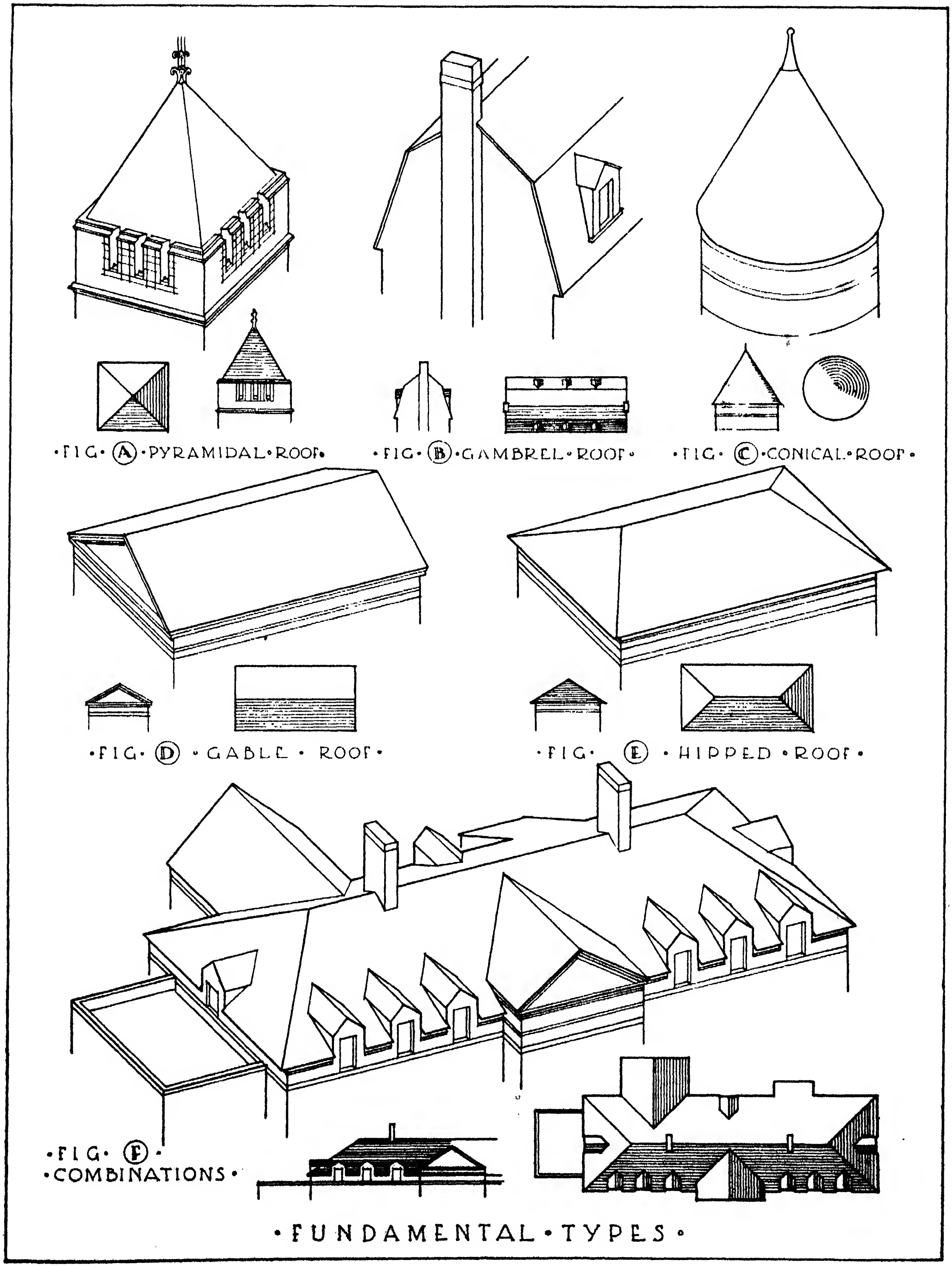
In office practice considerable attention is given to the roofing of a building because of the practical requirements connected with this feature of a structure. In the school problem a study of the roof is often neglected, and the plan is thus improperly covered. This is usually due to a lack of understanding of the simple rules of roofing or of an unwillingness to make roof plans and clay models which will show the relation of the various parts of the building. Often when difficulty is encountered in roofing a plan, it is the fault of the plan itself which may be composed of awkward shapes that do not lend themselves to a logical scheme of enclosing. If the student persists in retaining this kind of a plan, the roof will have slopes which differ too violently in pitch, flat decks which hide difficult intersections, and valleys which form pockets for rain, snow, and leaves. In order successfully to roof a building which has a plan composed of units of varying sizes, shapes, and projections, it is necessary that a thorough study be made of these features in plan and perspective, and of the intersections of the various curved and straight planes which form the different slopes. A typical example may be seen in Fig. 87 F.

DOMES represent an elaborate and highly specialized type of roof or covering. The dome grows most logically from a circular plan, as it is a comparatively simple matter to set a hemisphere upon the open end of a cylinder so that the perimeters of their sections coincide. However, the dome is often used to cover a square plan, but this involves the additional task of developing a surface at the corners of the plan to serve as a transition between the round shape of the dome and the angular squareness of the supporting element. This is accomplished, as in Figs. 89 E and 93 D, by the aid of the pendentive, which is the triangular, curved section of vaulting uniting the two elements at the upper point of the reentrant angles of the lower member.

Domes vary in their contour or profile—they may be high or low, pointed or hemispherical. The flat, saucer-like dome was common with the Romans and the builders of the Byzantine churches in Constantinople, as in Fig. 89 A, which represents a type based upon the Pantheon in Rome. (See Fig. 29 B.) Concrete and brick faced with marble were used, and the resulting characters were similar in both styles. These domes were heavy, massive, and structural. Although they were not designed for effect, they were conspicuous on account of their size. The thrusts were counteracted by the thick walls of the Roman and the adjoining masses and half domes of the Byzantine examples.

The domes of the Romanesque period were often pointed, or were segmental upon the interior with a conical roof upon the exterior. The example in Fig. 89 B is based upon the dome over the crossing of the church of S. Michele, Pavia.

Renaissance domes were often more decorative and sometimes less structural than the earlier types. They were usually in the form of hemispheres, slightly stilted to prevent the optical illusion of their being depressed, and frequently were supported on cylindrical drums or bases. In order that they might have the necessary accent and interest, they were terminated by lanterns or cupolas which were smaller reflections of the domes themselves. If the profiles of Renaissance domes are studied, it will be seen that the thrust of the structural forces is in an outward direction and is not parallel to the supporting walls of the drum. The introduction of the drum made it more difficult to adjust the stresses than in the saucer type and necessitated the use of metal bands in

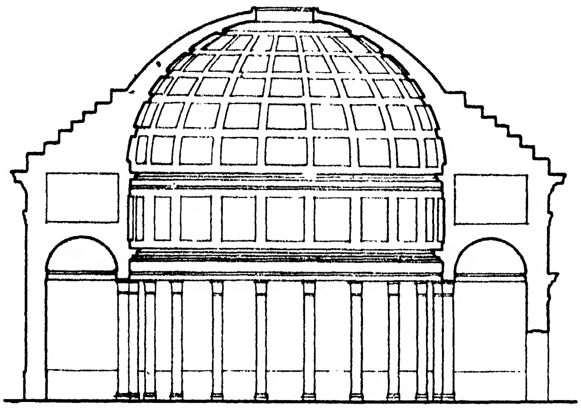

·FIG· (A) ·PYRAMIDAL·ROOF·
·FIG· (B) ·GAMBREL·ROOF·
·FIG· (C) ·CONICAL·ROOF·
·FIG· (D) · GABLE · ROOF·
·FIG· (E) · HIPPED ·ROOF·
·FIG· (F) ·
·COMBINATIONS·
·FUNDAMENTAL·TYPES·

the masonry or the buttressing effect of external columns. The interior and exterior profiles of a dome may tend to be parallel to each other, which results in one shell, as in the dome of S. Peter, Rome, Fig. 89 C, or they may be designed for an effect upon the inside which is quite different from that on the outside. This makes two or more shells necessary, as are shown in Fig. 89 D, which is based upon the dome of The Invalides, Paris. Domes are usually reserved for buildings which tend to be monumental or decoratively ornate in character.

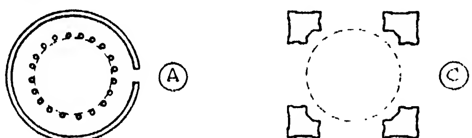
CEILINGS are either flat or slightly curved; and are plain, beamed, or coffered—depending upon the material and the style of architecture used. With the flat treatment, the transition between the walls and the ceiling is often effected by the use of a moulded cornice, and the ceiling itself may be painted, or decorated with ornament in low relief or with simple, shallow panels (Fig. 94 A). Plaster usually forms the material for the flat ceiling. The beamed ceiling is typical of many of the domestic buildings of the Gothic and of the early structures of the French and Italian Renaissance. Usually the larger beams of wood span the shorter dimension of the room with smaller beams membering with them at right angles. In the mediaeval examples the dark wood of the structural members and the areas between, relieved to some extent by touches of color, contributed to the somber interiors; in the Renaissance ceilings the entire composition received richly tinted decorations and carvings. The open timber roofs of England (see Fig. 161 A) offer a further variation of the beamed treatment of the Middle Ages. The coffered ceiling is another type which was popular during the Renaissance in Europe and its counterpart in this country. Here the ceiling was divided into deep compartments which were of any desired regular shape and which usually were decorated with painted scenes or carved ornament. Often the details of the coffers were similar to those used in Renaissance cornices—egg and dart, and bead and reel mouldings, etc.—and received a liberal application of color as shown in Fig. 94 B. The materials used were commonly wood, plaster, and composition.

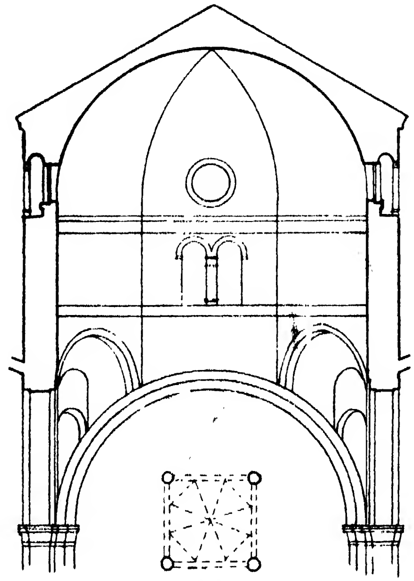
VAULTING holds the same relation to the arch that the flat ceiling holds to the lintel—the vault may be developed from the arch, and lintels placed side by side will produce a ceiling. The vault indicates the necessity or desire to span a space with a curved form. This may be because of the large distance to be covered or it may be due to the effect desired. Vaults vary greatly in their character and form—from the simple barrel vault of the Romans to the fan vault of the late Gothic (Fig. 95 C). They may be divided according to whether they are monolithic, of reinforced concrete; or non-monolithic, of stone, brick, or tile. The latter group may be subdivided into two types depending upon their methods of construction. One will be composed of vaults without ribs, in which there tends to be a uniformity in thickness and in the distribution of the weights and thrusts, as in the simple barrel or domical vault. The other group will include those vaults with ribs in which the thrusts are concentrated on isolated piers at the corners of the vaulting compartment, such as the cross vaults of the Romanesque and Gothic styles.

The barrel vault is the simplest and the earliest type with which we will come in contact, as shown in Fig. 91 A. It is a continuous vault and may be semicircular, segmental, semi-elliptical, or parabolic in section. It readily adapts itself to long, narrow rooms or to corridors (Fig. 95 D). It formerly indicated a heavy type of masonry construction with the vault and walls approaching similarity in treatment throughout. The next step in

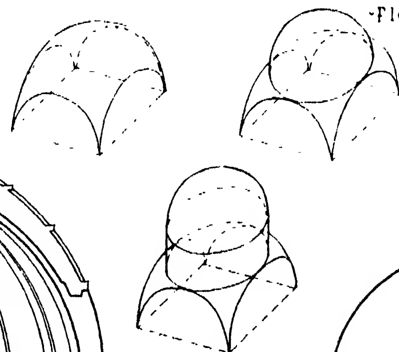


•FIG• Ⓐ • CLASSICAL•TYPE • OF • DOME•

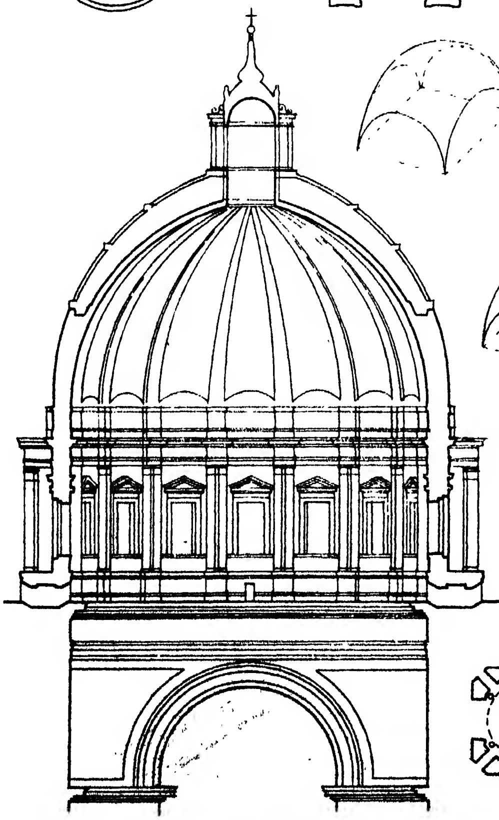


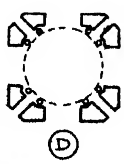


•FIG• Ⓑ • •SEGMENTAL• •DOME•

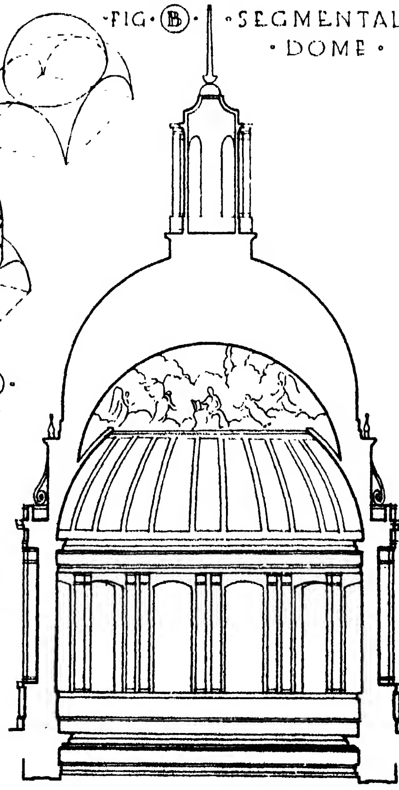


•FIG• Ⓔ• •TYPES•





•FIG• Ⓒ•DOME•WITH•CONCENTRIC•SHELLS•



•FIG• Ⓓ •DOME•WITH•TRIPLE•SHELL•

the development of vaulting was the introduction of simple intersections, which offered no difficult problems as long as the penetrations were smaller or no larger than the barrel vault itself. The most interesting solution of the vault, however, came with the covering of the square or oblong bay. The Romanesque vault was arrived at by the use of two semicircular barrel vaults of equal height and span, as in the isometric representation in Fig. 91 C. The four elevations thus created consisted of four round arches of similar size. The groins or intersecting ribs in plan were the diagonals of the square. If the plan was not square, the situation was somewhat different. In order to keep the height of the vaulted surfaces the same, it was necessary to stilt, or raise, the arches which spanned the shorter sides, as in Fig. 91 B; or if the former were to retain their semicircular shape, it was necessary to make the arches on the longer sides elliptical. If these expedients were not desirable, the arches spanning the shorter dimensions were pointed in order to make their heights equal to the arches on the longer sides, the latter remaining semicircular, as shown in Fig. 91 D. Later, all the arches were pointed for structural reasons and for the sake of uniformity of treatment. The degree of pointing depended upon the construction and upon the phase of Gothic architecture which was then prevalent. The profile of the pointed arch coincides, more nearly than that of any other shown, with the direction of the thrust of a vaulting system. This made possible the vertical quality of the architecture of the Middle Ages. (See Figs. 91 E, 95 B, 69 B, 69 C.) The longer sides of the oblong bays were sometimes divided into two parts, which produced the sexpartite vault, and added the intermediate rib to the already existing transverse, diagonal, and wall ribs. These ribs and their carved decorations imparted to Gothic vaulting the complexity and richness for which it is noted. The arches themselves and the ribs at the intersections of the vaulting surfaces constituted the structural members; the thin stone panels supported by the ribs completed the enclosure and the construction of the Gothic vault.

BALUSTRADES are so closely related to the Orders of Architecture that it might be more logical to discuss them in that connection. However, they do not contribute to the structural scheme of a building and must be either protective or decorative. They may serve both purposes, but their primary function is that of protection. The Classical or Renaissance balustrade or parapet takes on the character of the pedestal of the Order with which it is used. It was developed from this pedestal and has the same members; base, die, and cap. The simplest kind of balustrade, one which perhaps should not correctly be called by that name, consists of a continuation of the pedestal resulting in a solid motif with no perforations. It might more logically be designated as the parapet.

A true balustrade must consist of balusters supporting a top rail. In the more typical examples, these turned balusters are spaced in a regular manner between dies and uncut sections. These unmoulded members give strength and stability to the balustrade and should be so located that an effect of security is obtained. They also impart an added interest by means of their contrasting accents. The balusters themselves conform to the typical examples indicated in Fig. 73 C and vary in proportions and in richness of detail according to the architectural treatment with which they are used. Balustrades should be correctly related to the human figure, since they, together with steps and doors, give a definite indication of the scale of a building. (See page 248.) A balustrade two feet high and one five feet high would, respectively, minimize and exaggerate the necessity for protection.

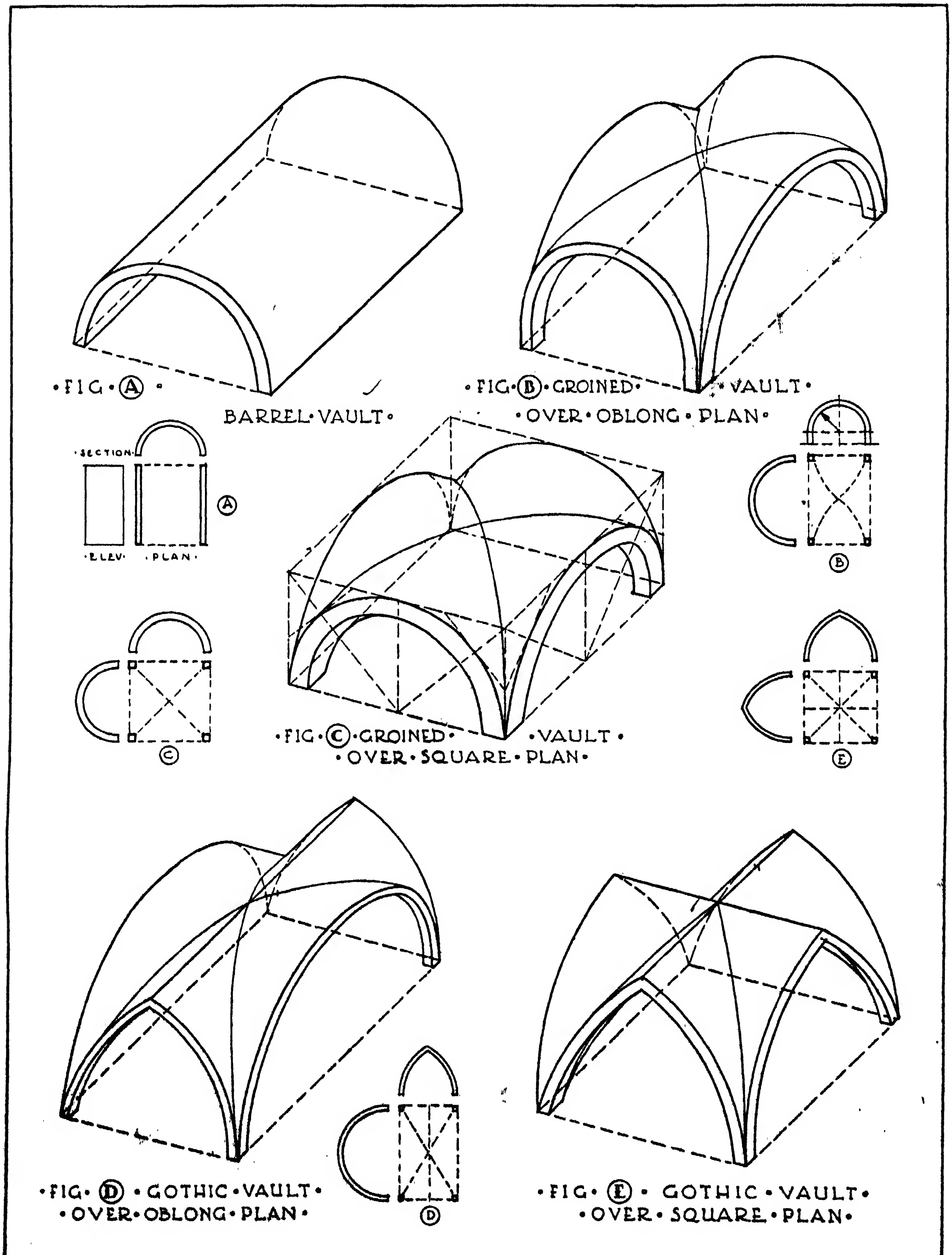
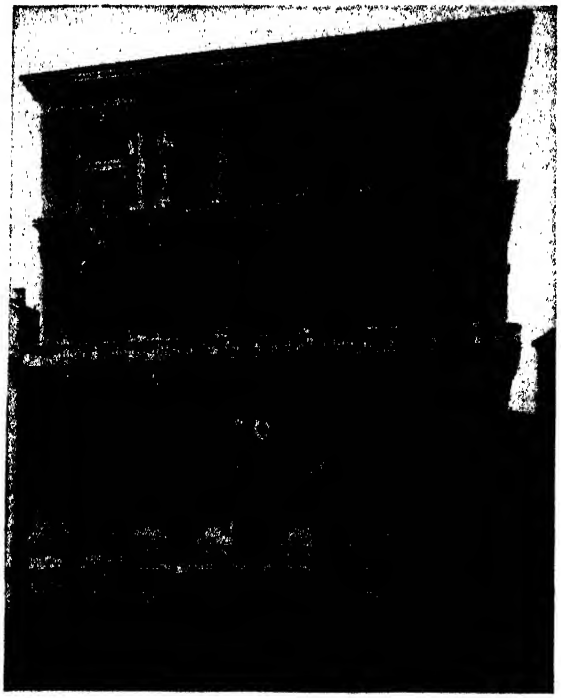
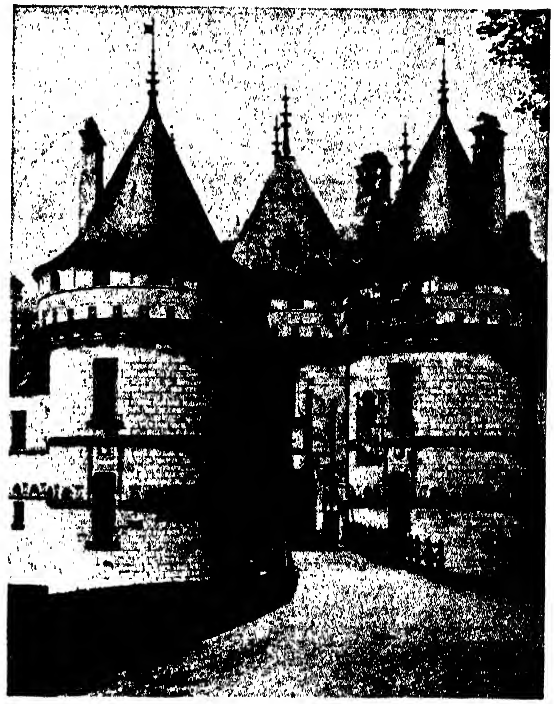
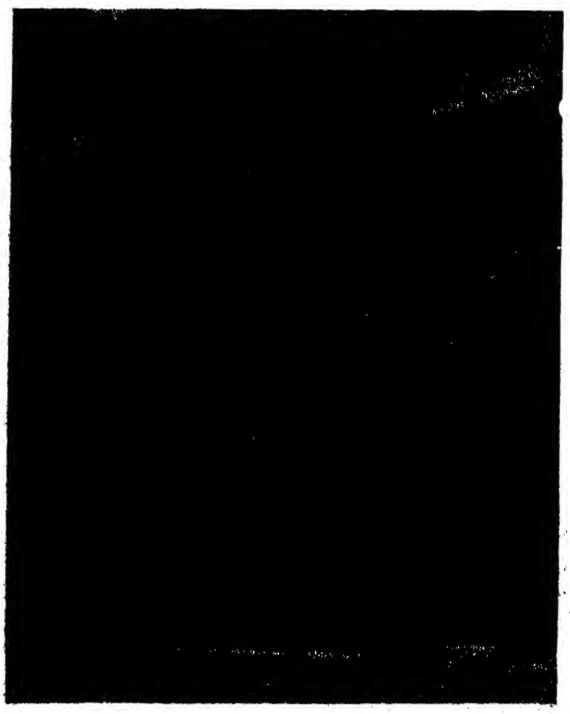


FIG. A. BARREL VAULT.
SECTION
ELEV.
PLAN.
A
FIG. B. GROINED VAULT. OVER OBLONG PLAN.
B
FIG. C. GROINED VAULT. OVER SQUARE PLAN.
C
E
FIG. D. GOTHIC VAULT. OVER OBLONG PLAN.
D
FIG. E. GOTHIC VAULT. OVER SQUARE PLAN.







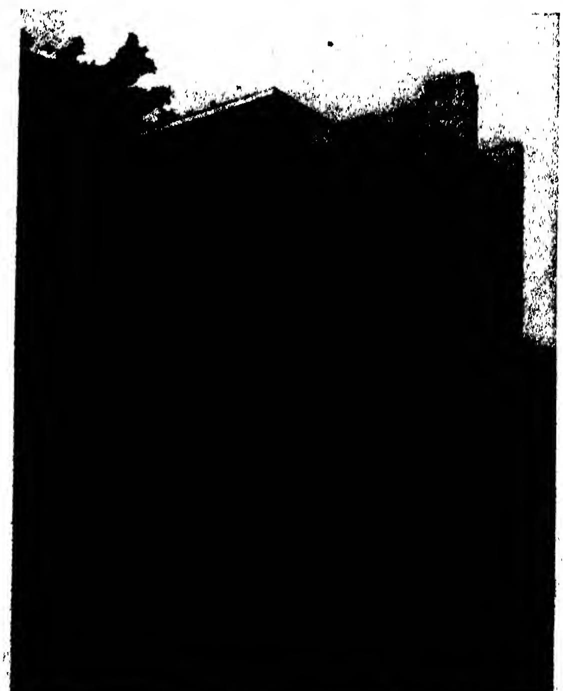
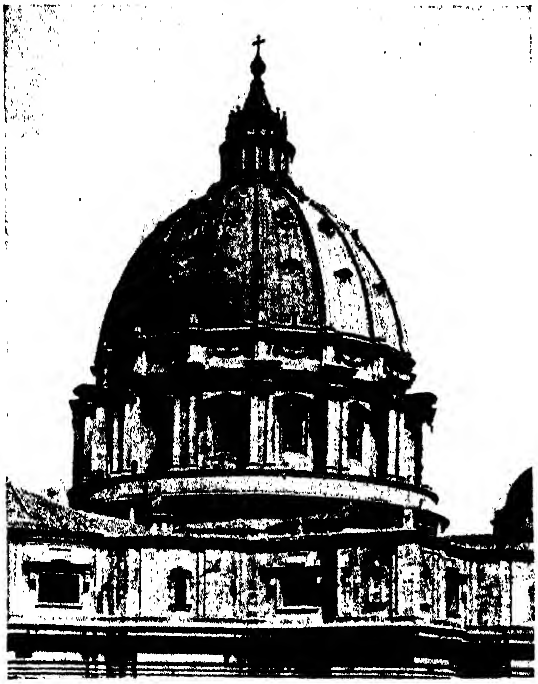


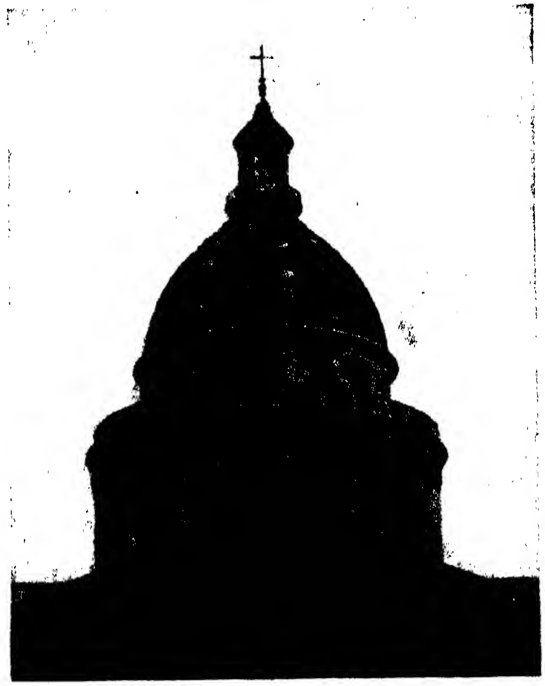
FIG. (A), above.—Palazzo Grimani, Venice. Showing the unimportance of the roof in the design of Italian Renaissance palaces.

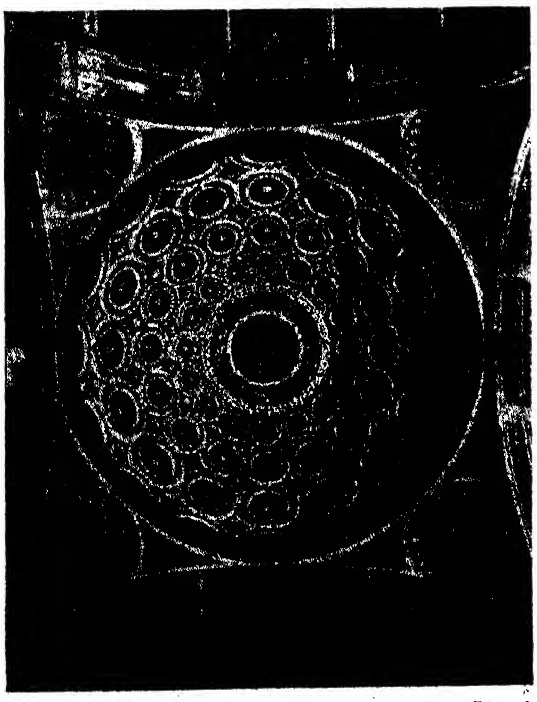
FIG. (C), below.—Merton College, Oxford. Steep mediaeval type of roof, illustrating use of dormers.

FIG. (B), above.—Château de Chaumont. Picturesque grouping of geometric shapes to express the plan.

FIG. (D), below.—House, Rue Mallet-Stevens, Paris. Here the roof has become a terrace for rest and recreation.







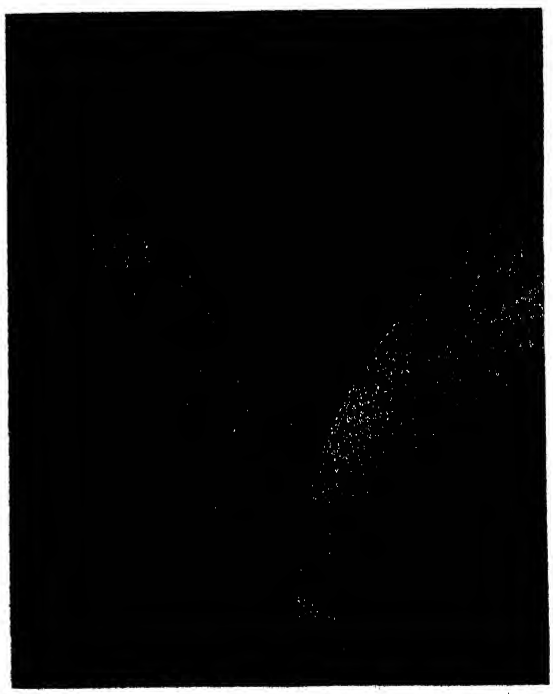
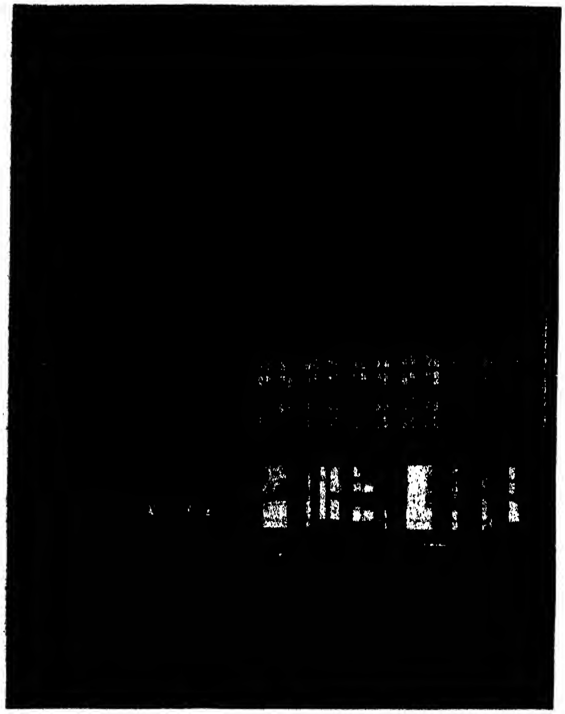


FIG. (A), above.—S. Peter, Rome. Showing buttressing effect of columns around drum. See Fig. 89 C.

FIG. (C), below.—Pazzi Chapel, Florence. Looking up into coffered dome on pendentives. Polychrome terra cotta.

FIG. (B), above.—The Panthéon, Paris. Slender, graceful type with a triple shell. See Fig. 89 D.

FIG. (D), below.—Public Library, Los Angeles, showing a pendentive which connects angular and circular forms.



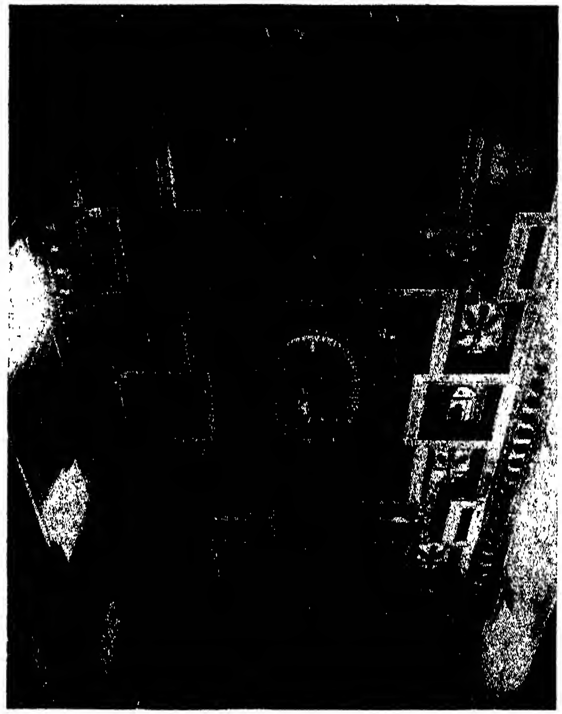
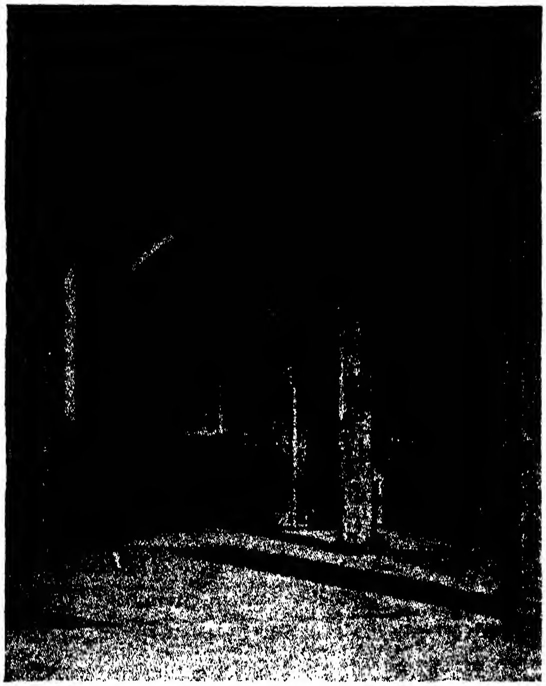
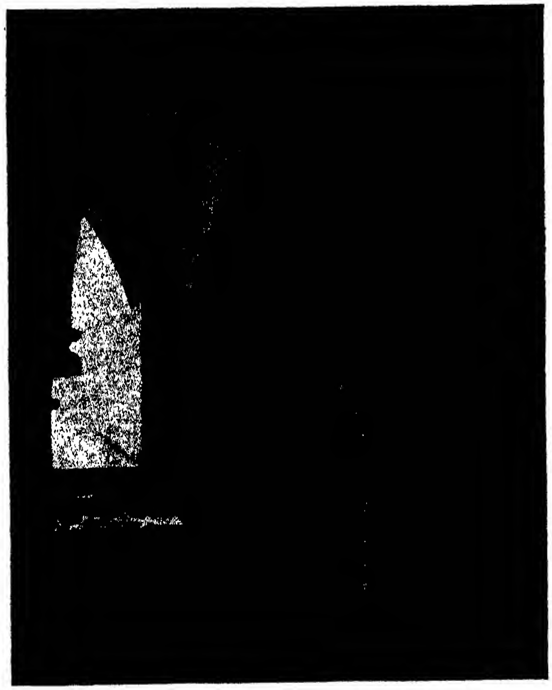


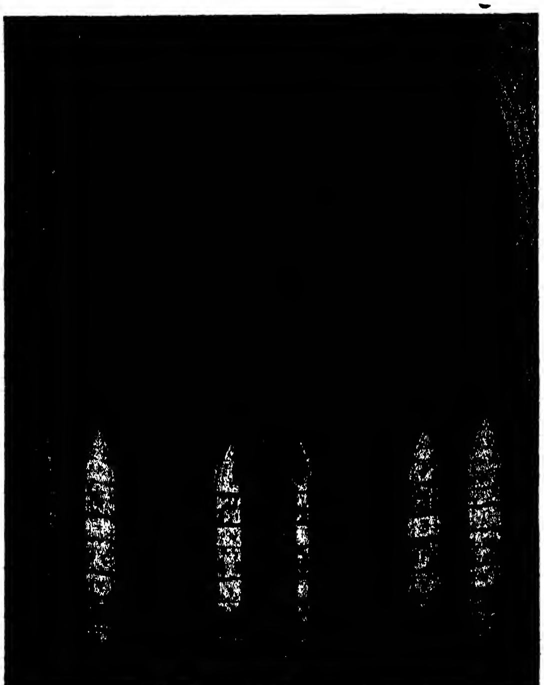
FIG. (A), above.—Lobby of Telephone Building, San Francisco. A flat, decorated ceiling with black marble walls.

FIG. (B), above.—S. Marcello, Rome. Richly painted and carved coffered ceiling. Typical Renaissance treatment.

FIG. (C), below.—Los Angeles Public Library. Beamed ceiling with painted decoration. Note relation of beams.







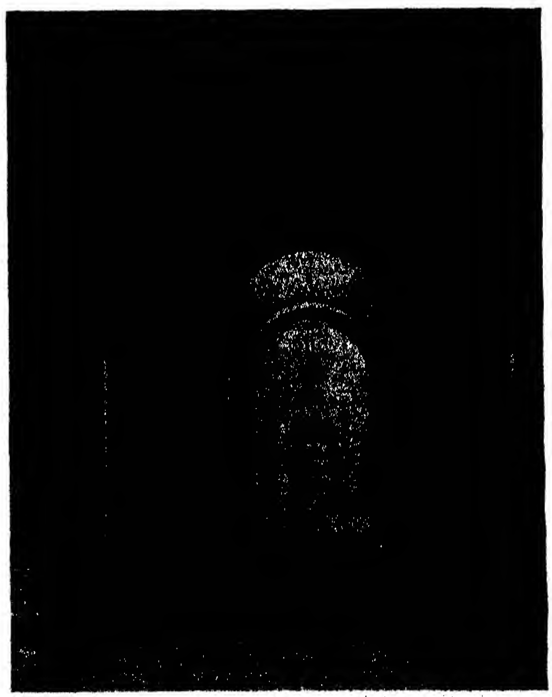


FIG. (A), above.—Palazzo Vecchio, Florence. Groined vault with ribs supported on heavy piers.

FIG. (C), below.—Chapter House, Lincoln. Fan vaulting supported on a central shaft. Gothic. Intricate gracefulness.

FIG. (B), above.—Crypt, Wells Cathedral. Gothic vaulting of a robust type; simple pointed arches.

FIG. (D), below.—Palazzo Farnese, Rome. Entrance to court. Paneled barrel vault carried on Doric columns. Renaissance.

Circulatory Elements

After the walls of a building are up and the floors and roof are in place, the structure is enclosed, but it could not function if a consideration of the elements dealing with circulation had been omitted. This involves not only the circulation of the individual from place to place but also the movement of light and air throughout the building. The horizontal and vertical elements of circulation are as follows: (1) Openings, to permit passage from the exterior to the interior or from one room to another; (2) corridors, to allow travel from one part of the building to another; and (3) stairs, ramps, and elevators which make possible the necessary communication between the various floors. All these elements vary with the periods during which they were developed, but they have structural and decorative members in common.

OPENINGS. Doors and windows may be divided according to the various historic styles, or by characteristics of construction and details which may be conspicuous throughout several periods. Openings may have flat lintels, if the distance to be spanned is small, or arched heads, if the distance is greater or if an appearance different from that imparted by the lintel is desired. Greek openings are identified by the use of the lintel, Roman by the lintel and the arch, Romanesque by the round arch, Gothic by the pointed arch, and Renaissance by the lintel and the round arch. Contemporary openings make use of all, depending upon the material employed and the effect desired.

Classical Openings. The examples on page 97 show two Greek and two Roman openings, all of rectangular shape, and consisting of jambs and a flat head—the simplest type and one which offers the easiest solution to the fitting and operation of doors. Doorways and windows of this kind are usually framed by flat or moulded architraves, as in Fig. 97 A, with the addition of a cap or modified cornice, Fig. 97 B, or by a complete Order with an entablature or pediment, as shown on page 107 in the Renaissance examples. This trim around an opening is a glorification of the structural elements. The faces of the jambs and the lintel offer surfaces for decoration which give the necessary enframement and accent to the openings and make possible a change of material from that used in the walls themselves.

The window from the Erechtheum at Athens, Fig. 97 A, illustrates the use of an elementary type of opening with emphasis given to the head by the break in the moulded member of the architrave. The doorway from the Erechtheum, Fig. 97 B, is one of the finest and one of the most typical of Greek examples. It shows the refinement of detail and the simplicity of conception which are characteristic of this civilization. It will be noticed that the openings of the window and the door are battered, or narrower at the top than at the bottom, giving a feeling of stability to these elements. In order to convey some idea of scale, we may indicate that the doorway is approximately eight feet wide at the base, while the width of the window is three feet.

The two Roman doorways are similar in general shape and appearance, with a distinguishing feature in the use of consoles in the first example. The doorway of the Temple of Hercules at Cori, Fig. 97 C, retains the simplicity and delicacy of Greek art. As in the case of examples which follow, it is given scale, or the opening is reduced to a height compatible with human use, by the introduction of the transom. The width of the opening, the jambs of which again taper, is about seven feet. The doorway of the Pantheon

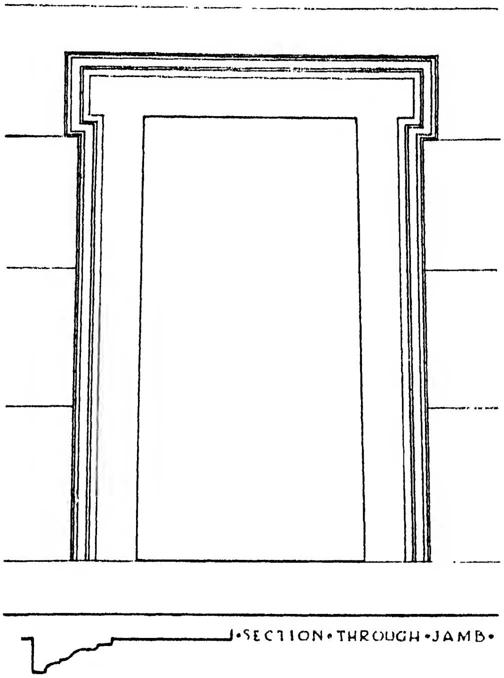


FIG. (A) WINDOW OF ERECHTHEUM

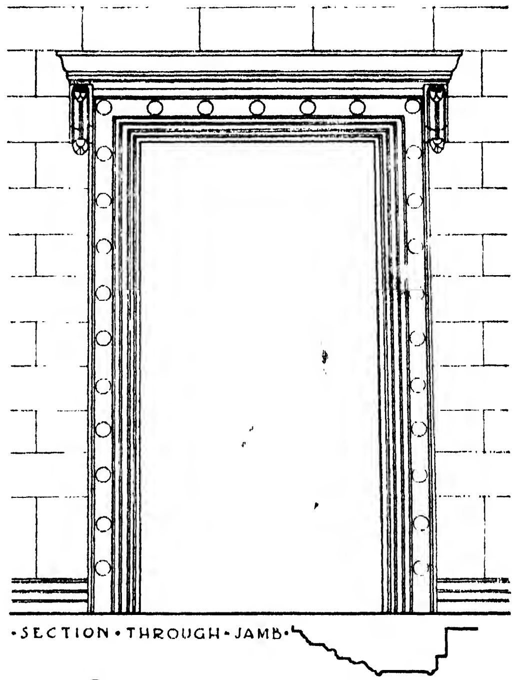


FIG. (B) DOORWAY OF ERECHTHEUM

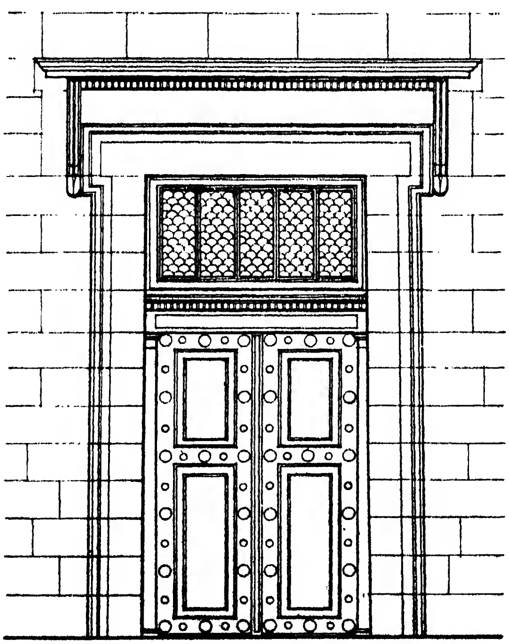


FIG. (C) DOORWAY TEMPLE AT CORI

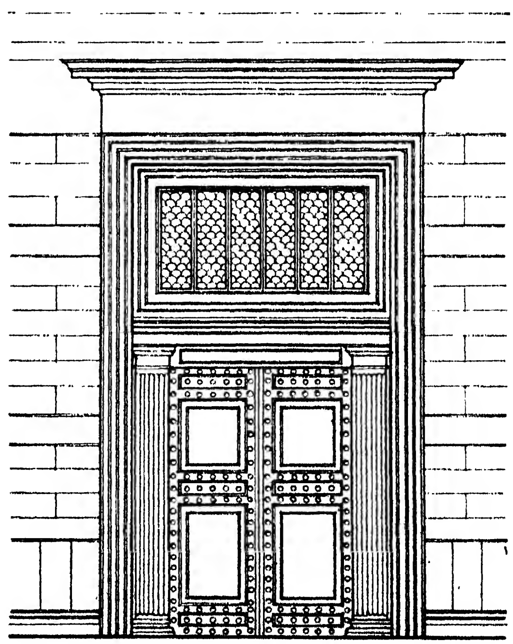


FIG. (D) DOORWAY PANTHEON ROME

CLASSICAL OPENINGS

in Fig. 97 D, displays characteristics of the architecture of this period. The architrave is elaborately moulded, and the opening is filled with fluted pilasters and richly ornamented doors and transom grille of bronze. Whereas the doorway in Fig. 97 C is located in a Doric temple, that in Fig. 97 D is used in connection with a Corinthian Order. The former is in harmony with the desire for simplicity; the latter sympathizes with the attempt at ornateness. The scale of the doorway of the Pantheon is large, the opening between the moulded jambs being about twenty feet.

ROMANESQUE OPENINGS. Arched openings are composed of the pier, impost cap, and archivolt. The archivolt may be either plain or moulded, and is made up of voussoirs or the stones of the arch ring, and the keystone or the stone in the key position in the centre of the arch. In the Romanesque examples the jambs or piers and the archivolts were often multiplied until the openings consisted of a series of receding moulded planes which were called "orders," as in Fig. 100 C. The circular and rectangular sections of the shafts were repeated in the mouldings of the arches which they carried.

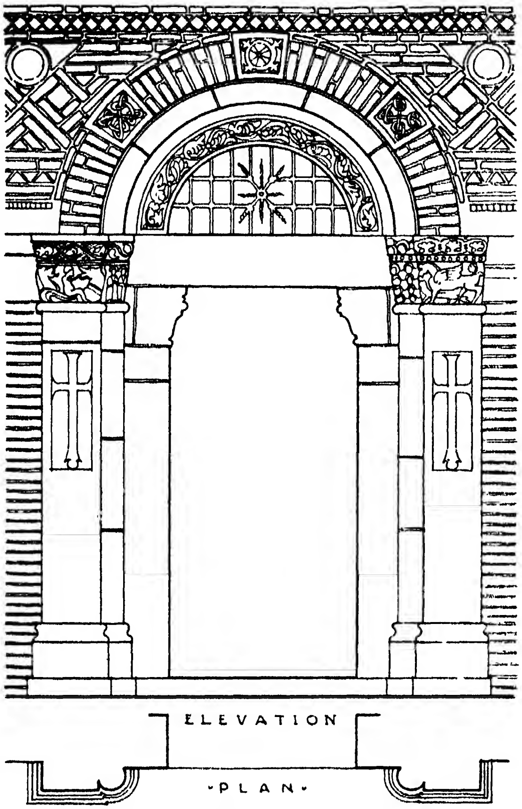
The example in Fig. 99 A shows a doorway from the church group of S. Stefano in Bologna. It is typical of Northern Italy in its use of stone and brick. The roughly carved figures of men and animals, together with the ornate foliated forms, are characteristic of the period. It will be noticed that the height of the opening has been reduced by the introduction of a lintel at the spring line of the arch to form a transom bar and to create a semicircular tympanum above. The opening is approximately four and one-half feet wide.

The doorway shown in Fig. 99 B is an English example from the cathedral at Ely. It again has the recessed orders with semicircular arches, all richly carved and decorated. In this case there are no existing bases to the columns. The capitals are of the cushion type with their identity almost lost under the carving. The tympanum is filled with intricate, conventionalized sculpture depicting an episode in biblical history.

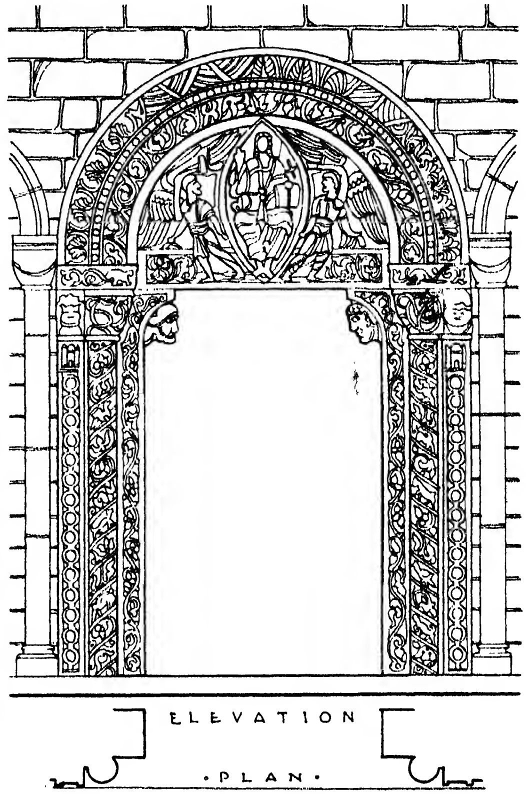
The Norman church at Iffley furnishes the example in Fig. 99 C. The general effect of the doorway is heavy and broad, a characteristic of the style, even though the opening itself is comparatively tall and narrow. Again the motif is richly carved but chiefly with a geometrical form of decoration rather than with curved and naturalistic details. Zigzag lines give chevron patterns to the columns and the arches.

The window illustrated in Fig. 99 D is a lesser-known example of French origin. It is from the church of St. Pierre, at Melle. Its short, heavy columns support capitals of the same type while the members of the arched head spring from a decorated string course. The decorations of the arch are very simple and geometrical, and their lack of refinement harmonizes with the general character of the rest of the opening. In spite of the slightly awkward relations which may exist between the various parts, the window has a rugged simplicity which is very satisfactory. . . . When a stylistic treatment is being used as a source of inspiration, it is essential that the spirit of the original be retained. Details must be correctly interpreted, but the attaining of proper character is even more important. These typical examples of architectural elements are intended only as an introduction to a more complete study of movements of the past.

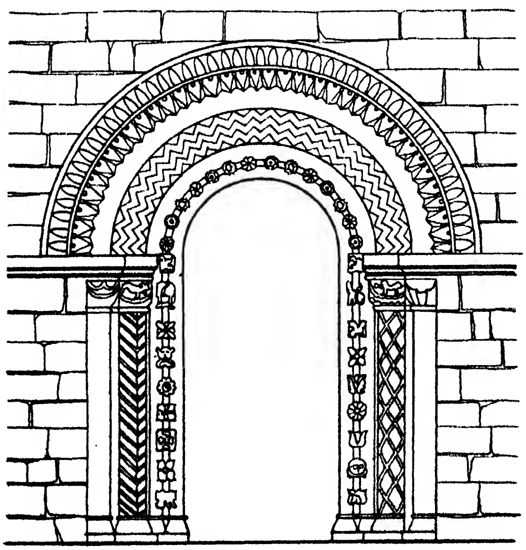
GOTHIC OPENINGS. In order to illustrate the character of Gothic openings, English examples have been chosen. This choice was influenced by the definite manner in which the English Gothic style developed from one period to another and also because of the favor which its details have found in this country. The doorway in Fig. 103 A exhibits the



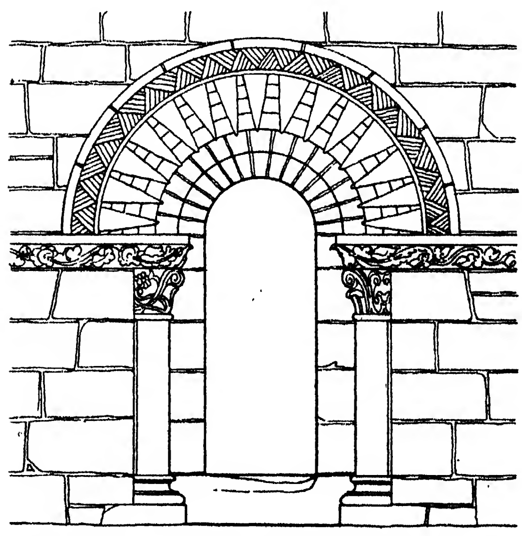
•FIG•Ⓐ•DOORWAY•S•STEFANO••BOLOGNA•



•FIG•Ⓑ•PRIOR'S•DOORWAY••ELY•CATHEDRAL•

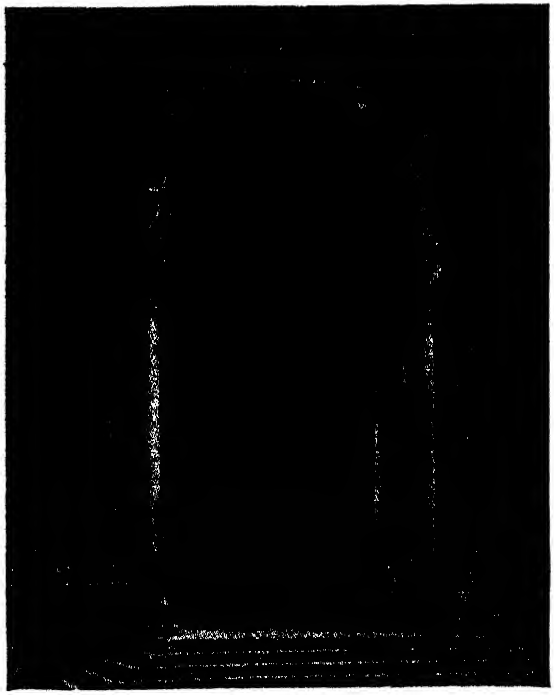


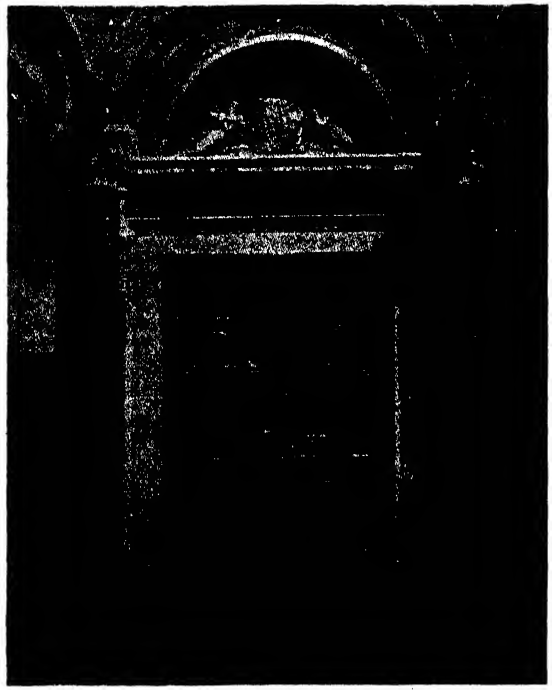
•FIG•Ⓒ•DOORWAY••CHURCH•AT•IFFLEY•



•FIG•Ⓓ•WINDOW••ST•PIERRE••MELLE•

•ROMANESQUE•OPENINGS•





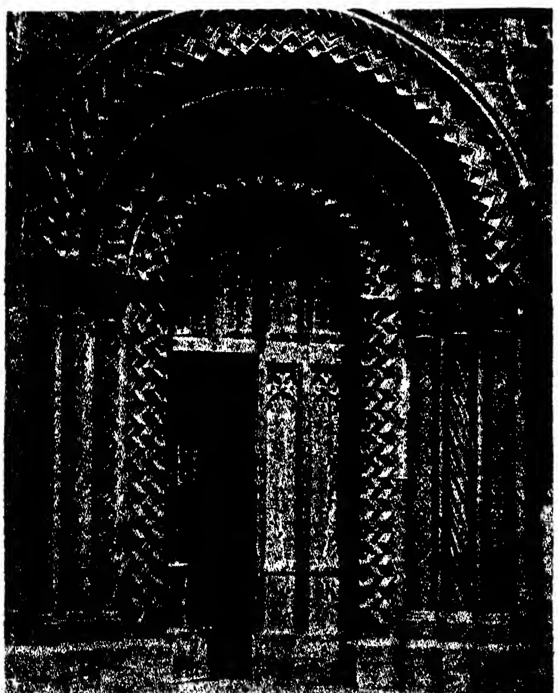
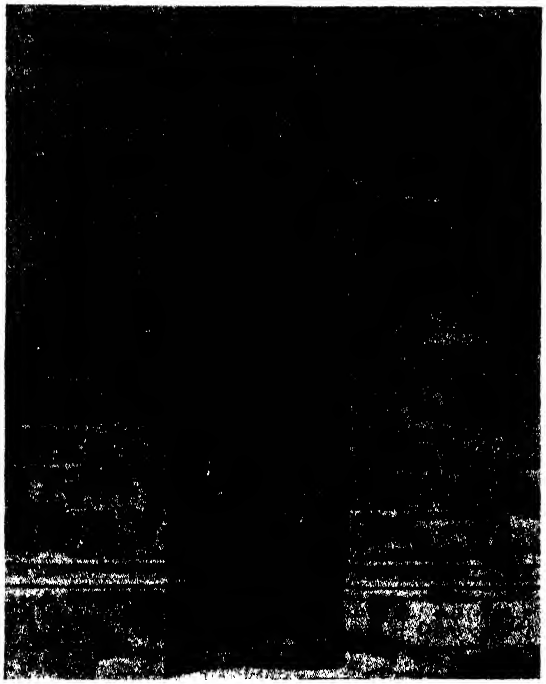


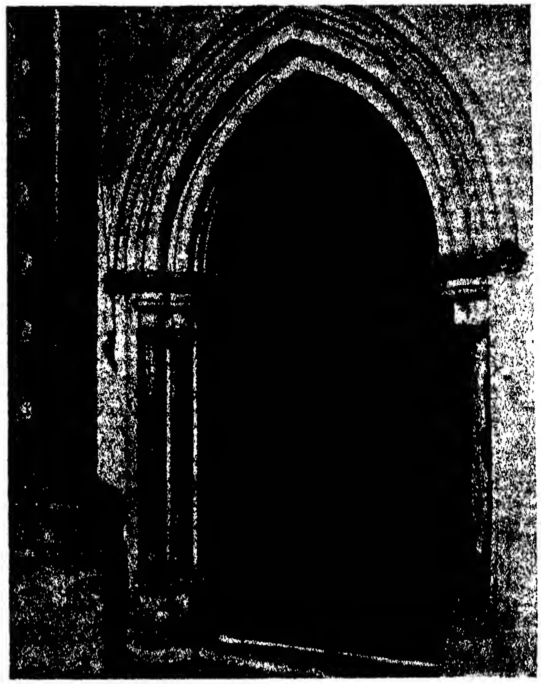
FIG. (A), above.—S. Zeno, Verona. Pink marble columns 17 ft. 6 in. on center. Hood of colored marble and brick.

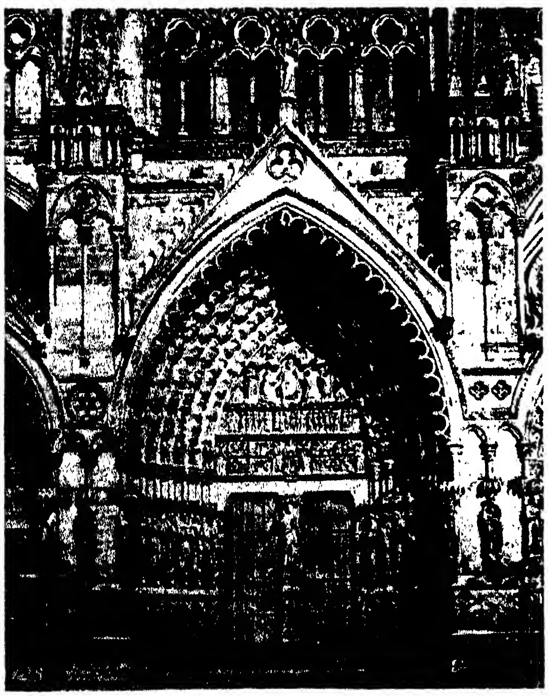
FIG. (C), below.—Lincoln Cathedral. Typical Norman doorway with orders of columns and arches; geometric ornament. (Fig. 134 A)

FIG. (B), above.—Pisa Cathedral. Opening 11 ft. 6 in. wide. White, gray, and buff marble. Marked Classical influence. (Fig. 261 B)

FIG. (D), below.—S. Marcello, Capua. Round arch, lintel, and tympanum. Grotesque carving. Early mediaeval.







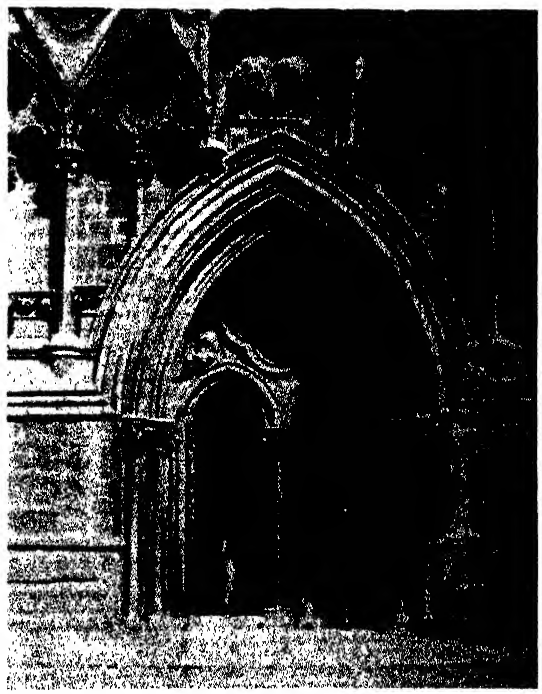


FIG. (A), above.—House of Jacques Coeur, Bourges. Simple; secular; compare with (C). Note label mould, crockets, and finials.

FIG. (C), below.—Amiens Cathedral. Elaborate; ecclesiastical. Deeply recessed; series of statues in jambs and arch.

FIG. (B), above.—Lincoln Cathedral. Early English. Engaged shafts and moulded capitals. Opening 4 ft. 8 in. wide.

FIG. (D), below.—Wells Cathedral. Arcade type. Scale given to entrance by introduction of two smaller openings.

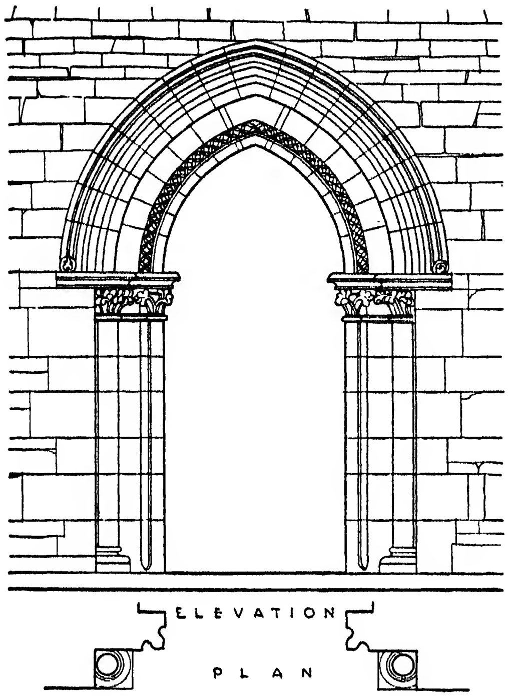
essential characteristics of the Early English style in which the proportions were comparatively tall and narrow and simplicity was a distinguishing quality. In this doorway of St. Mary's Church, Lincoln, the jambs, which are five feet apart, are composed of detached columns and simple mouldings. The capitals consist of crisply carved foliated forms, while among the mouldings of the arched head may be seen the dogtooth ornament which reveals the proximity of the Early English to the Norman period.

During the next phase of the English Gothic, the Decorated, the doorways became more ornate in their decoration and wider in their proportions. The example in Fig. 103 B, St. John's, Norfolk, illustrates the tendencies of this phase of the development. The cinquefoil, or the arrangement of five foils terminating in cusps, gives a rich, traceried appearance to the head of the opening. The projecting outer moulding, or label mould, is terminated with carved heads and carries a series of conventionalized leaves in the form of crockets ending in a finial. The opening is about seven feet wide.

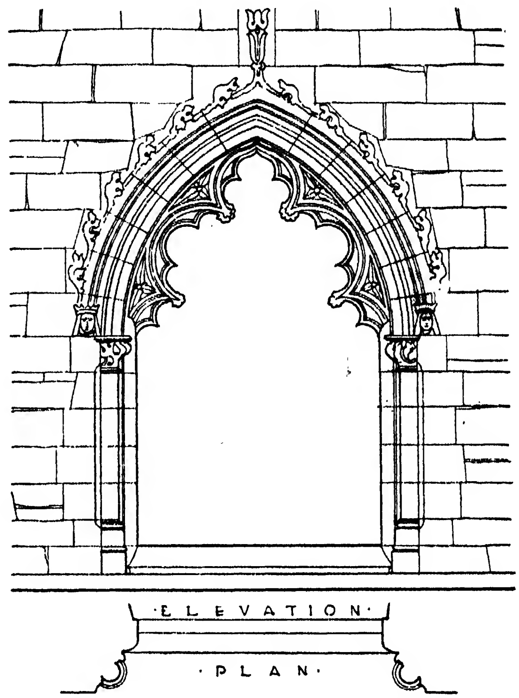
The Perpendicular phase witnessed the change from the simple pointed arch to the four-centred arch. With an arrangement of this kind the head of the opening is usually framed by a vertical and horizontal label mould over the arch, and the triangular spandrels thus created are decorated in the manner shown in Fig. 103 C. The jambs of the doorway from St. George's Chapel, Windsor, are made up of several orders of slender colonnettes on high bases and a series of deeply undercut mouldings which carry up and form the arch and complete the spandrels.

The window illustrated in Fig. 103 D, from St. John the Baptist, Cirencester, is characteristic of the Perpendicular phase, during which it was the practice to carry the mullions through to the main arch. This is in contrast to the Early English where the tracery is of the simple plate or perforated type, and to the Decorated where the tracery tends to break into flowing lines above the spring line of the arch. This Perpendicular window shows the use of the elaborate, vertical tracery and also the manner in which the opening completely fills the area between buttresses. The latter—constituting part of the structural scheme of the building—are shown in front and side elevation and in plan. Particular attention is called at this point to the way in which the mouldings of the jambs, mullions, arch, and tracery all member with each other. The complexity of Gothic details may be minimized if each part and its relation to the ensemble are carefully scrutinized. Minor parts of a Gothic motif usually repeat sections to be found elsewhere. Flat surfaces, or fillets, must member with other similar surfaces, while concave and convex mouldings must coincide with like shapes. It is through a realization of the importance and necessity of this relationship that a successful interpretation of the Gothic style can be obtained.

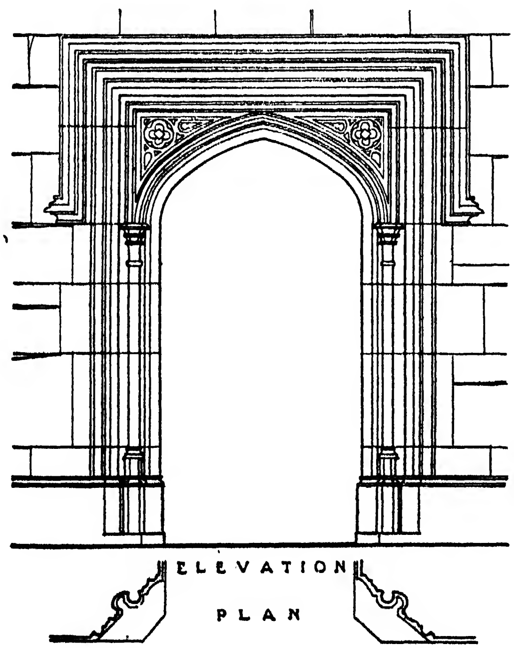
Renaissance Openings show such a variety of treatment and have had so much influence upon twentieth-century architecture that two pages of examples are shown—one of doorways and one of windows. They are, of course, composed of elements taken from Classical sources; the pilasters, columns, arches, and mouldings of Roman architecture. Fig. 106 A, from a house in Rome, shows the use of the architrave type with consoles and a pediment, the entire composition carried on a pedestal course and flanked by pilasters. In this connection, attention might be called to the fact that the original purpose of the sloping pediment was to shed water from the opening and that its logical use is therefore external. The motif has been used decoratively so much on interiors that this significance has been lost and is no longer regarded as binding, but its origin suggests the desirability



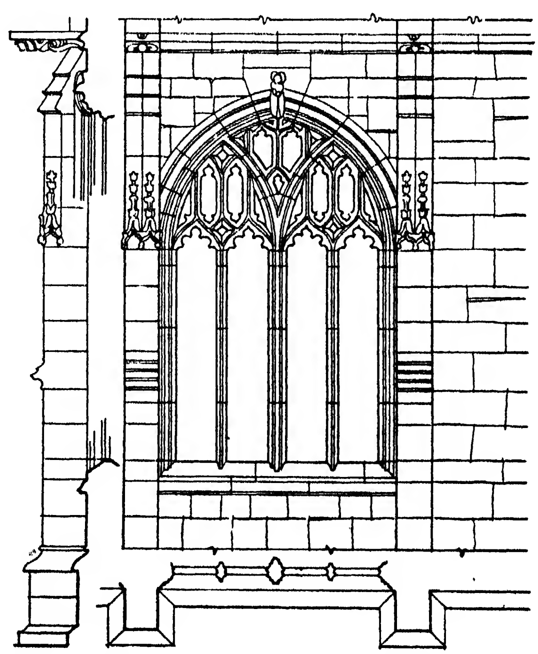
•FIG•Ⓐ•DOORWAY••ST•MARY'S••LINCOLN•



•FIG•Ⓑ•DOORWAY••ST•JOHN'S••NORFOLK•

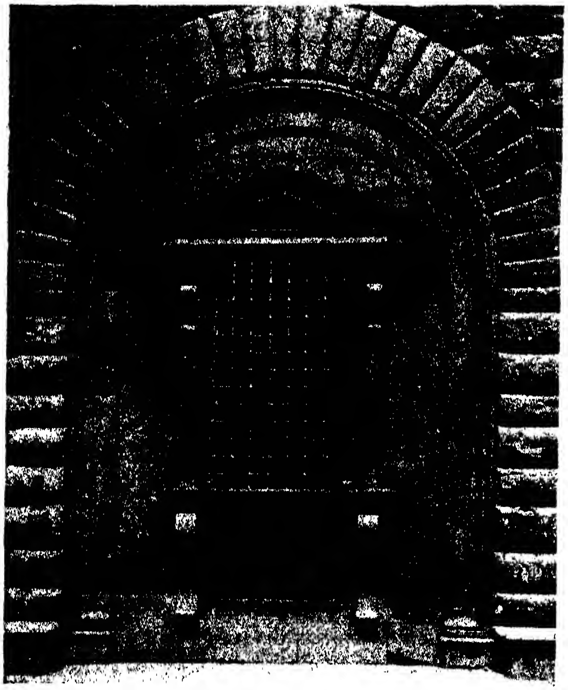


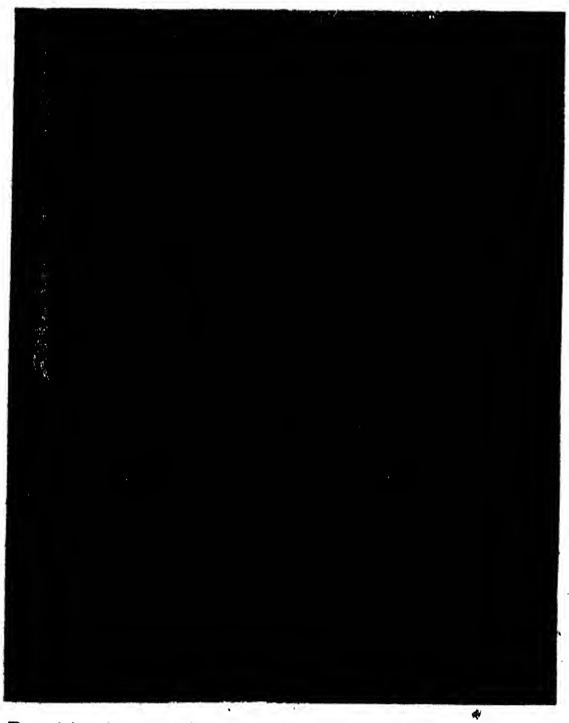
•FIG•Ⓒ•DOORWAY••CHAPEL••WINDSOR•



•FIG•Ⓓ•WINDOW••ST•JOHN••CIRENCESTER•

•GOTHIC•OPENINGS•





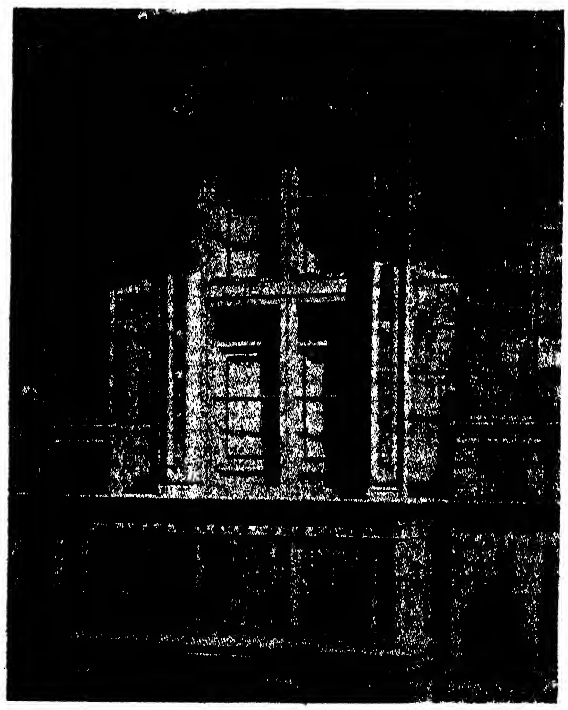
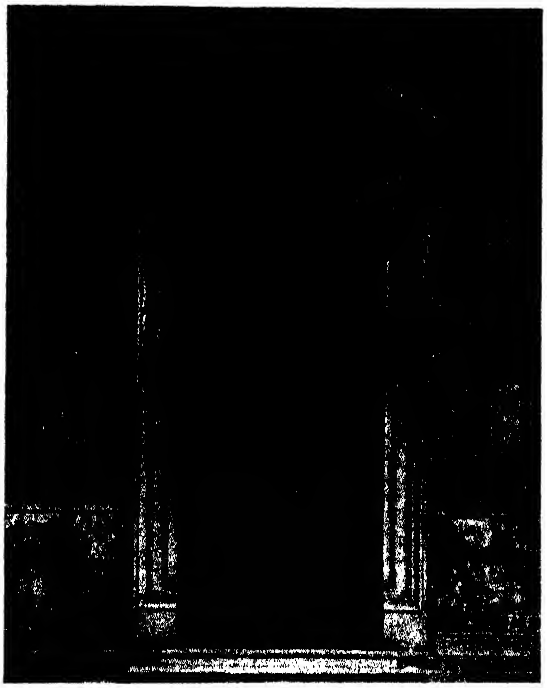


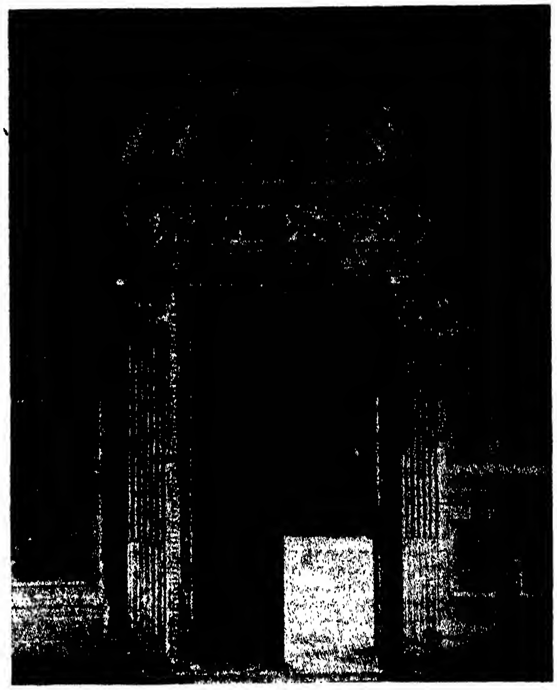
Fig. (A), above.—Palazzo Riccardi, Florence. Rustication and simple mouldings—satisfactory first floor treatment. (Fig. 153 A.)

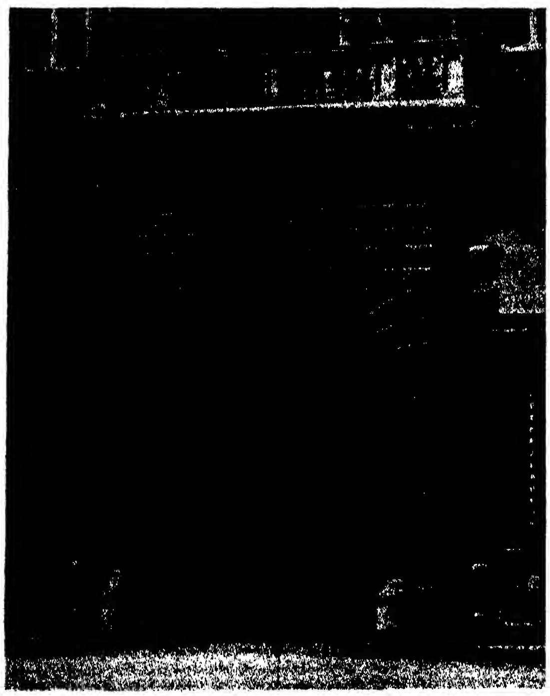
Fig. (C), below.—Palazzo Cuccoli Fiaschi, Florence. A heavier and more angular treatment than in Fig. A.

Fig. (B), above.—Palazzo Quaratesi, Florence. A lighter and more graceful design for upper floors; arcade type.

Fig. (D), below.—Palazzo della Cancelleria, Rome. Refined details contrasting with rustication. See Fig. 153 B.







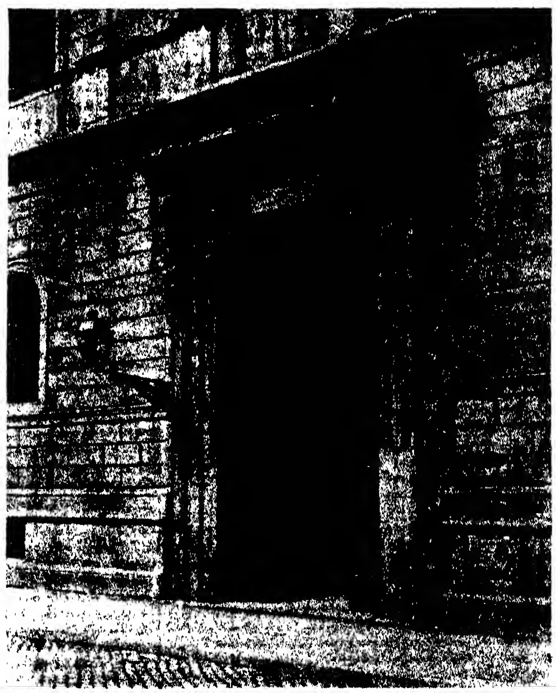
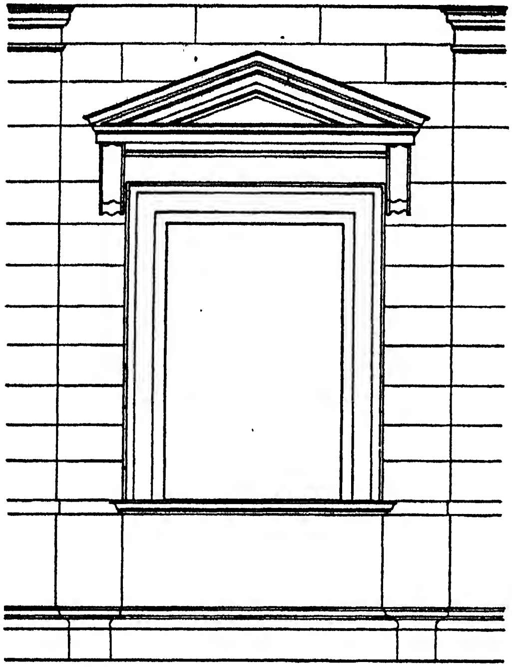


Fig. (A), above.—S. Maria del Popolo, Rome. Moulded architrave and entablature with pediment. Light, graceful.

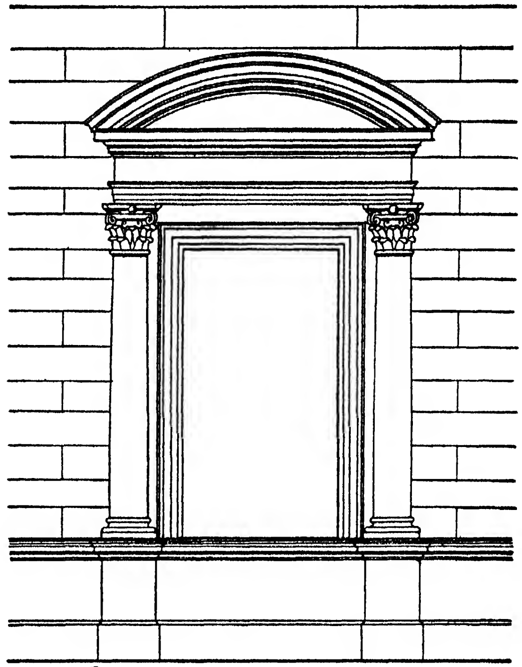
Fig. (B), above.—Palazzo Vecchio, Florence. Order type. Rich and delicate carving suitable for interior.

Fig. (C), below.—Palazzo Farnese, Rome. Heavy, dignified simplicity to mark main entrance. Note stone jointing.

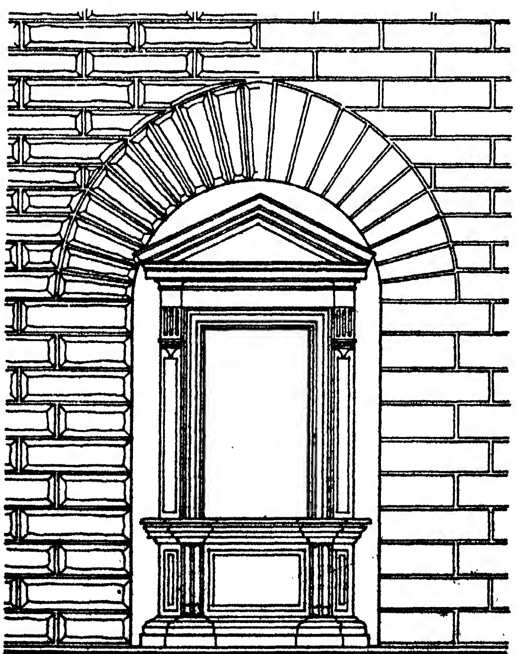
Fig. (D), below.—Palazzo della Cancelleria, Rome. Large in scale, width of opening 8 ft. 10 in. Exterior treatment.



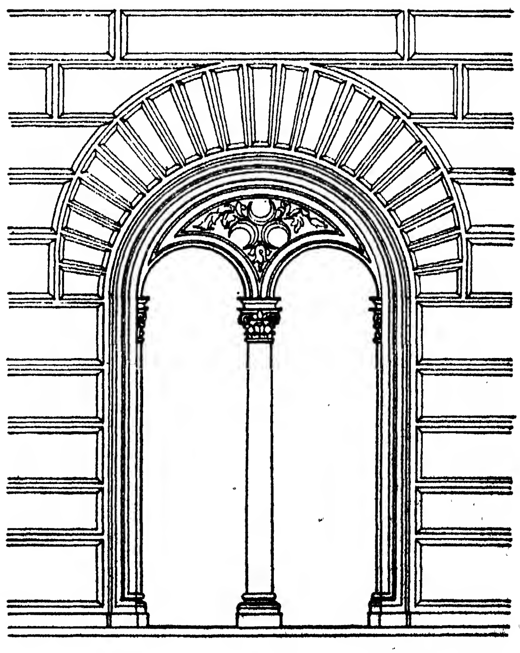
•FIG• Ⓐ •HOUSE•IN•ROME•BY•PERUZZI•



•FIG• Ⓑ •PALAZZO• FARNESE• •ROME•

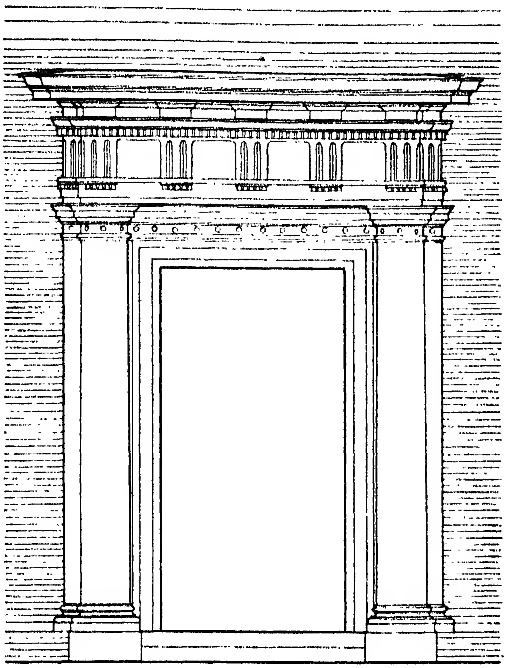


•FIG• Ⓒ •PALAZZO•PITTI• •FLORENCE•

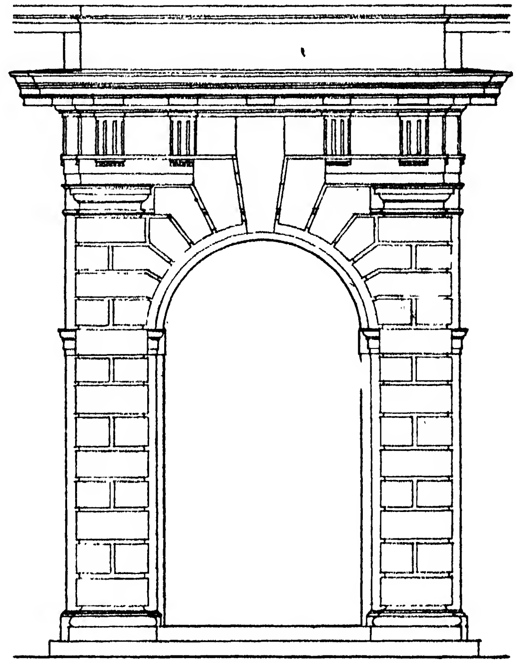


•FIG• Ⓓ •PALAZZO•STROZZI•FLORENCE•

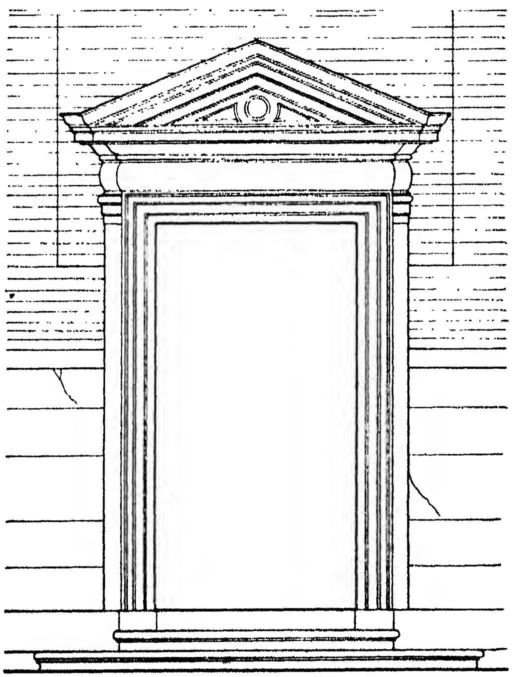
• RENAISSANCE • WINDOWS •



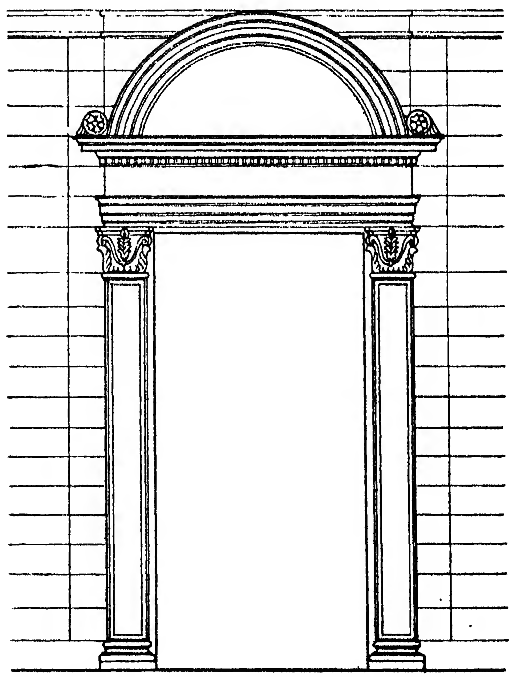
·FIG·A· PALAZZO·ALBERGATI··BOLOGNA·



·FIG·B· PALAZZO·CAPRAROLA··ROME·



··FIG·C· S·TOMA··VENICE··



·FIG·D· S·ANNUNZIATA··FLORENCE·

·RENAISSANCE·DOORWAYS·

for truth of expression in architecture. The adjacent, Doric pilasters are also decorative.

The example in Fig. 106 B shows a window from Palazzo Farnese, Rome, which is framed with engaged columns carrying an entablature with a curved pediment. In the Farnese palace the windows with the curved pediments alternate with those having sloping or pointed pediments—a typical arrangement and one which gives variety and contrast. On account of the use of the columns in the manner illustrated, it is called the order type of window.

The window from the Palazzo Pitti, in Florence, Fig. 106 C, offers an example of the architrave type composed within a heavily rusticated arch and pier. The scale of this motif is large, the opening of the window measuring a little over five feet in width. This architectural element shows an interesting contrast between the complexity of the mouldings of the window itself and the heavy simplicity of the surrounding stonework.

Another type which is often found in the earlier palaces of Italy is shown in Fig. 106 D, from the Palazzo Strozzi, Florence. It consists of a single rusticated arch which contains two slender, arched openings separated by a single column. This has been called the arcade type of opening. The delicacy of the carving of the mouldings and capitals and the space above the arches again contrast pleasantly with the rustication.

The doorways on page 107 range in character from the slender, graceful one in S. Annunziata, Florence, to the more robust one from the Palazzo Albergati, Bologna. The latter, Fig. 107 A, shows the use of a heavy Doric Order of the mutular type with engaged columns. In Fig. 107 B, from the Palazzo Caprarola, Rome, a rugged effect is secured by the application of rusticated stonework to form an arched opening, which in turn supports an entablature. Attention should be given to the Doric capitals which suggest the presence of pilasters, and to the manner in which the stone courses member or join with the other elements of the composition.

The doorway from S. Toma, Venice, in Fig. 107 C, is less Roman in character than the first two on this page. It is lighter and more graceful and reflects the spirit of the early Renaissance. The projection of the moulded architrave, the convex frieze, and the pediment beyond the face of the flanking members is an unusual treatment.

Figure 107 D illustrates the manner in which the location of an architectural element may affect its appearance. Whereas the other openings have been designed for the exterior, this one is located upon the interior. It is, therefore, protected from the weather and can thus make use of more delicate details. The robustness of exterior work is neither necessary nor desired, and the tympanum, frieze, and pilasters are decorated with delicate carving, similar to Fig. 105 B, which is seen to an advantage in a diffused light.

It will be observed that the Renaissance doors and windows have been taken entirely from Italian buildings. This seems quite logical, since the movement had its birth in Italy and there witnessed its greatest development. We have been forced to omit from this discussion any reference to the reflections of the Renaissance in other countries. If the designer is interested in these variations, he can easily consult the architectural documents. The examples herein shown are basic types. From these were developed the French, Spanish, German, and English Renaissance with their national flavors and characteristics.

Contemporary Openings. By this time it is evident that it is a comparatively easy matter for the initiated to identify the elements of the historic styles. A doorway or a building may be recognized as Classical or Gothic. Contemporary architecture may stand

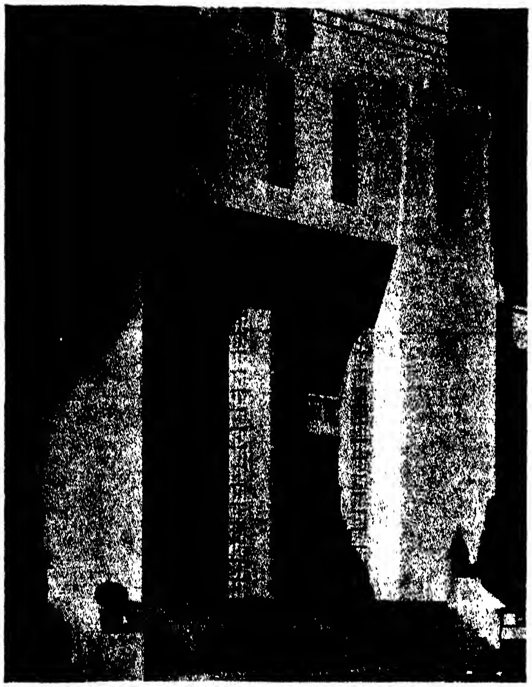
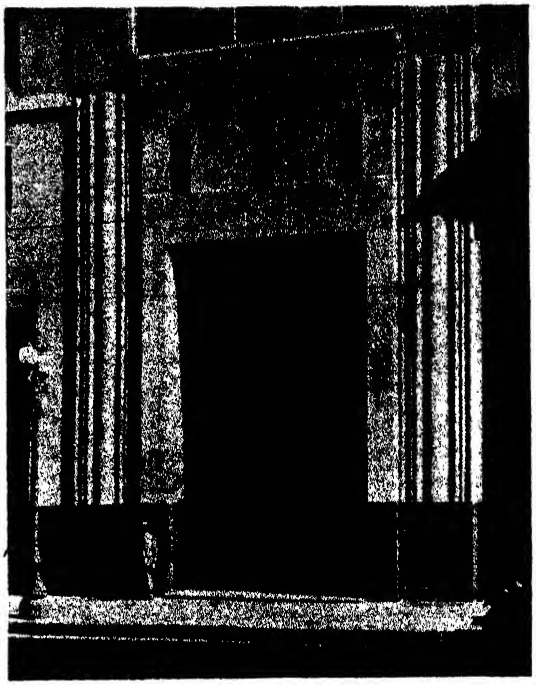
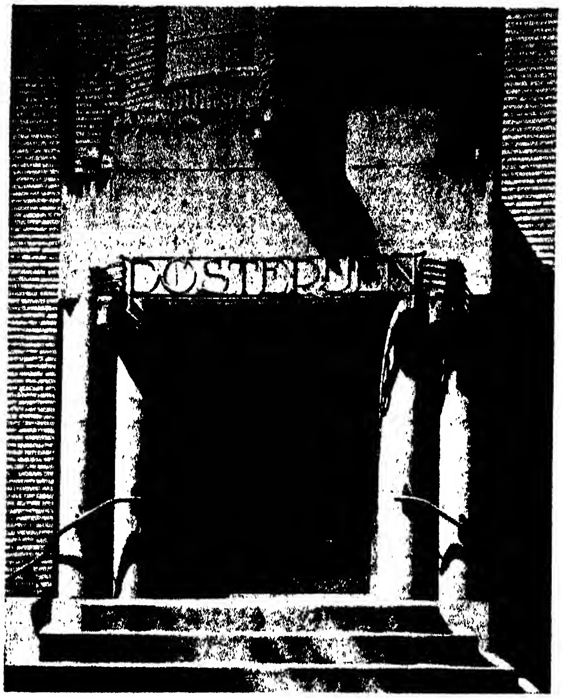



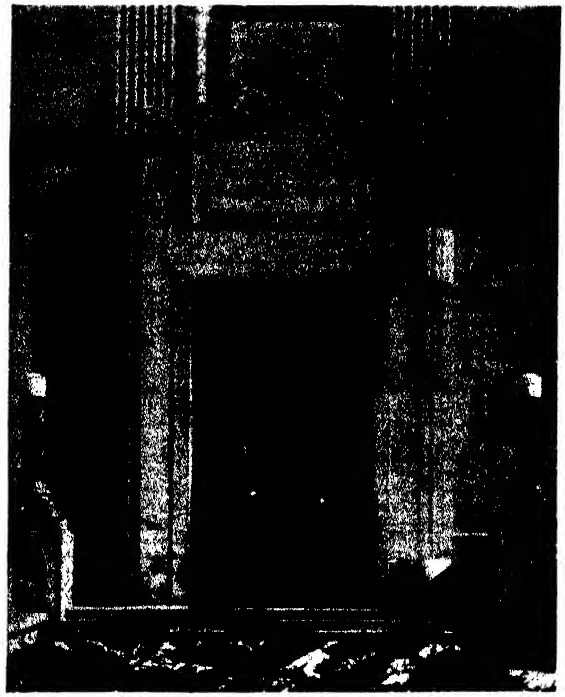
FIG. (A), above.—Sears Roebuck Bldg., Los Angeles. A truthful expression of concrete. Simple, angular details and surfaces.

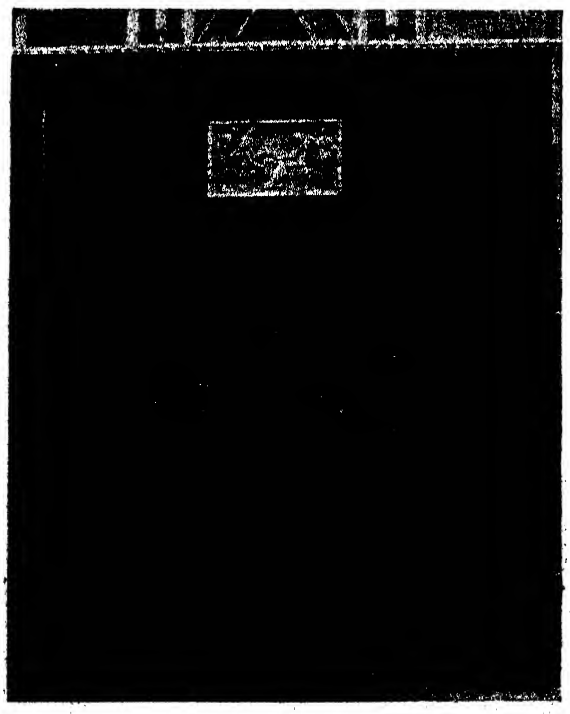
FIG. (C), below.—Telephone Bldg., Atlanta, Ga. Non-stylistic use of details; flat surfaces; unusual opening.

FIG. (B), above.—Bank Bldg., New Orleans. Classical qualities interpreted in limestone. Note moulded "pilasters."

FIG. (D), below.—Irving Trust Bldg., New York. Verticality of the Gothic; decoration accenting structure; (B), (C), and (D), limestone.







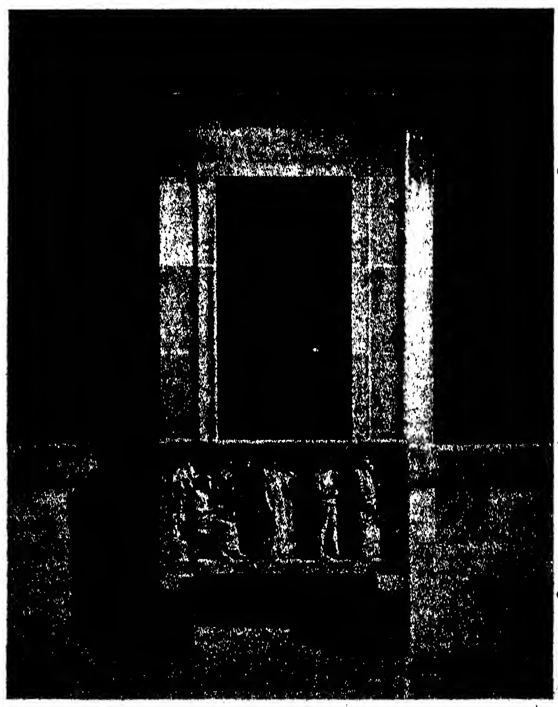
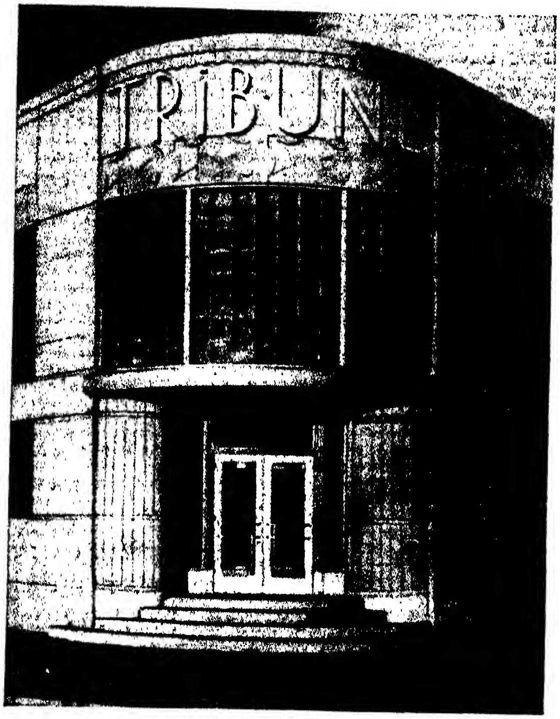


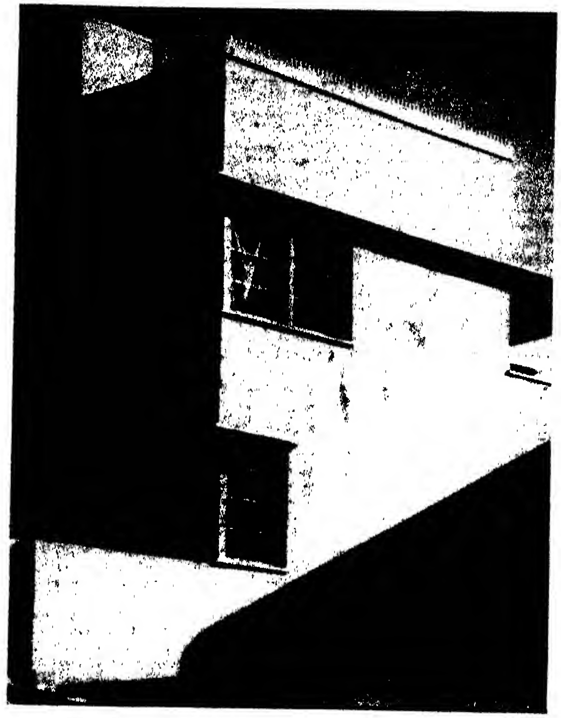
FIG. (A), above.—Post Office, Haarlem, Holland. Stone, brick, and metal. Simplified post and lintel.

FIG. (C), below.—Integrity Trust Bldg., Philadelphia. Monel metal and polished stone. Rich simplicity.

FIG. (B), above.—Library, University of Cincinnati. Elementary planes; concentrated ornament. Restraint.

FIG. (D), below.—Library, University of Cincinnati. Successful merging of Classical feeling with modern expression.





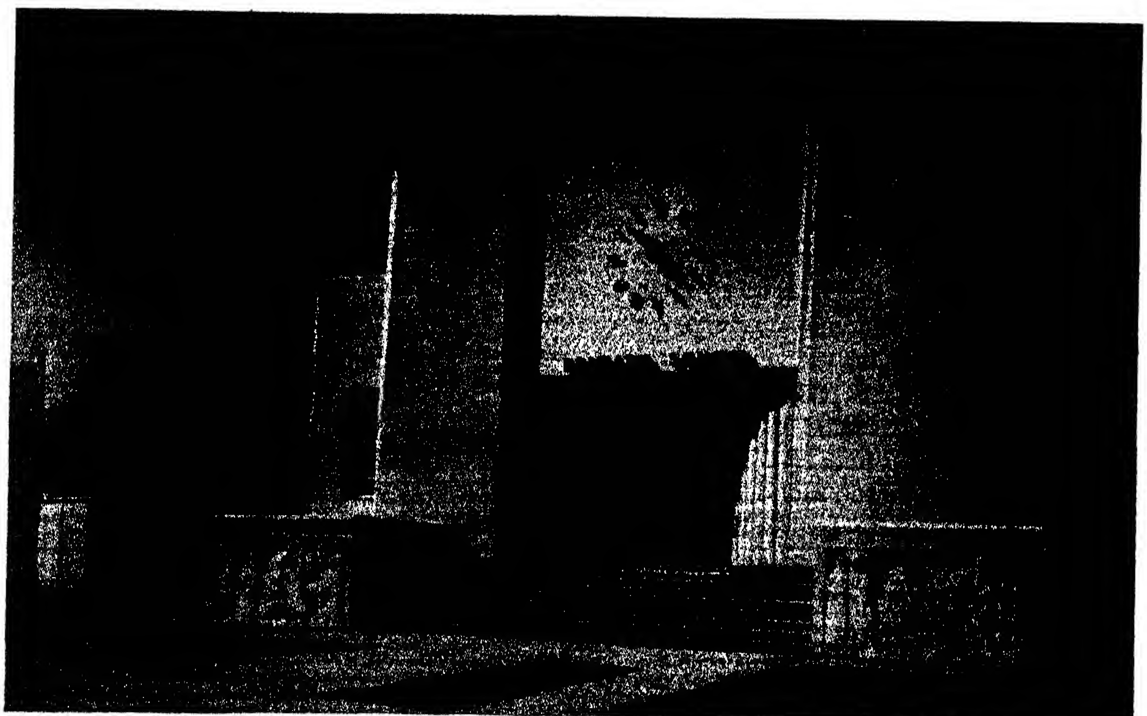


FIG. (A), above.—Newspaper bldg., La Crosse, Wis. Satisfactory combination of concrete and glass. Utilitarian, yet decorative.

FIG. (B), above.—Residence, San Francisco. Non-traditional corner windows of aluminum.

FIG. (C), below.—School, Tupelo, Miss. Pleasing simplicity of contemporary doors and windows framed by interesting areas of concrete.

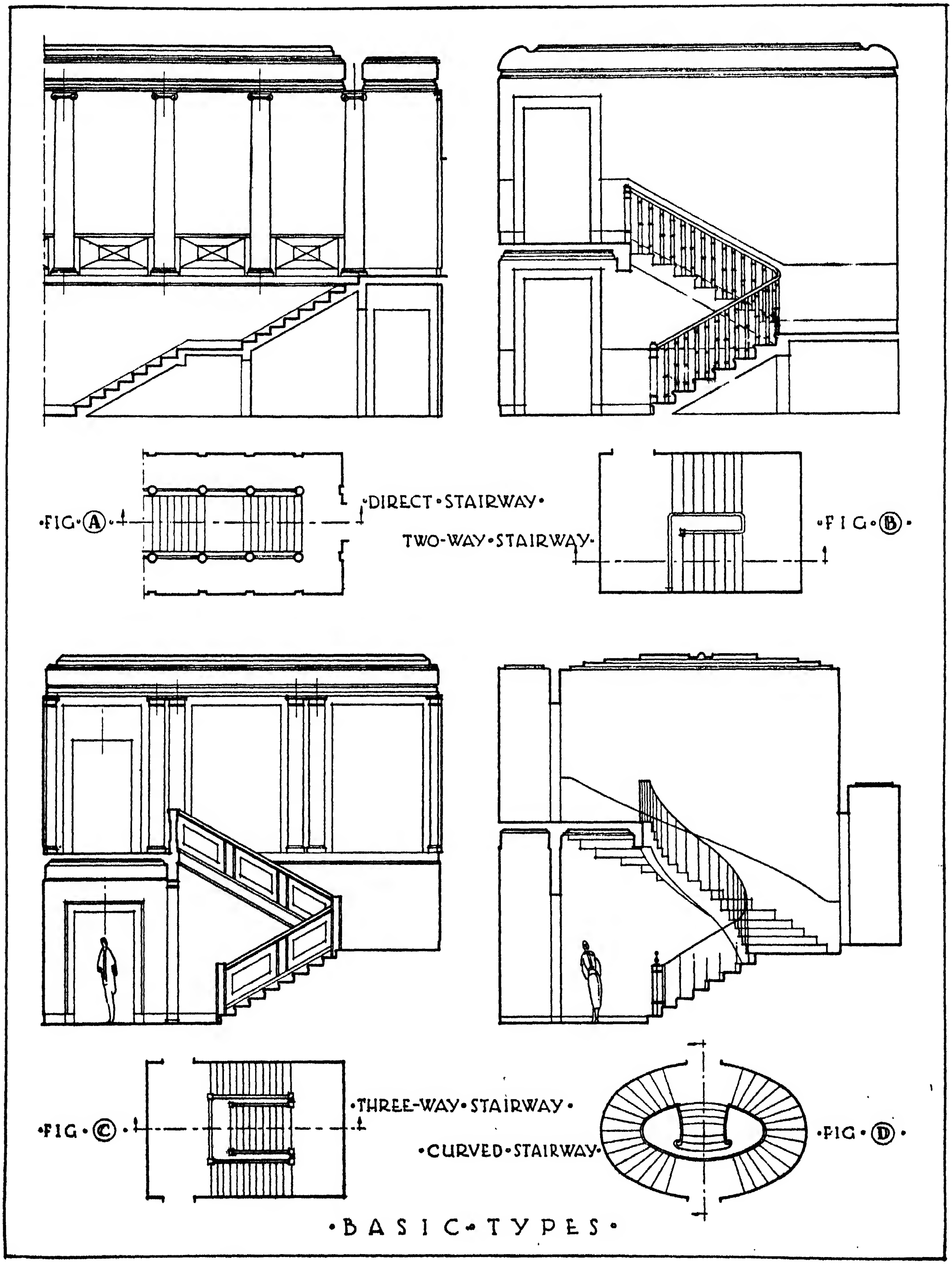
out as something quite different from preceding examples in method of treatment, but as yet its distinguishing characteristics have not become crystallized. It is not a style; it is only a movement which may change with each succeeding decade. However, there are tendencies which may foretell the developments of the future, and these may become more significant after early enthusiasms have subsided and stability has been reached.

Contemporary openings are recognizable chiefly on account of their partial or complete lack of resemblance to historic styles. Too often a motif is "modern" if it is simply different. Its appearance should be the outgrowth of an attempt to use present materials in a way which is sympathetic with prevailing social and economic conditions, instead of a deliberate effort simply to break with tradition. The prevalence of angular rather than curved forms in contemporary openings results from the steel skeleton beneath the enveloping shell. The vertical columns and the horizontal I-beams or girders define the shapes of doors and windows. Concrete—monolithic or with columns and beams, obtained from easily constructed forms—expresses itself in simple rectangular shapes. Or arched openings reflect the plastic quality of concrete, or the flexibility of stone, brick, or metal, where these attributes are desired.

Doors and windows are conspicuous in the composition of modern exteriors on account of their size and number, but often inconspicuous in their treatment. For their final effect, exteriors depend largely upon the texture of materials, masses of architectural volumes, and the relation of solids to voids. A problem in contemporary design concerns itself with the expression of the structural elements and with the disposition of these previously discussed circulatory units as they become part of the general composition. During the Renaissance and Gothic periods, windows and doors alike received an equal share of decorative treatment. Usually they stood out as individual elements, framed by pilasters, columns, or arches. In present-day architecture, particularly that of the so-called Non-Traditional type, windows often receive less attention than do the doorways. The former must be properly placed, but frequently they simply assist in emphasizing the position and direction of more important members (as in Fig. 109 D), being reduced to unpretentious openings with little enframement. Doorways may also follow this general scheme, but they are often more evident by reason of the attention which they receive. This may be due to the necessity for marking the entrances to the building in a manner more convincing than is necessary with windows.

Contemporary openings may range from those which resemble in detail stylistic examples of the past to those which have little hint of anything that has preceded this present century. Many of the doors and windows which we see at least retain the spirit of some previous movement. Many fine entrances reflect the simplicity of Greek architecture, as in Figs. 109 B and 110 B. Others have the vertical quality of the Gothic, even though the decorative forms and the use of architectural sculpture may strike a new note. Interesting massing of the surrounding elements and uniquely shaped openings are often more characteristic than strict adherence to an expression of the post and lintel or the arch.

STAIRWAYS, ramps, or elevators are necessary adjuncts to a plan in order to provide vertical circulation. The inclusion of a stairway naturally indicates the presence of more than one floor. Stairways may be divided according to their location—exterior or interior; importance—major or minor; type—curved or straight; and character—decorative or utilitarian.

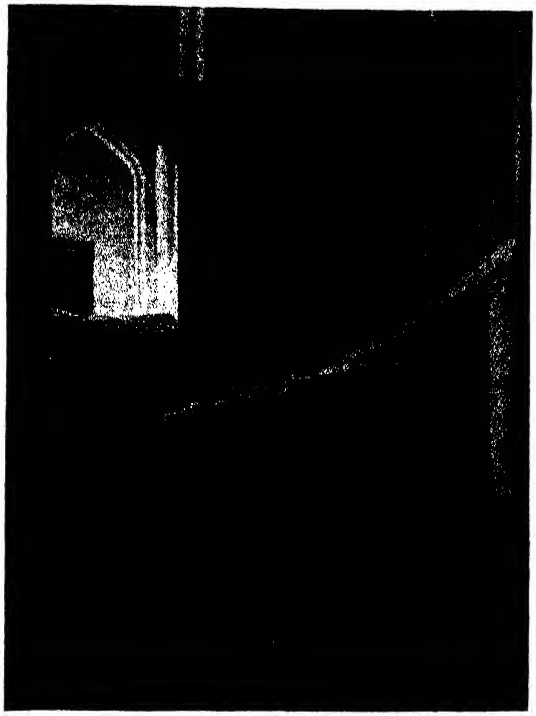

·FIG·Ⓐ·
·DIRECT·STAIRWAY·
TWO-WAY·STAIRWAY·
·FIG·Ⓑ·
·THREE-WAY·STAIRWAY·
·FIG·Ⓒ·
·CURVED·STAIRWAY·
·FIG·Ⓓ·
·BASIC·TYPES·

If the various historic styles are studied, it is seen that stairways vary in their importance, depending upon the type of architecture and the requirements of the building. During the Classical period, external flights of steps led up to the floor level of the temples, and constituted the principal stairways known to the Greeks. This was also true of Roman architecture, except for the simple stairways in some of the secular buildings. This general absence of stairways indicates an architecture of one story, even though the latter often assumed heroic proportions. The cathedrals and manor houses of the mediaeval period continued to reflect the relative unimportance of the stairway (Fig. 115 A). It was not necessary to move many people from the nave level to the triforium gallery or from the hall to the bed chamber, so that winding stairs were carried up within the thick walls of the church towers or simple flights ascended quite informally from various parts of the dwelling.

It was not until the time of the Renaissance that the stairway assumed the importance which it held for several centuries. The planning of the palaces of this period was usually monumental in its conception and organic in its arrangement. Stairways often became focal points in the composition and were rich and decorative in their use of detail, as in Fig. 115 B. With the contemporary movement in architecture, monumental stairways are losing their prominence in plan and treatment. In buildings of few stories in height, stairways are efficiently planned and executed, but they usually lack the ornate quality of earlier examples. Polished marbles and metals replace rococo carving and baroque contortions (Fig. 115 C). In tall buildings the elevator has relegated the stairs to service and emergency uses.

Exterior Stairways may be entirely utilitarian or they may be designed for the sake of effect. It is usually desirable to create an impressive approach to a monumental building, and it has been found that broad, low flights of steps give an adequate setting to a structure of this type (Fig. 280 A). External stairways may follow the example of Greek temples and consist of a single flight leading directly to the entrance of the building. Or they may be based upon the ornate conceptions of the French palaces, composed in the form of curves—segmental, semicircular, or of horseshoe shape—or consisting of several flights parallel or at right angles to each other with landings or terraces between. The decorative effect of the exterior stairway is almost unlimited and offers in itself a major problem in design. External stairways are usually much easier in their ascent than those on the interior. The measuring of many examples in this country reveals a ratio of riser to tread of about one to three—the dimensions of the riser varying from five to six inches and those of the tread from fifteen to eighteen inches.

Interior Stairways and ramps, or their modern substitute, the elevator, are important elements in plan composition. Their location in the building must receive early consideration. This involves not only their relation to the various important rooms and entrances, but also their position with reference to each other. If possible, stairways should be superimposed, one above the other, so that communication between floors will be direct and easy. Stairways should be so placed that all parts of the building are served in a satisfactory manner. This involves a spacing based upon the use of the different elements of the plan. Important stairways should serve main entrances and should be visible and accessible to those who would use them. Minor stairways should be so located that steps need not be retraced to the centre of the building in order to ascend or descend.



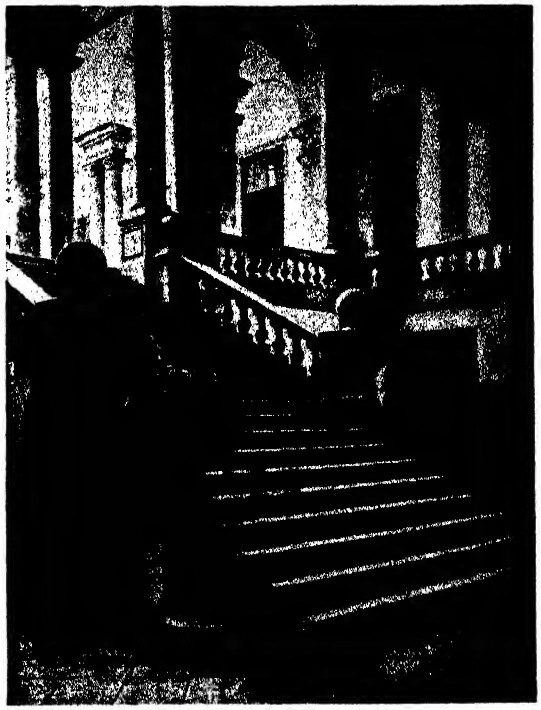


FIG. (A), above.—Wells Cathedral. The informal, mediaeval stairway, as contrasted with the one in Fig. (B).

FIG. (B), above.—The University, Genoa. The monumental, single-flight stairway; important, heavy, robust.

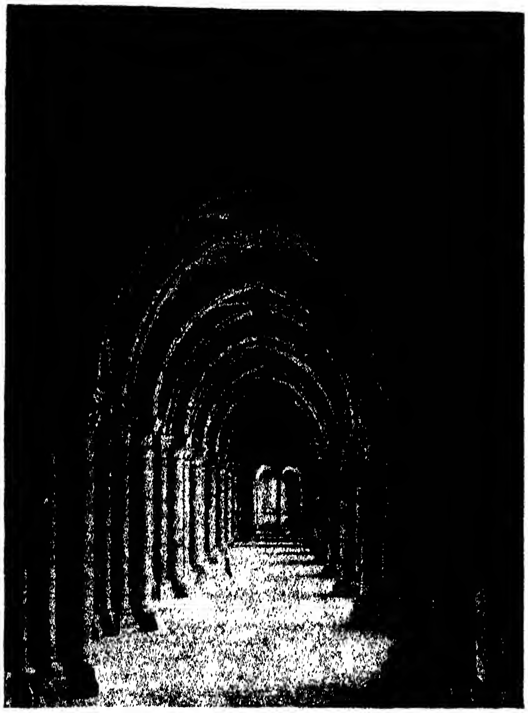
FIG. (C), below.—Eaton Store, Toronto. The stairway in contemporary architecture; marble and monel metal. Simplicity.

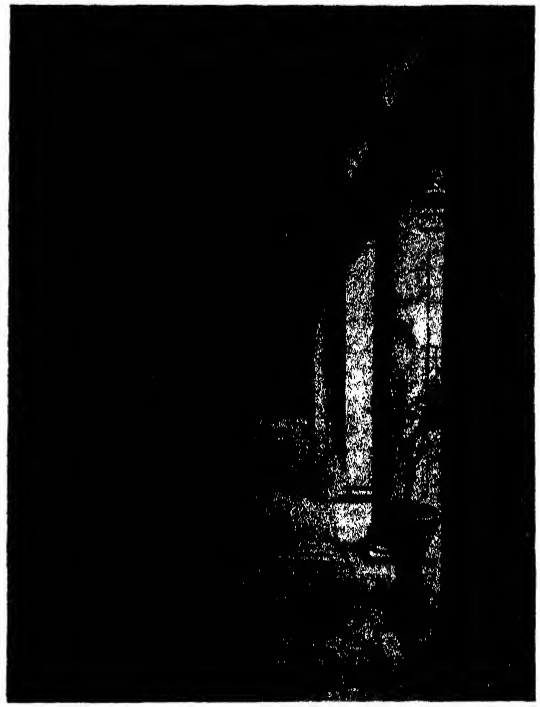
The lighting of stairways is also a problem of major importance, and one which is often overlooked. Light from above or from windows on landings or in side walls must be provided for the stairs themselves. Often this light also contributes to the lighting of the connecting corridors and lobbies.

In arriving at the correct solution of stairways, considerable thought and study are required. This element of circulation should not be left for a hasty consideration after the other elements are located. The stairways should influence the scheme of each successive study. After the stairway takes its assigned place in the plan, a type should be selected, although the designer probably already has very definite ideas about it by this time. The type chosen should be the one which is best suited to the space available and to the character of the building. If there is ample room and an effect of grandeur is desired, a single, monumental flight with considerable architectural embellishment, such as is shown in Fig. 113 A, may be used. Unless the distance between floors is small, it is always advisable to break the run with landings in order to afford a place for a slight pause or rest and to make a turning easy and logical. If space is to be conserved in a longitudinal direction, the flights may return parallel to each other, forming the two-way type, as in Fig. 113 B. A stairway of this kind may have an open well, or space between the flights, in order to allow light to penetrate to the lower levels and to give a sense of spaciousness.

The three-way stairway, or one with a centre flight and two side flights—one returning on each side—offers a more monumental and symmetrical composition than the one just mentioned. It is sound reasoning, in this case, from the standpoint of circulation, to make the width of the centre run greater than that of the other two, as shown in Fig. 113 C. This centre flight is the one which usually rises from the floor, unless the exigencies of the plan require the opposite treatment. If a graceful and decorative effect is desirable for the stairway, it may be of a curved type within a circular or elliptical space. There are few architectural elements more beautiful than the rhythmic spiral of this motif. Fig. 113 D shows an example which has its counterpart in the halls of our Georgian and Colonial houses, borrowed from Italian and English palaces.

The four types of stairways shown on page 113 may present many variations, and no attempt is made here even to enumerate them. These examples just discussed are fundamental, and from them the student may develop his own combinations. In doing this, however, there are a number of practical requirements which must be satisfied if a successful solution is to be attained. A window may be a little too small or too large without being conspicuously at fault. A stairway, with its direct contact with human movement and comfort, can err but little in its mission of providing vertical circulation. Stairways should display those proportions which time has shown to be the most satisfactory in their relations to each other. The height of the riser should be such that the pitch is not too steep, making the stairway difficult to ascend, nor too low, resulting in wasted effort. Current practice in design and construction recommends that the angle of the stairs be about thirty to thirty-five degrees with the horizontal. Indicating specific dimensions, it is found that the tread—with its nosing or moulded projection beyond the face of the riser—may vary between ten and thirteen inches, and the riser may be from 6 to 7¾ inches high. However, the combination should be related to the human stride, and the larger dimensions in each case should not be used together. A common rule is that the sum of the riser plus the run, or tread without the nosing, should not exceed 17½ inches. When designing a stairway, sec-





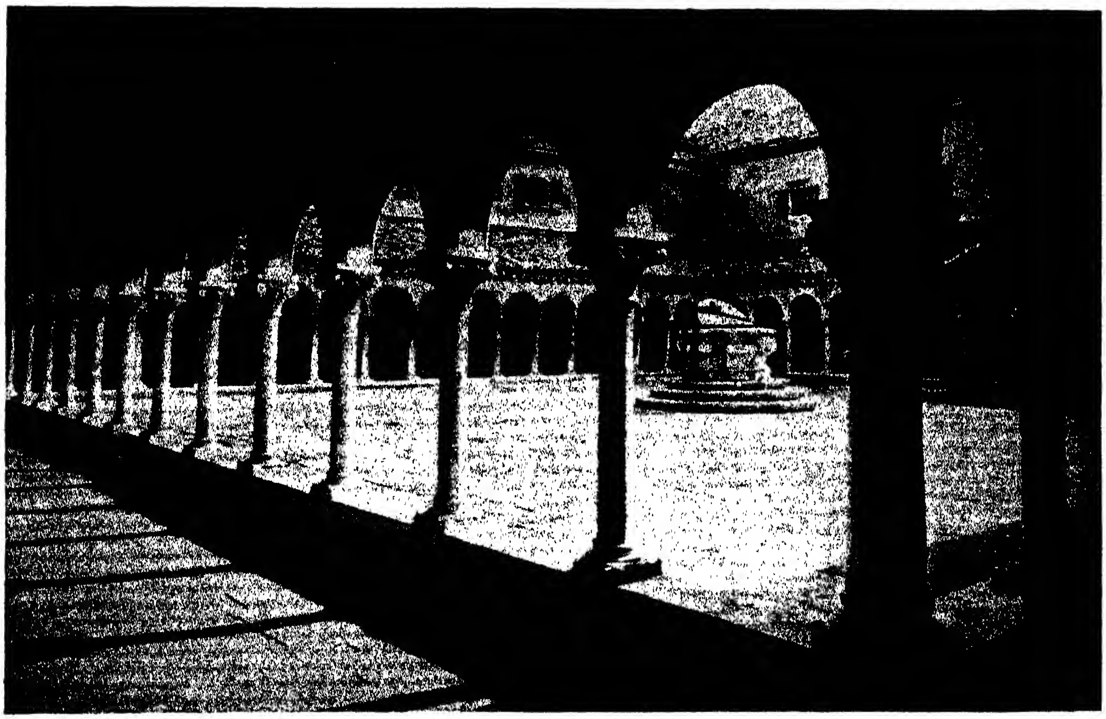


FIG. (A), above.—Laon Cathedral, Triforium. A Gothic passage with clustered piers, pointed arches, and vaulting. Verticality.

FIG (B), above.—Palazzo Pietro Massimi, Rome. Portico of courtyard. Renaissance barrel vault with penetrations. Formality.

FIG. (C), below.—S. Michele, Venice. Romanesque cloisters with exposed timber roof, stone columns, and round arches. Horizontality.

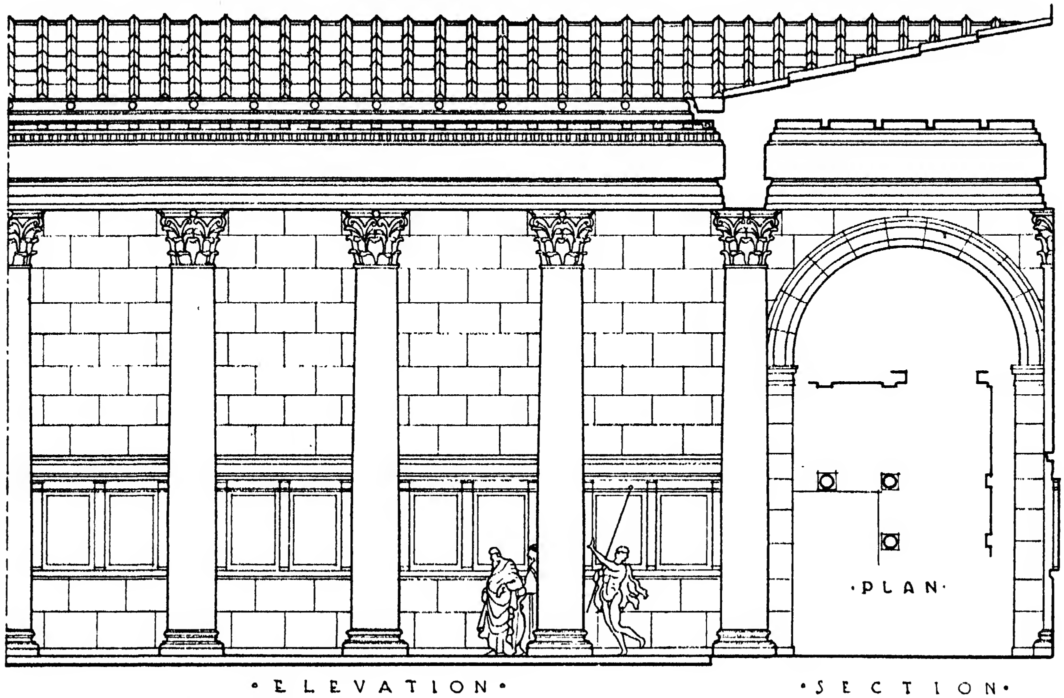


FIG. A ROMAN COLONNADE

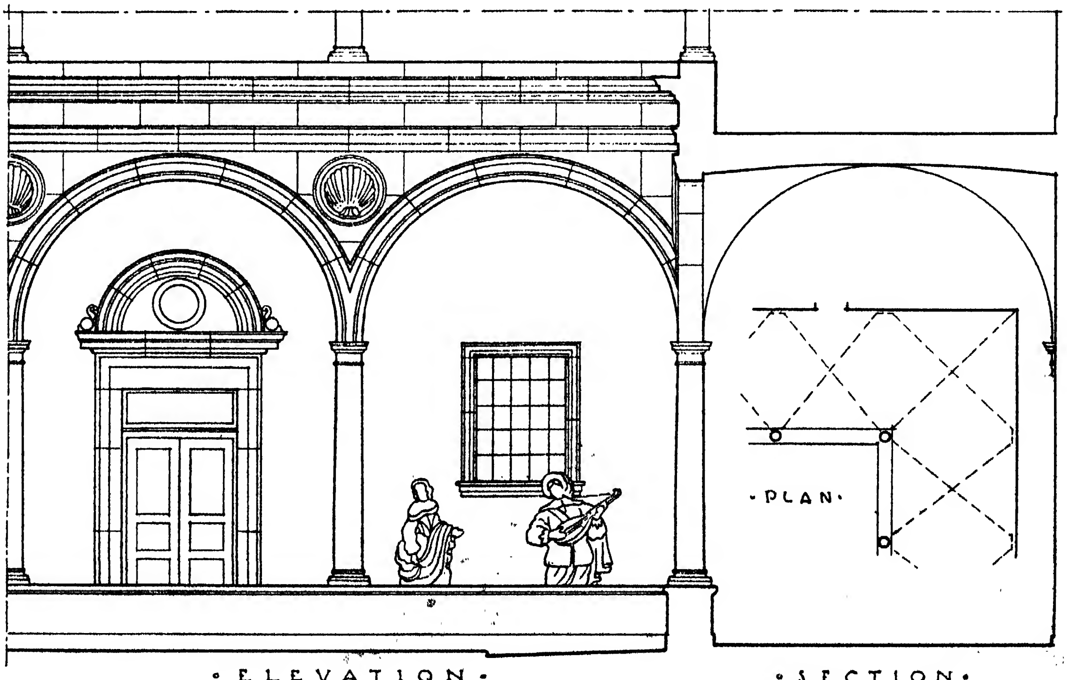
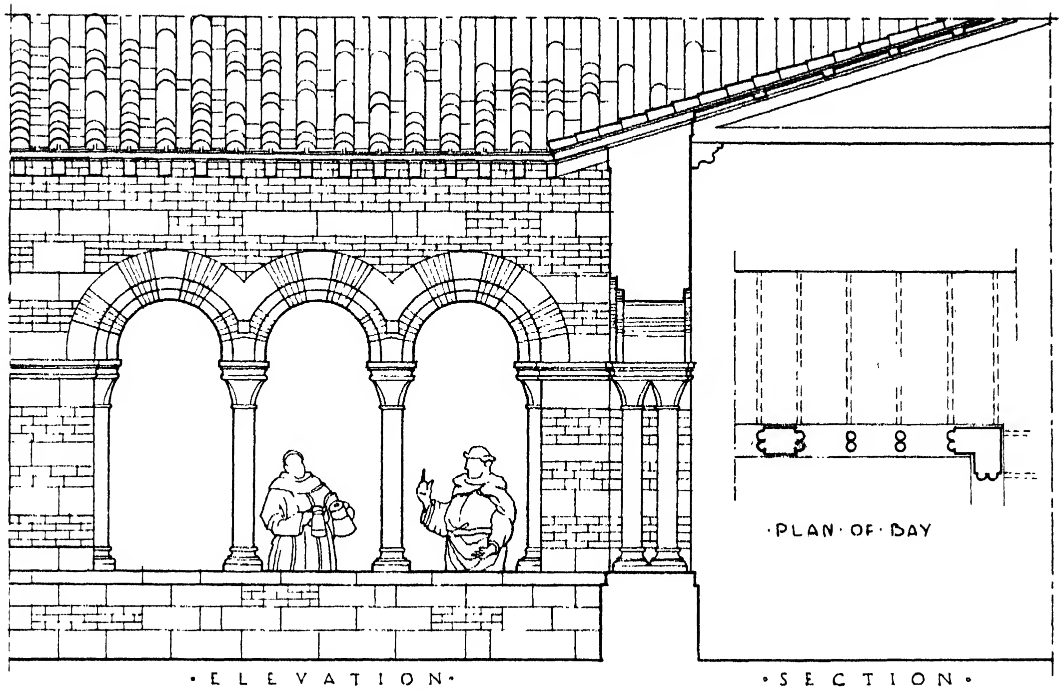
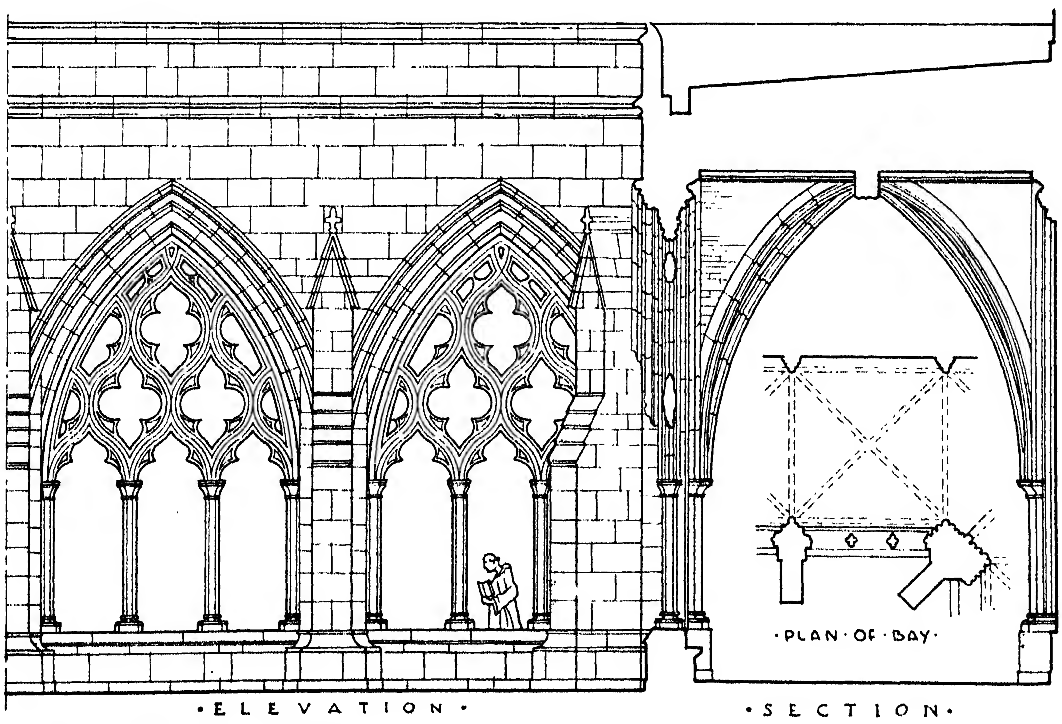


FIG. B RENAISSANCE ARCADE



· FIG · (A) · A · ROMANESQUE · CLOISTER ·



· FIG · (B) · A · GOTHIC · CLOISTER ·

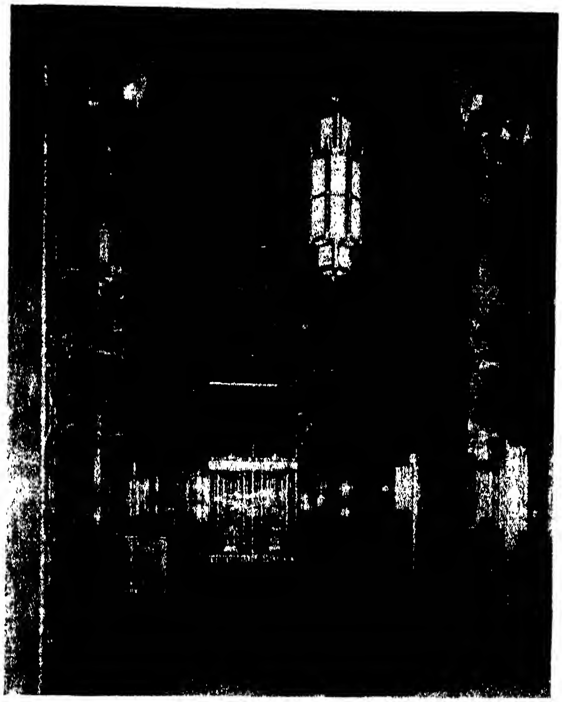
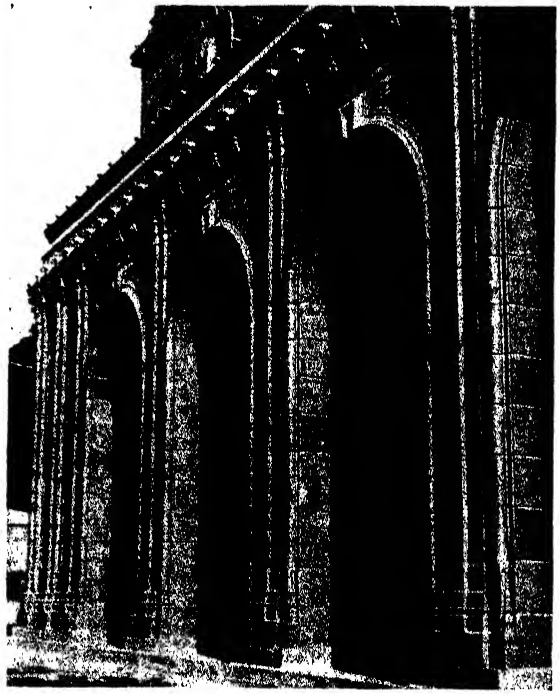
tions and elevations should be developed which will show the number of steps necessary, the location of the landings, and the presence of ample head room. The latter should consist of not only actual head room but visual head room as well. Its appearance should relieve one of any doubt as to his physical comfort. The lack of head room is more noticeable in descending than ascending, because in going upstairs the head is down and the figure is slightly bent or stooped.

Stairways should be confined to stair halls, which may be square, rectangular, octagonal, or curved in plan. Stairways should not begin in one space and cut through walls in a haphazard manner to arrive at some illogical destination. One of the most common faults of beginning designers is their apparent disregard for the unity of a stairway. It must start in the proper place, but it is just as essential that it land at some predetermined, correctly located position. Only by a thorough study of relations, types, and proportions can the successful solution of the problems associated with stairway design be reached.

PASSAGES. In the plans of most buildings there are certain elements given over exclusively to the function of providing circulation. Rooms may be devoted to work, recreation, assembly, etc., but it is necessary that these units be connected in such a way that one may go about the building without intruding upon the privacy of the separate parts. Passages may be divided according to their location on the plan. If they are found upon the interior, they are usually called corridors or lobbies (Fig. 121 A); if upon the exterior, they may be in the form of arcades, cloisters, colonnades, or loggias (Fig. 117 C).

Corridors are often designed more from the standpoint of utility than for effect. It is true that an impressive vista may be obtained by the use of a long passage with an interesting climax at the end, but as a rule corridors are simple in treatment and serve simply to join the decorative lobby with the more important units of the plan. In providing passage, the corridor should be dimensioned in accordance with the circulatory needs of the building—large or small, depending upon its position. It may extend down the centre of a wing and be bounded on either side by rooms, or it may run alongside of a single series of rooms. Corridors and lobbies should be adequately lighted, and their decorative treatment should be such as to not necessitate members with excessive projections. In order to give interest, their walls may be broken with pilasters or panels, which, if possible, should have some relation to the structural scheme of the building. It is needless to add that the character of the wall treatment should harmonize with the adjoining rooms. A reference to the drawings on pages 118 and 119 will show the importance of corridors and lobbies in plan study.

External passages may occupy various positions in the plan. They may surround courts and provide shelter from the sun and rain. They may decorate the façade and emphasize the entrance. They may be more than one story high, as in Fig. 118 B, and they may be roofed or carry the wall of the story above. They may be vaulted with simple barrel vaults, Fig. 117 B, or groined vaults, Figs. 119 B and 121 D, or finished with flat, beamed, or coffered ceilings, Fig. 118 A, or with exposed pitched roofs, Fig. 117 C. This will vary with the style used and the character desired. During the Classical period, the colonnades of the temples were monumental in scale and arrangement, as in Fig. 118 A. The cloisters of the Romanesque and the Gothic were smaller in size and more informal in their treatment (page 119). The arcades of the Italian Renaissance were open in character and graceful in their proportions, as shown in Fig. 118 B.

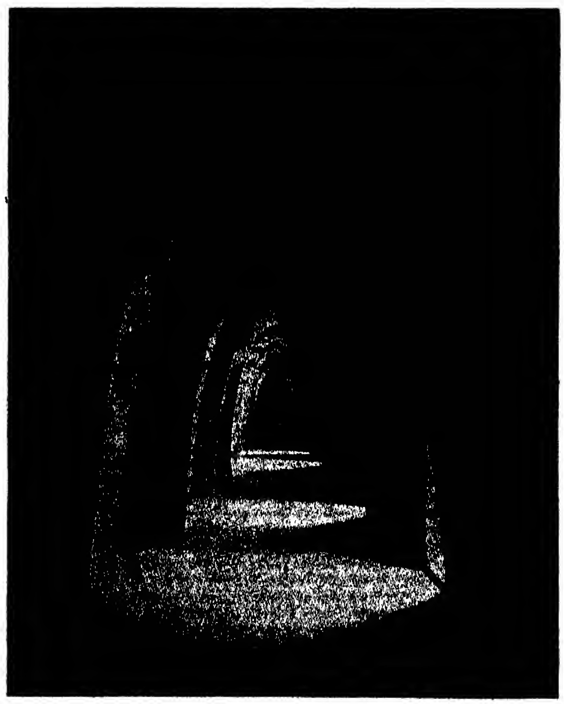


FIG. (A), above.—City Bank Bldg., New York. The lobby in contemporary architecture; polished marbles and metals.

FIG. (B), above.—Store Bldg., Honolulu. Arcade. Unique interpretation of Renaissance details. Terra cotta. Note jointing.

FIG. (C), below.—Church, Bishofsheim, Germany. Aisle. Concrete and the parabolic arch. Rhythmic repetition of form.

FIG. (D), below.—Institution, Copenhagen. Arcade with simple cross vaults and square piers. Uninterrupted circulation.

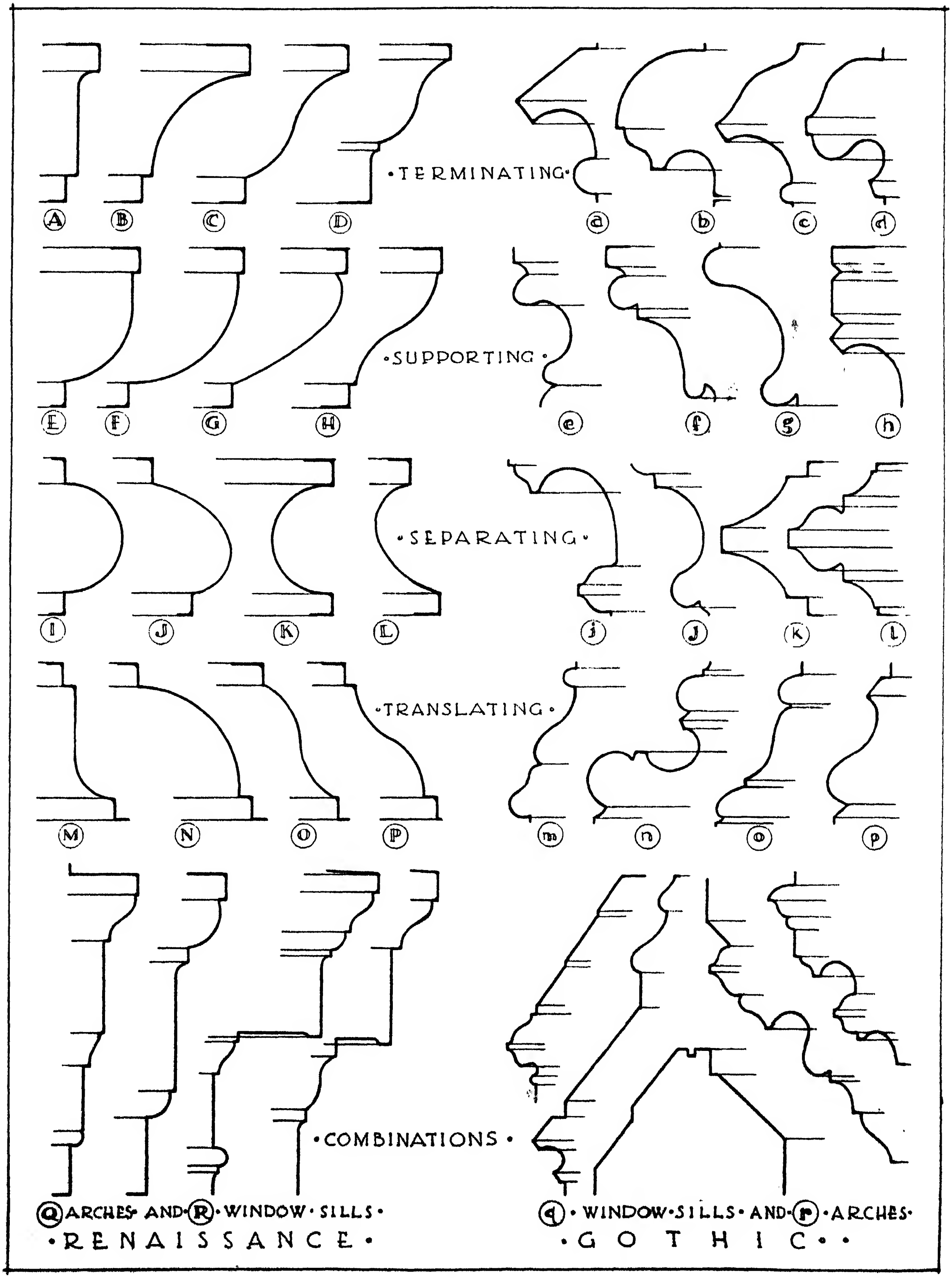
Decorative Elements

In attempting to reach the solution of an architectural problem, it is first necessary to consider the mass and the general proportions of the building and then later to study the details of the elements of which the former are composed. In spite of the secondary importance of those decorative features which embellish a structure, it is essential that a complete understanding be had of the principles which govern their design. Decoration may consist of mouldings, conventional carving, sculpture, surface pattern, etc., secured by the use of stone, wood, metal, or color.

MOULDINGS are architectural elements which are composed of narrow, curved and flat projecting or receding members arranged in such a manner as to give a play of light and shade and to furnish emphasis to certain parts of a building. Although they may have a structural significance, they are essentially decorative in their function. The study of mouldings is a very important phase of architectural design but one which, unfortunately, is often neglected by both the student and the practicing architect. A designer may have considerable knowledge of plan composition and still know, or apparently care, little about the use of details and the theory underlying the successful combination of moulded members. It is imperative that this part of design should receive due consideration.

In order to approach the study of mouldings in a confident manner, it is necessary to know something of the types available, their development, and the purpose of their different parts. The cornices of Classical and the moulded courses of Gothic architecture are the outgrowth of the influences of man and nature which should be understood by those working with these forms. If an analysis is made of the functions of various mouldings, it will be seen that their shapes are dependent upon their positions in the composition. Since Classical mouldings form the basis for those which follow, we shall refer to them on page 123 and classify them according to their purpose. They may (1) terminate, (2) support, (3) separate, or (4) translate. Those in the first division are the ones which crown a group of mouldings or a cornice (Fig. 123 A–D). Their final direction is usually horizontal, since there is no load to be carried and since their function is the protection of the members beneath. The supporting mouldings are more sturdy in character and vertical in general direction, thrusting upward in a manner which leaves no doubt as to their intention. They must appear to carry the weight of the members above, as in Fig. 123 E–H. The mouldings which separate are those concave, convex, and flat surfaces which give interest to a composition by reason of introducing a change of direction between two more important elements. Size is always a determining factor in the classification of mouldings. The convex tori in Fig. 123 I–J may be increased in size until they lose their identity as separating members and become important parts of a translating motif. The mouldings in this last division usually have an outward and downward direction to their contours. They are used at the base of a column or wall and help to translate the weight above to the broader area of the plinth below (Fig. 123 M–P). Their function is to create a spread of surface at the base for support, just as the terminating mouldings do for protection at the crown. It is only by an appreciation of the origin of these various mouldings and of their correct use that details can be successfully interpreted.

Mouldings may be combined into cornices, belt courses, arches, capitals, or base



A B C D
a b c d
•TERMINATING•
E F G H
e f g h
•SUPPORTING•
I J K L
i j k l
•SEPARATING•
M N O P
m n o p
•TRANSLATING•
•COMBINATIONS•
Q ARCHES AND R WINDOW SILLS
•RENAISSANCE•
q WINDOW SILLS AND r ARCHES
•GOTHIC••

courses. It is possible to copy mouldings directly from other sources, but even this cannot be done with confidence unless the designer has a knowledge of their purpose, scale, and character. If mouldings are to be modified or developed to harmonize with existing conditions, it must be with an understanding of the principles of composition and particularly with a realization of the importance of the contrast which may be secured by the combination of flat and curved surfaces. This contrast is made possible by the effect of light upon the contributing parts. The quality of the sunlight, the reflection of light, and the depths of the direct and reflected shadows, all play a rôle in the drama of mouldings. In securing a proper combination of members, in allowing crowning mouldings to cast direct shadows and dentil courses to create reflected shadows, care must be taken to see that all parts are in scale with each other and with the rest of the building. Classical mouldings have so successfully withstood the critical analysis of centuries that their proportions should serve as a guide to the designer. A well-composed entablature or belt course must also have proper variety in the size and shape of its members, alternating large and small, flat and curved, so that weakness and indecision may disappear.

The quality of mouldings may vary with the materials used and the effect sought. The climate of the country and the nature of its inhabitants also have profound influences. Mouldings may be subtle or mechanical in their contours; they may be delicate or coarse, weak or strong. During certain periods of historic development, they have been noted for their refinement of line. Greek mouldings usually assumed the character of sensitive freehand curves. This was due to the influence of the strong sunlight which rendered pronounced changes in direction undesirable, to the use of a fine, close-grained marble which permitted superior workmanship, and to the persistency of the people in their pursuit of abstract perfection. The architects of the early Renaissance in Italy also developed delicate mouldings and carvings which are characteristic of their tombs and interior details. Some phases of the Renaissance in England, particularly that associated with the Brothers Adam, are recognized by the high state of refinement of their decorative elements. Our own Colonial period is another example of the thought which may be given to the design and execution of mouldings. The slender and graceful forms of this movement show a sympathetic understanding of the nature of wood which is susceptible to this often desirable refinement.

On the other hand, Roman mouldings are mechanical and cold as compared to those of the Greeks. The Romans were not imbued with the same creative spirit, and their curved surfaces took on the contours of parts of a circle instead of freehand curves. The mouldings of the Romanesque buildings, though naïve and interesting, are usually coarse variations of the Classical. The mouldings of the Gothic are complex but vigorous and robust; those of the late Renaissance, or the Baroque, are heavy and florid.

A comparison of the two contrasting systems of mouldings—the Classical and the Gothic—will indicate their salient differences and their important characteristics.

Classical or Renaissance mouldings are composed of curved and straight sections, combined in manners which have become almost invariable in use, as shown in the impost caps, arches, and sills in Fig. 123 Q–R. As seen on page 123, typical mouldings are called the cavetto (*B*), scotia (*L*), torus (*J*), or ovolo (*F*), while combinations give the cyma recta (*D*) and the cyma reversa (*H*). The flat members of the Classical cornice are called the corona and the fillet. Gothic mouldings do not lend themselves so readily to such classification, even though they are derived from these shapes just mentioned and often bear a resemblance to them. Gothic mouldings are more complex in their composition than are the Classical, being combined with the greatest amount of freedom. The curved members, though often approaching a circle in cross section, do not abide by any mechanical methods of reproduction. The resultant flowing lines show frequent changes in direction. The concave and convex surfaces, separated at times by small fillets, are often alternated with deeply undercut sections in order to catch the maximum amount of light in the grayness of the northern climate (Fig. 123 b–d). This device, when employed in Italy, gives a feeling of restlessness to the architecture. The large, flat surface of the Classical corona is not often employed in Gothic moulded elements. Fig. 123 Q–R and Fig. 123 q–r afford an opportunity to compare Classical and Gothic window sills and arch mouldings.

THE ORNAMENT which adorns the structures of the past and the present consists, on the whole, of carvings in stone and wood. These may be mouldings or they may include those other forms of carved details which cannot be classed as mouldings. It is difficult to tell where mere carving leaves off and sculpture begins, or where one should stop in a discussion of architectural embellishments. For, in addition to strictly architectural decoration, there must be included under the heading of ornament the products of the arts of painting and sculpture. The artist, sculptor, and metal worker have all contributed the decorative elements of each period of development.

Ornament may be analyzed, first of all, with reference to its character:

1. Abstract.
2. Pictorial.
    - Naturalistic.
    - Conventional.
3. Non-Pictorial.
    - Naturalistic.
    - Conventional.

Abstract Ornament is that which has no reference to any particular object, or at least to any familiar, easily recognized object. It is abstruse, and into it a meaning must be read by the observer. It usually consists of a pleasing arrangement of geometrical forms to produce a pattern or composition. Much primitive decoration is abstract to us, although the designs may be pregnant with meaning for those who developed them. Contemporary architecture, with its conventionalized masses and treatments, has gone to abstract and primitive ornament as one of its sources of inspiration, as seen in Fig. 140 A–B. Modern decoration is often produced as a result of the influence of the simple straight and curved lines shown on page 140.

Pictorial Ornament usually has less connection with architecture than with some other forms of expression. Pictorial art must tell a story. In the accepted sense, it must be a narrative—a pastoral scene or a battlefield, tranquillity or death. Naturalistic, pictorial decoration is not in sympathy with the architectural planes of a building. Scenes from biblical or secular history are sometimes depicted in the sculpture of a church or a public building, but the results are more satisfactory if the figures are reduced to a convention. Realism has little place in architecture. It is too difficult and too presumptuous of man to attempt to reproduce realistically in wood or stone beasts of the forest and plants of the field. Such efforts are "aside from art and materials apart." Man should not compete with nature. Also, realistic figures do not "stay in place." They tend to detach themselves from the rigid lines of the structure (Fig. 74 A). Conventionalization should consist of the simplification of the design and its reduction to a basic structural pattern which will express the character of the material to be used. Figures 135 A, 136 B, 142 C, and 143 B, show sculpture from various periods which has been conventionalized so that it might be more architectural in its meaning. In another field of art, by way of comparison, Japanese prints represent conventionalism whereas the paintings of the late Renaissance strive for realism.

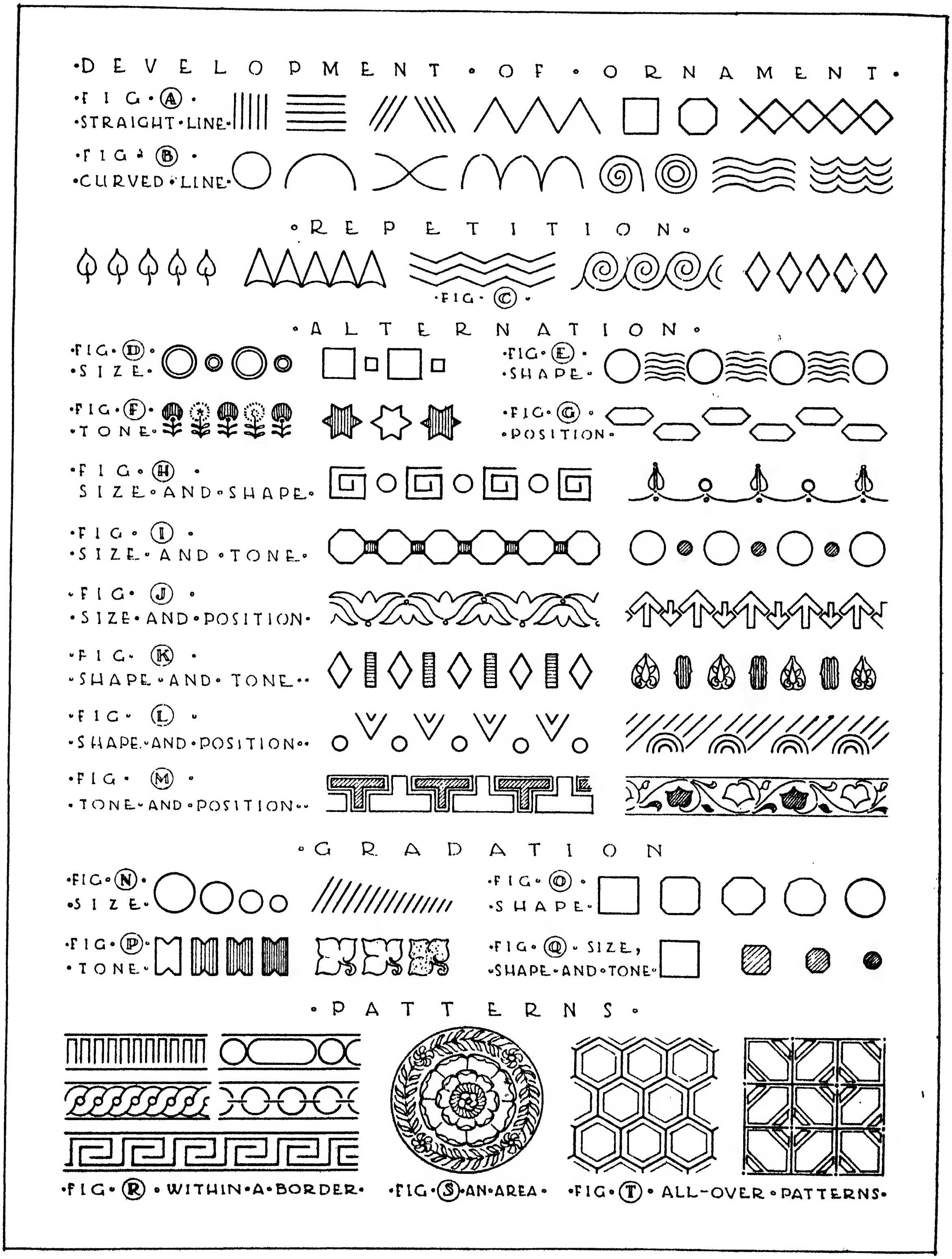
NON-PICTORIAL ORNAMENT does not tell a story—there should be no pictorial meaning to the design. It is, of course, difficult to put all examples in water-tight compartments; one may not be able to place accurately the boundary lines between the different groups. Classification should not be too arbitrary. However, much of the carving of the various historic periods belongs to this non-pictorial type. The egg and dart and anthemion motifs of the Classical, the intertwined forms of the Romanesque, the crockets, crestings, and capitals of the Gothic, and the garlands and ribbons of the Renaissance (all seen on pages 130 and 131) are usually of the non-pictorial kind. Whether they were naturalistic or conventionalized—although often the latter—depended upon the sculptor's desire to imitate nature.

Another approach to decoration is by way of the form which it assumes, as:

1. TWO-DIMENSIONAL.
    - Painting.
        - Painted decoration.
        - Murals.
        - Frescoes.
    - Mosaics, tiles, marbles.
    - Inlays of metals, woods, etc.
2. THREE-DIMENSIONAL.
    - Ornament, carved, cast or hammered.
        - Low relief.
        - High relief.
    - Sculpture.
        - Low relief.
        - In the round.
        - Free-standing.

During many of the periods of development there has been collaboration among architect, painter, and sculptor. This cooperation is conspicuous in contemporary design. It is most successful if the different artists work together from the beginning of the project. The murals and the sculpture should be an integral part of the composition—not merely an afterthought. The architect should know as much as possible about the advantages and the limitations of painted, carved, and applied decoration.

Low-Relief Sculpture is best represented by the bas-reliefs of the Egyptians and the Assyrians and also by some of the modern efforts in concrete (Fig. 188 B). If we wish to find examples of carving or sculpture in high relief or in the round, we may turn to almost any of the historic styles since antiquity, as shown in Figs. 75 A and 101 C. If we should


DEVELOPMENT OF ORNAMENT
FIG. A. STRAIGHT LINE
FIG. B. CURVED LINE
REPETITION
FIG. C.
ALTERNATION
FIG. D. SIZE
FIG. E. SHAPE
FIG. F. TONE
FIG. G. POSITION
FIG. H. SIZE AND SHAPE
FIG. I. SIZE AND TONE
FIG. J. SIZE AND POSITION
FIG. K. SHAPE AND TONE
FIG. L. SHAPE AND POSITION
FIG. M. TONE AND POSITION
GRADATION
FIG. N. SIZE
FIG. O. SHAPE
FIG. P. TONE
FIG. Q. SIZE, SHAPE AND TONE
PATTERNS
FIG. R. WITHIN A BORDER
FIG. S. AN AREA
FIG. T. ALL-OVER PATTERNS

attempt to distinguish between carving and sculpture, we must take the most obvious example in each case, for midway between the two extremes it may be impossible to define clearly the line of demarcation. It is quite evident that the decoration of Classical mouldings is carving while the figures from Chartres Cathedral, Fig. *131* M, are sculpture.

Sculpture, in some form or other, has been conspicuous in most architectural movements. During the Classical period it was used to decorate the pediments and friezes, and, in addition, statues were placed between the columns of the peristyle and were important for themselves alone. During the Middle Ages, sculpture was architectural in its character and played an important part in the adornment of the churches. The Renaissance employed it for decorative purposes but also released it from the strictly architectural function imposed upon it by mediaeval builders, and free-standing sculpture was again in evidence. In the present century, both types are prominent with a tendency toward conventional architectonic sculpture.

Abstract and conventionalized ornament, then, may consist of two-dimensional surface patterns secured by contrasting tones or colors of paint, metals, marbles, tiles, etc., or of three-dimensional carvings in low or high relief. These decorative forms did not blossom forth in their present types overnight; they have developed slowly. The basic elements and the situation into which they have been organized are as follows:

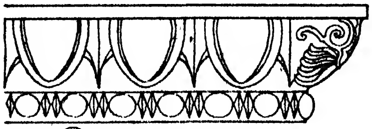
1. Origin.
   - Straight line.
     - Fret, zigzag, diaper, square, triangle, etc.
   - Curved line.
     - Wavy line, spiral, scroll, oval, circle, etc.
2. Composition.
   - Arrangement.
     - Within a border.
     - Within an area.
     - All-over pattern.
3. Treatment.
   - Variation of size, shape, tone.
     - Informal.
     - Formal.
       - Repetition.
       - Alternation.
       - Gradation.
   - Radiation, balance, emphasis, etc.

All ornament, or all architecture, may then be said to be derivatives of straight and curved lines. No matter how complex a building may become in its massing and detail, it is possible to reduce it to these fundamental elements. The straight line and the curved line, the square and the circle, teem with latent qualities. They assume characteristics which are inherent and which develop under the guiding hand of the artist. The Straight Line is sturdy. It is masculine and belongs to architecture with a determined mission to fulfill. However, it has its moods. The vertical line expresses the spirit of the Gothic; it is proud and exalted; it is inspiration. The horizontal line represents the horizon of the seascape; it is calm and peaceful; it is repose. The diagonal line symbolizes the flight of geese; it is vigorous or even angry; it is action. The CURVED LINE is more subtle than the straight. It is more graceful and sensitive. It is feminine, and represents that architecture which caters to the emotional rather than the physical. It may vary from the mechanical circle or the rhythmic spiral to the freehand curve.

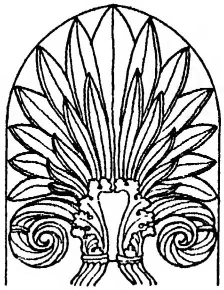
From the straight and curved line have been developed the combinations of simple forms, as seen on page 127. Repetition is the most easily understood, with alternation and gradation of various kinds following in close order. These conventionalized shapes may suggest the ornament of the Classical, the Gothic, or the Renaissance. If the sources of the Occident prove uninspiring, the Orient will supply unlimited imaginative energy. The egg and dart moulding of the Greeks is an example of alternation within a border. The tiles of the Saracens illustrate the use of a motif within an area, and the grilles of the Chinese temples show the application of the all-over pattern. Modern ornament, however, should not be approached through stylistic developments—it should not even be copied from other contemporary examples. It should be based directly upon the materials used and the effects desired. The straight line and the curved line are the alphabet, and they should be combined in repeating or alternating arrangements according to the rules of good composition. Modern ornament, as Greek or Gothic, should harmonize with the character of the building. It should have emphasis, balance, and rhythm (Chapter XIV). Its successful application depends upon the creative ability of the designer, not upon his skill in finding ready-made substitutes.

PERIODS. The ornament typical of the different periods varies from the simple decorations of mouldings to the intricate carvings of human and animal forms. In Greek architecture the ornament was delicate and refined, which permitted the adornment of the curved mouldings without sacrificing their shape and identity. The egg and dart, the bead and reel, the anthemion or honeysuckle, the stele cresting, and the fret were popular motifs, as seen on page 130. The sculpture of the Greeks is unexcelled, and frescoes played an important part in the decoration of their buildings. The Romans made use of ornamental forms similar to those employed by the Greeks. Their carvings were bolder and richer, on account of a coarser stone and a different attitude of mind. The friezes were often embellished with swags, candelabra, and ox-skulls, which found a later reflection in the Renaissance, as on page 138. Rich marbles, stucco reliefs, murals, and mosaics completed their magnificent decorative scheme. Renaissance ornament, since it is closely related to the Classical, is also shown on page 130. It used as a prototype the details of Greek and Roman architecture—at first in a sensitive and delicate manner but later becoming richer and more ornate. Pilasters, capitals, and friezes were carved with representations of fruit, flowers, masks, and cherubs, as in Figs. 130 I to N. Tempera paintings, frescoes, and mosaics embellished the interiors of churches and palaces, while architectural and free-standing sculpture was used profusely. Ceilings and domes were enriched by the application of color in the form of paint and terra cotta (Fig. 94 B).

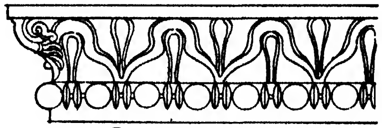
The philosophy of the ornament of the Middle Ages was different from that of the Classical which preceded or the Renaissance which followed. Plant and animal forms were treated more conventionally. As the centuries passed and Classical influence became weaker, the decorative schemes of the cathedrals became more individualistic. The Renaissance halted this and brought about a return to the ideals of antiquity.



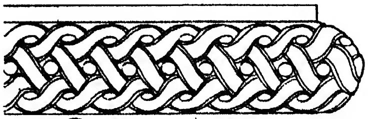
•FIG•(A)•EGG•AND•DART•



•FIG•(D)• STELE•



•FIG•(B)• LEAF•AND•TONGUE•



•FIG•(C)• TORUS•(GUILLOCHE)•

•FIG•(E)• HONEY-SUCKLE•

•FIG•(F)•BAS•RELIEF•

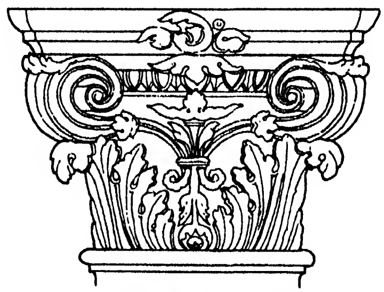
•FIG•(G)• EAGLE•

•FIG•(H)•GRIFFIN•

•CLASSICAL•ORNAMENT•

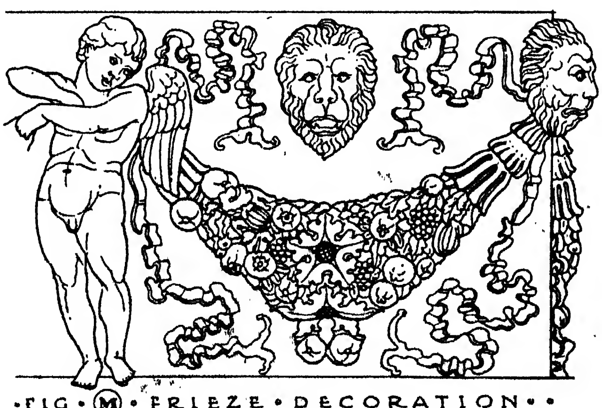
•FIG•(I)•CAPITAL•

•FIG•(J)•LION•



•FIG•(K)•CAPITAL•

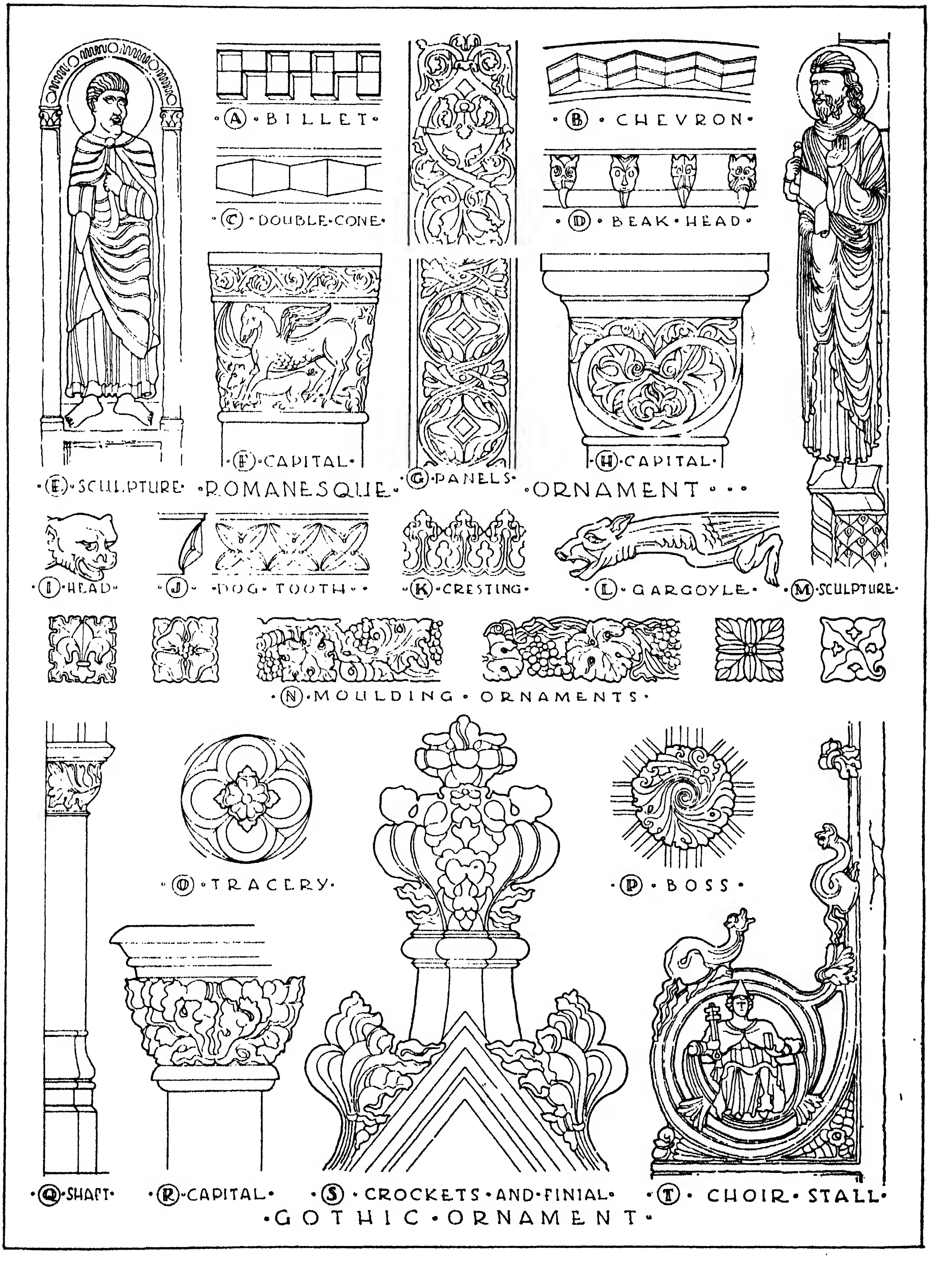
•FIG•(L)•PANEL•

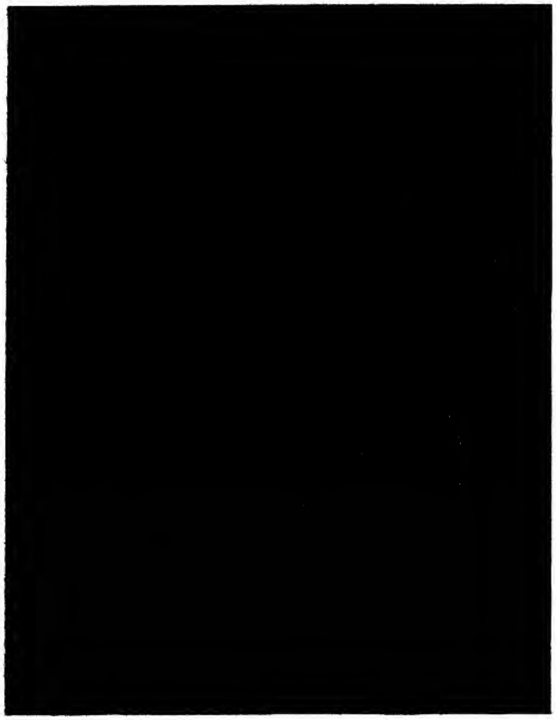


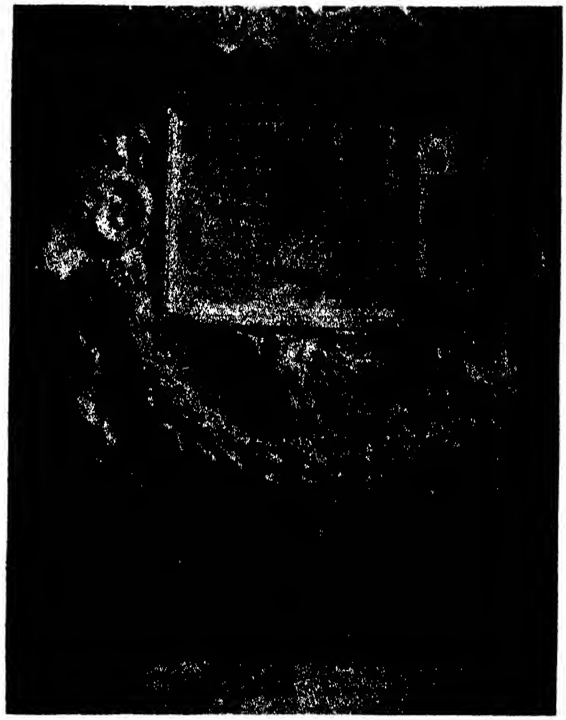
•FIG•(M)• FRIEZE • DECORATION••

•FIG•(N)•PANEL•

•RENAISSANCE•ORNAMENT•


A BILLET
B CHEVRON
C DOUBLE CONE
D BEAK HEAD
F CAPITAL
G PANELS
H CAPITAL
E SCULPTURE ROMANESQUE ORNAMENT
I HEAD
J
DOG TOOTH
K CRESTING
L GARGOYLE
M SCULPTURE
N MOULDING ORNAMENTS
O TRACERY
P BOSS
Q SHAFT
R CAPITAL
S CROCKETS AND FINIAL
T CHOIR STALL
GOTHIC ORNAMENT





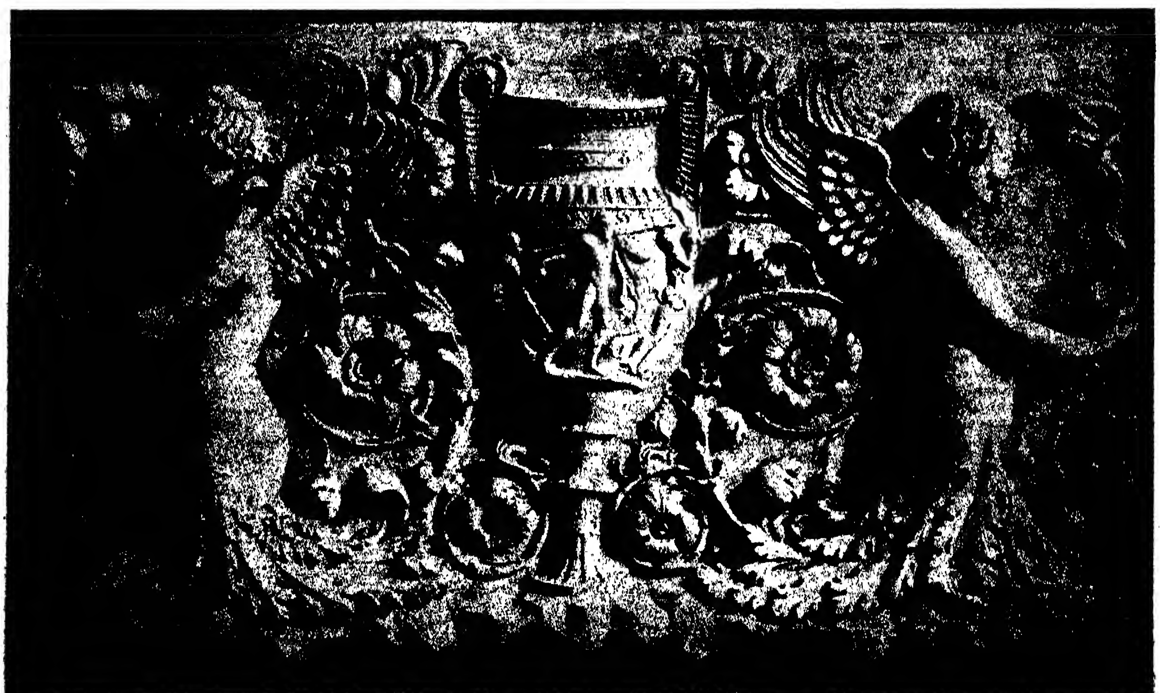


FIG. (A), above.—Table supports from Pompeii. A vigorous, conventional treatment of animal and plant forms.

FIG. (B), above.—Pedestal decorated with rams' heads and festoons of fruits and flowers.

FIG. (C), below.—Panel from the Forum of Trajan. A rich and graceful composition. Conventionalized realism. Symmetrical.

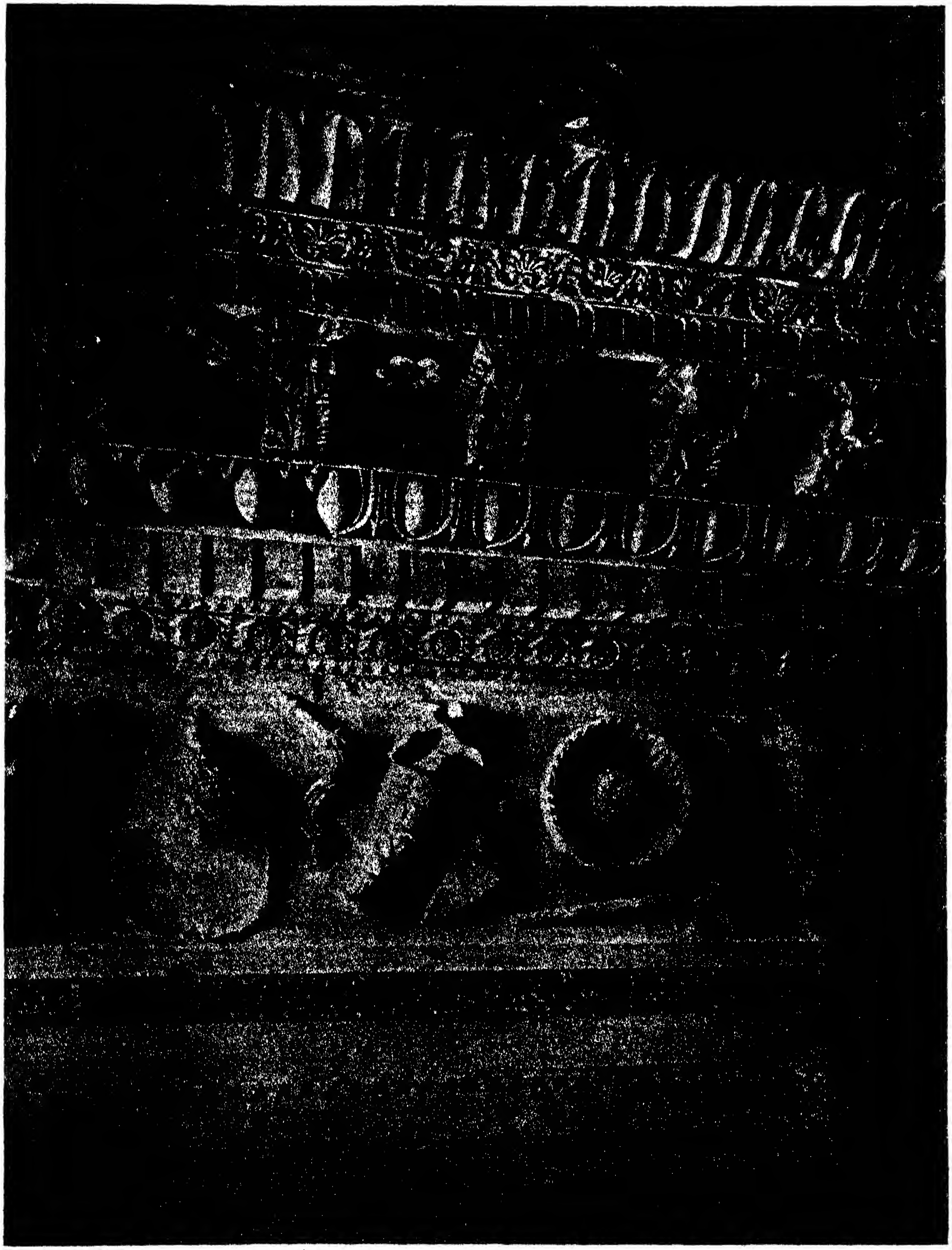
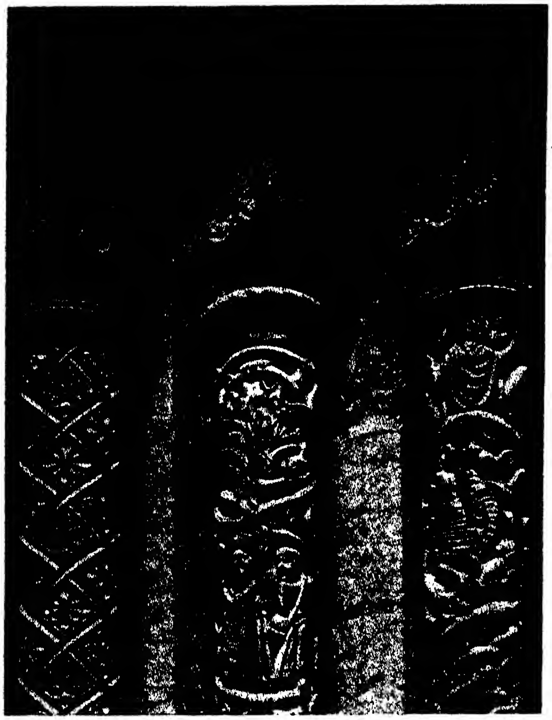


Fig. (a).—Fragment of entablature from the Temple of Vespasian, Rome. Note the relations and proportions of this part of the Corinthian Order. Mouldings richly decorated with the egg and dart, the anthemion, and the bead and reel.



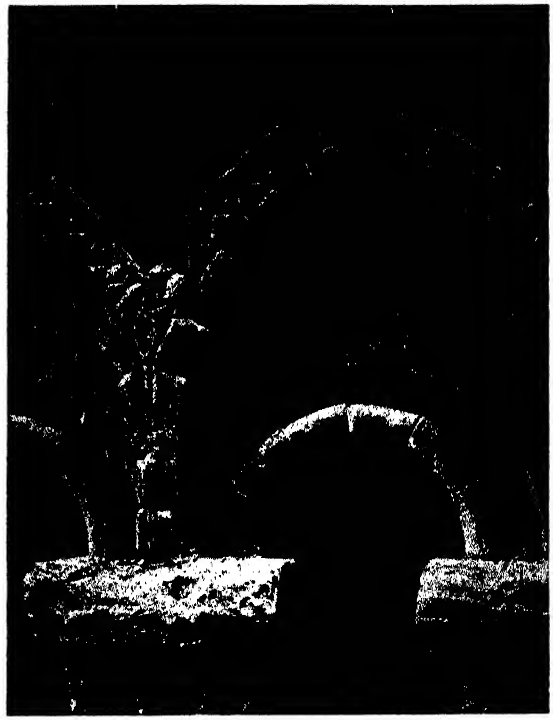


Fig. (a), above.—Lincoln Cathedral. Carved shafts and capitals; conventionalized. Norman. See Fig. 100 c.

Fig. (b), above.—Canterbury Cathedral. Norman. Simple round and interlaced arches; geometric ornament. See Fig. 65 c.

Fig. (c), below.—S. Giusto, Lucca. Lintel of doorway. Conventional, natural forms arranged to give repeating pattern. Heavy.

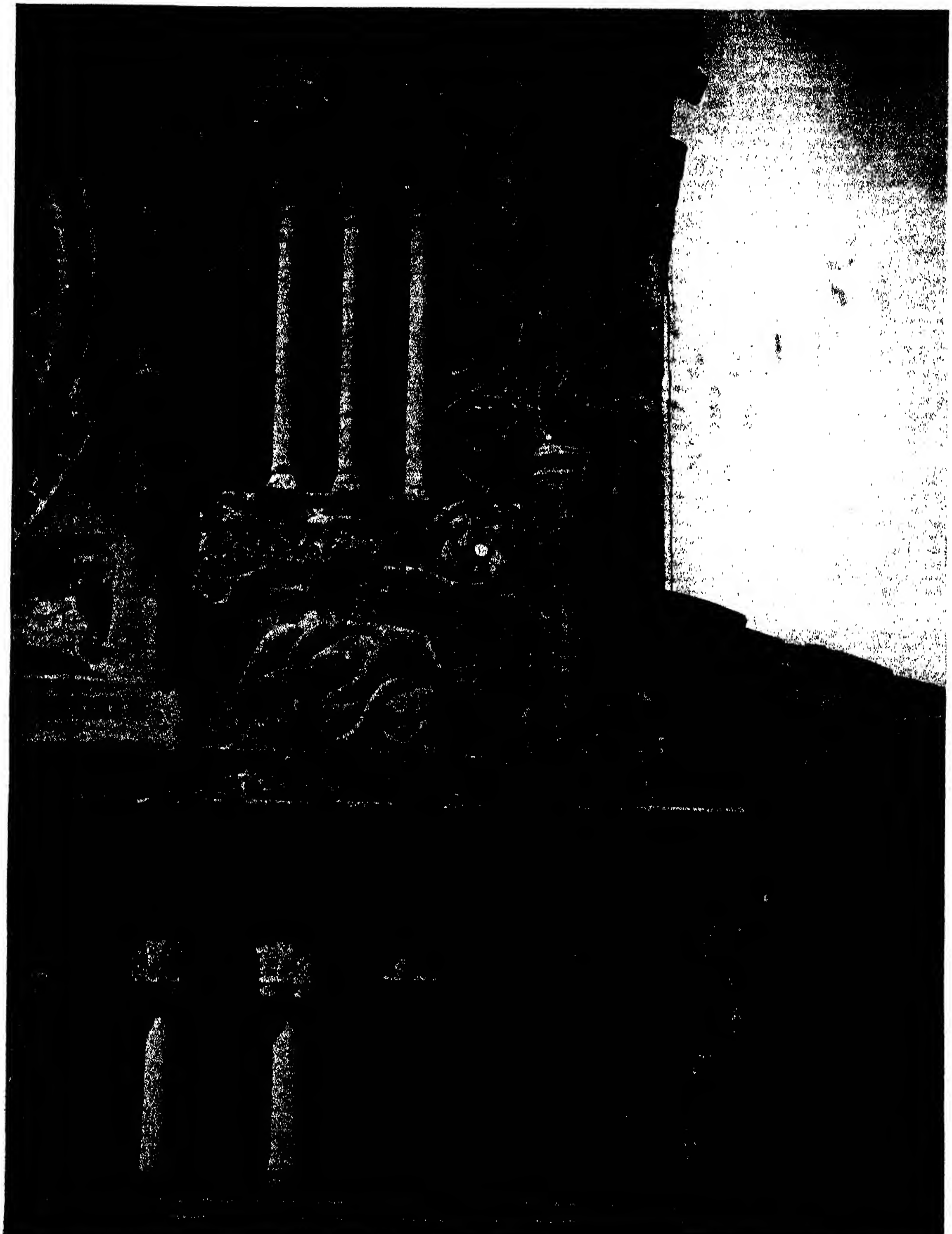
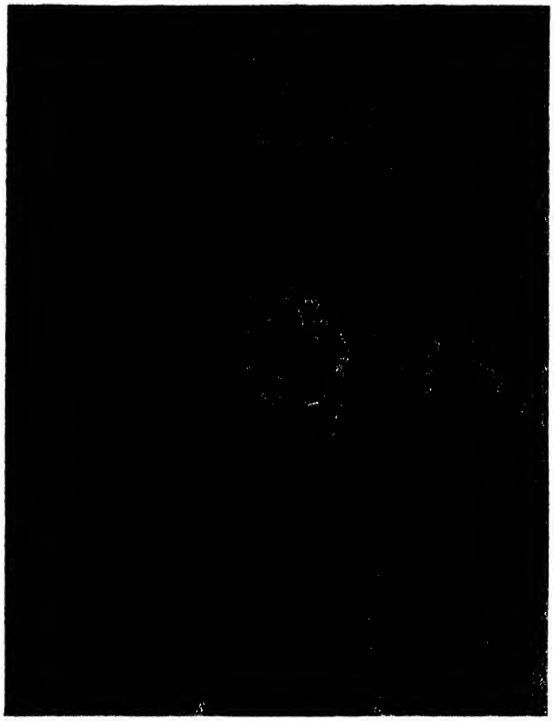


FIG. (A).—S. Pietro, Toscanella. Portion of the façade showing richly decorative arches, capitals, carving, and mosaics. The ornament is heavy but straightforward and direct. Interesting tone from shadows.



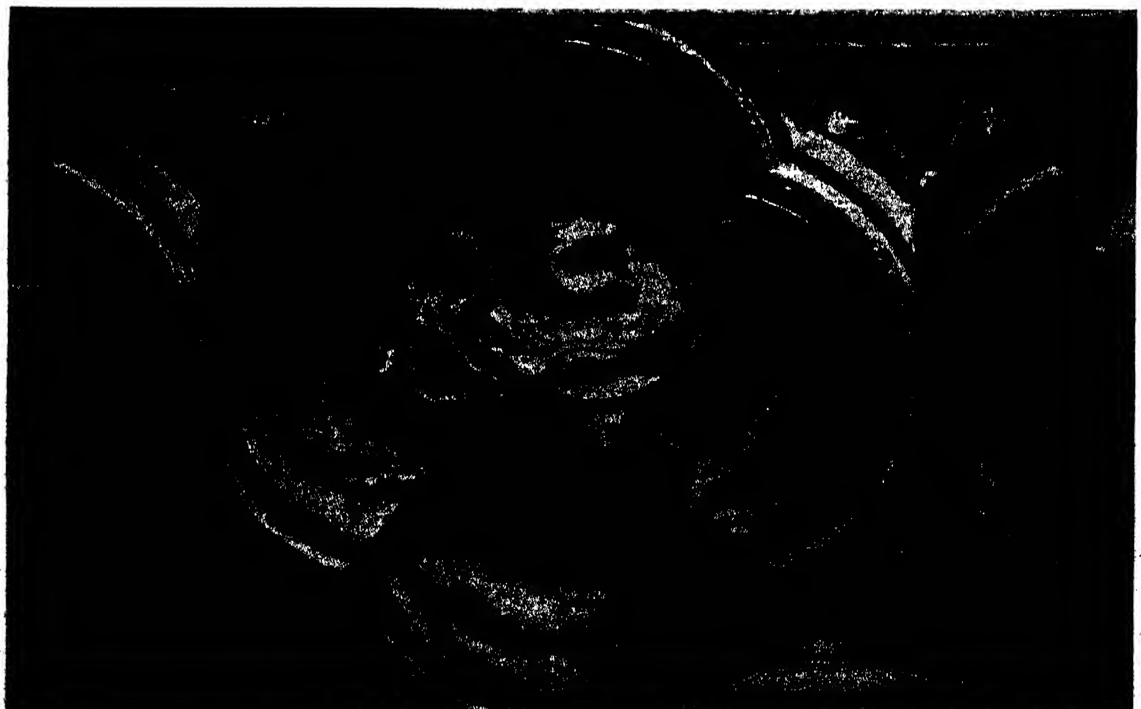


Fig. (a), above.—Lincoln Cathedral. Moulded capital, deeply undercut, with conventional, foliated carving. Crisp.

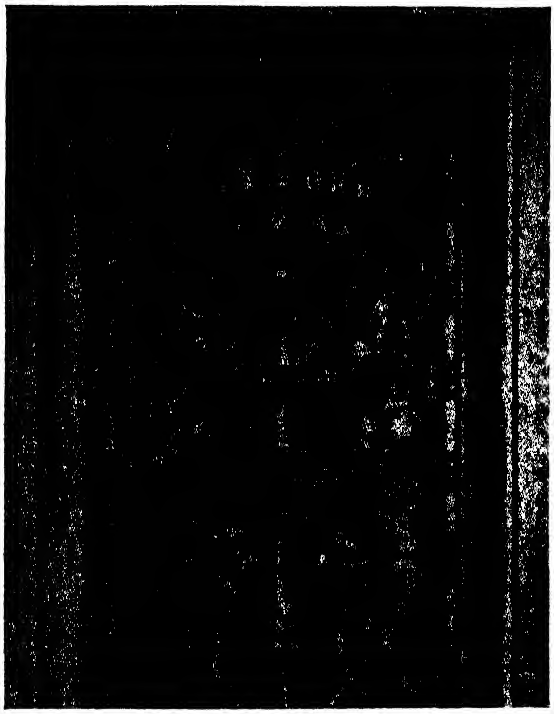
Fig. (b), above.—Lincoln Cathedral. Grotesque figure on buttress cap. Sculpture reduced to simple planes.

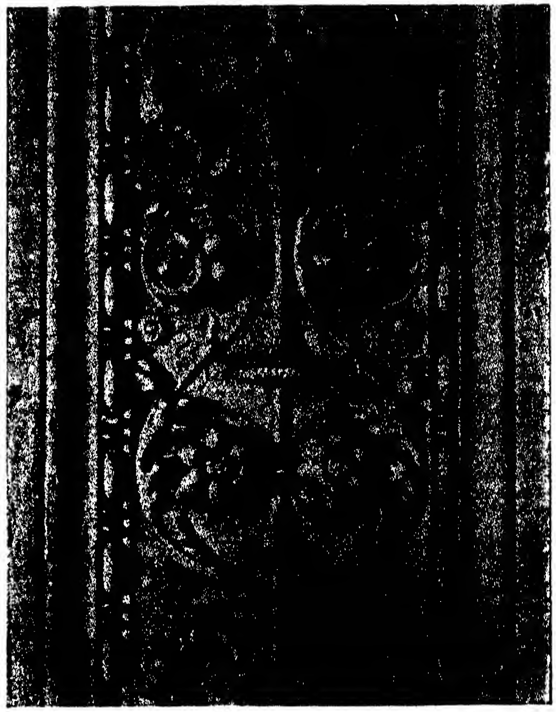
Fig. (c), below.—Lincoln Cathedral. Carving of choir stalls. Simplification of design to a pattern in sympathy with material—wood.

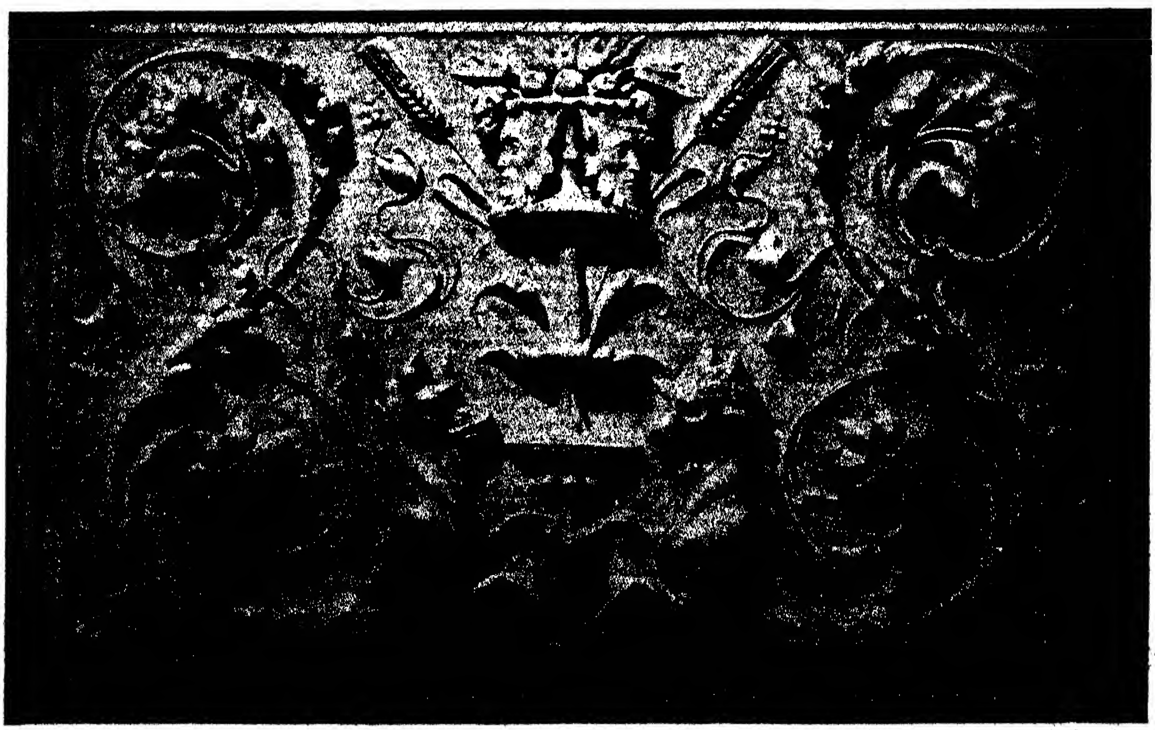
Fig. (A), above.—Amiens Cathedral. Portion of choir screen. Late Gothic, 16th century. Flamboyant; ornate.

Fig. (B), above.—Detail from Choir Screen, Chartres Cathedral, showing complex nature of Gothic mouldings and ornament.

Fig. (C), below.—Notre Dame, Paris. Decorated mouldings from one of the west doors. Deeply undercut leaves and grotesques.

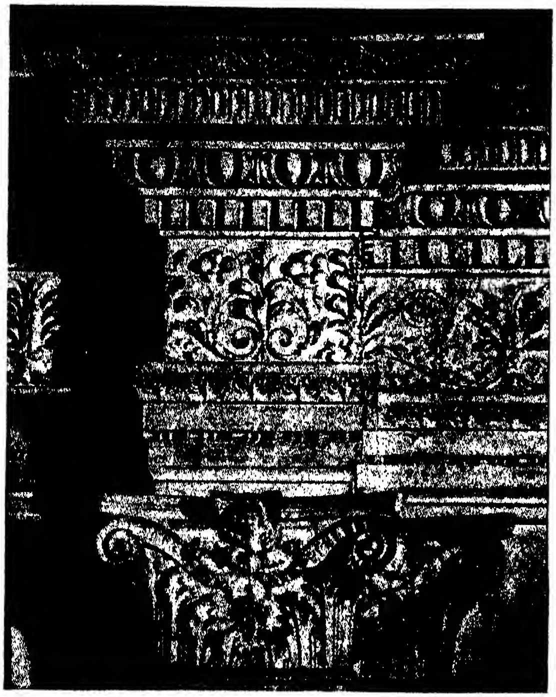






FIGS. (A) and (B), above.—S. M. dei Miracoli, Venice. Details of pilasters near altar. Delicacy of carving—made possible by the quality of the marble—is suitable for interior design. Note bead and reel ornament and crispness of decoration.

FIG. (C), below.—Panel from above church. This represents the best of the early Renaissance, the fifteenth century.



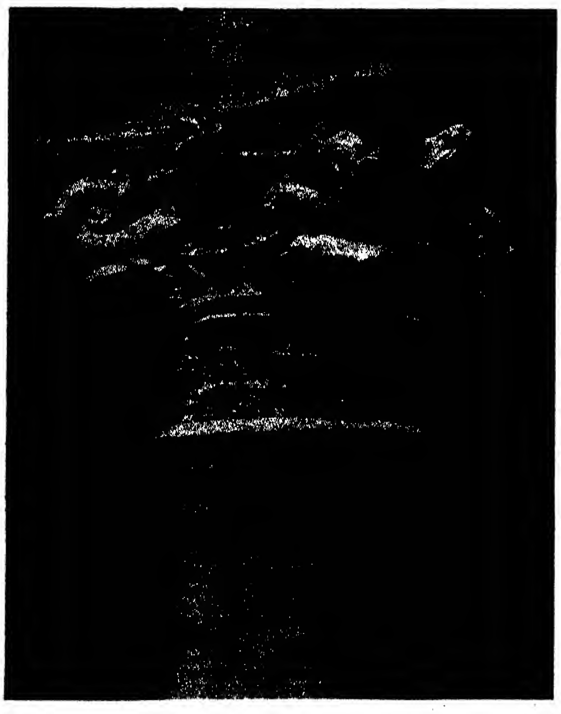
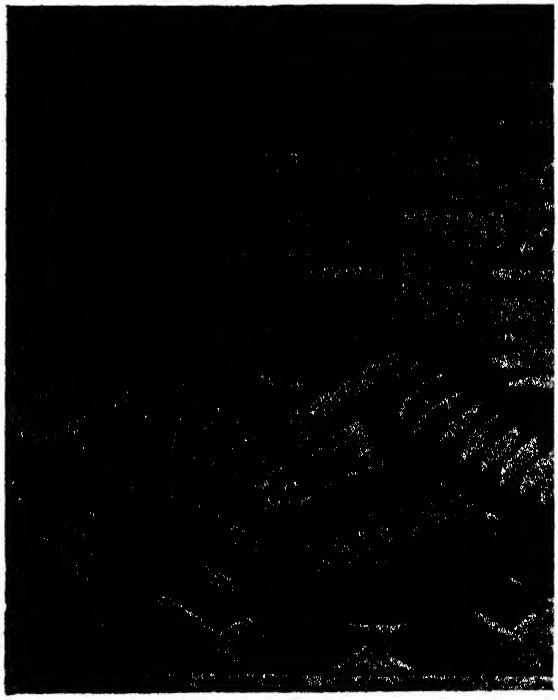


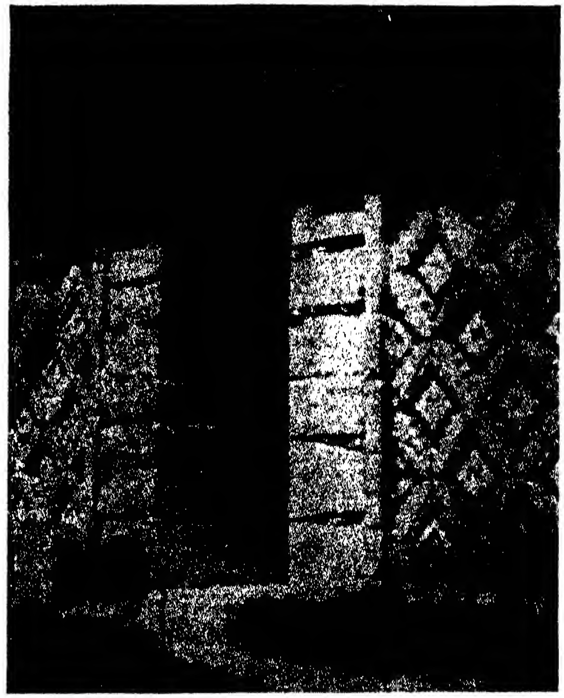
FIG. (A), above.—S. Giobbe, Venice. Detail of capital and entablature. The play of light and shade on Renaissance motifs.

FIG. (C), below.—Palazzo Quaratesi, Florence. Capital in courtyard. Volutes interpreted by forms of marine life.

FIG. (B), above.—Scuola di S. Marco, Venice. A Corinthianesque pilaster capital, architrave, and frieze.

FIG. (D), below.—Palazzo Gondi, Florence. The decorative portion of the structural system seen in Fig. 74 D.





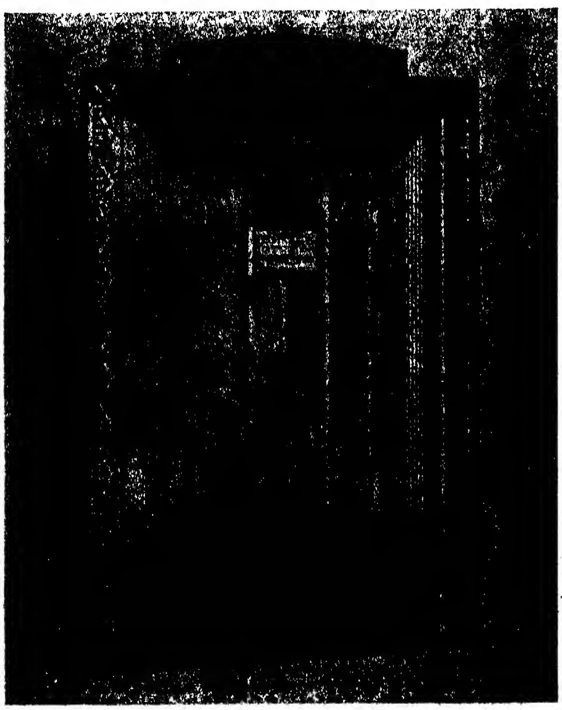
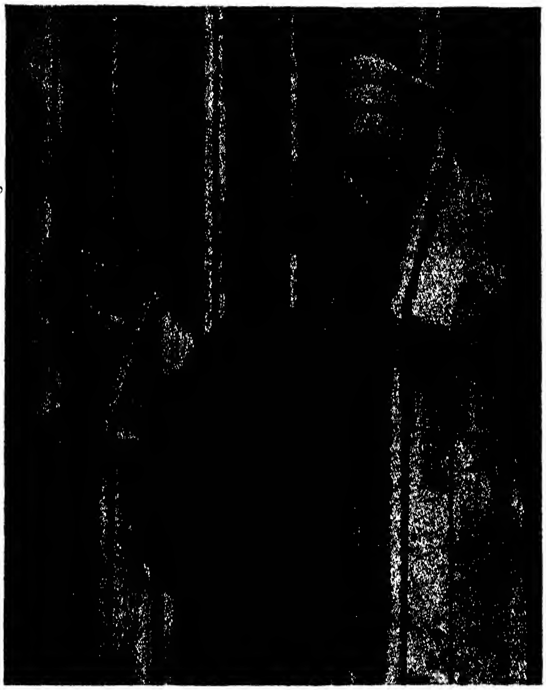


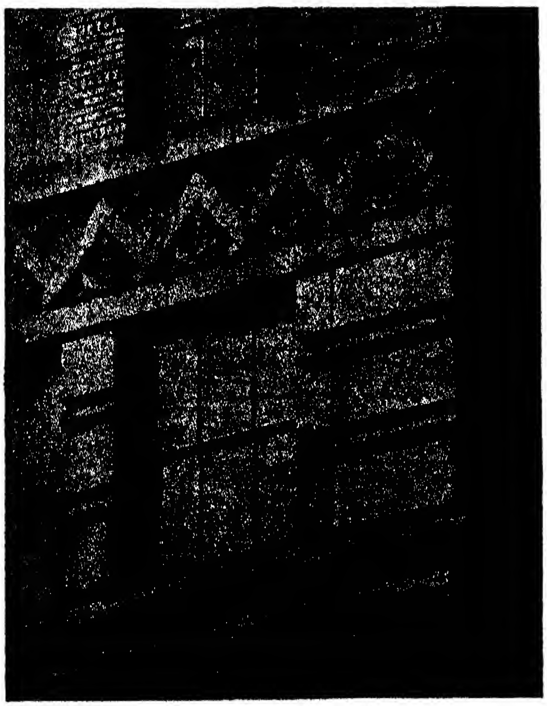
FIG. (A), above.—Mayan carving from Mitla. Abstract, geometric ornament; based upon use of the straight line.

FIG. (C), below.—City Bank Bldg., New York. Abstract ornament, based on primitive forms. Metal.

FIG. (B), above.—Doorway to Mayan building at Chichen Itza. A diagonal arrangement of elementary shapes.

FIG. (D), below.—Waldorf Astoria, New York. Bronze flag standard. Structural, directional quality to decoration.





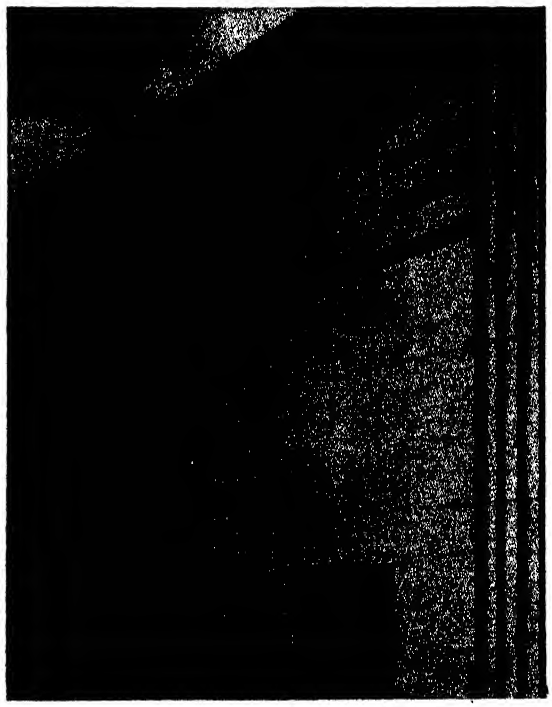


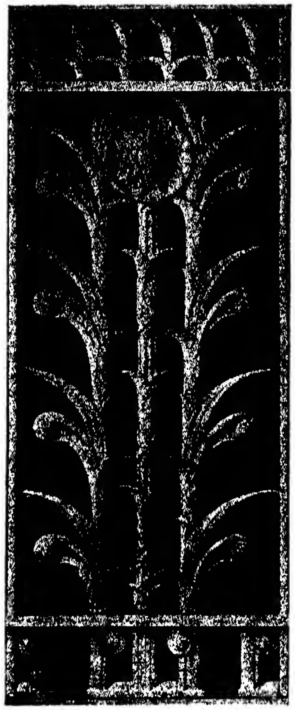
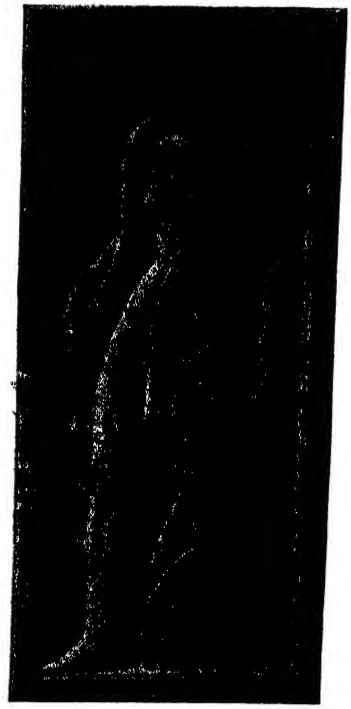
FIG. (A), above.—City Bank Bldg., New York. Accented termination to piers at 18th floor. Vigorous and direct.

FIG. (C), below.—Furniture Exchange, New York. Contemporary ornament derived from simple lines. Terra cotta. (Photo. Fischer.)

FIG. (B), above.—Public Library, Los Angeles. Detail above entrance showing simplicity of architectural sculpture. Concrete.

FIG. (D), below.—Will Rogers Theatre, Chicago. Angular ornament cast in concrete. Contrast of vertical and horizontal lines.

FIGS. (A) and (B) above, and FIG. (C), below, are from grilles from the City Bank and Farmers Trust Co., New York. They illustrate the desirable conventionalization necessary in order that the design may fit the material. The various motifs fill the different shaped spaces in a satisfactory manner.

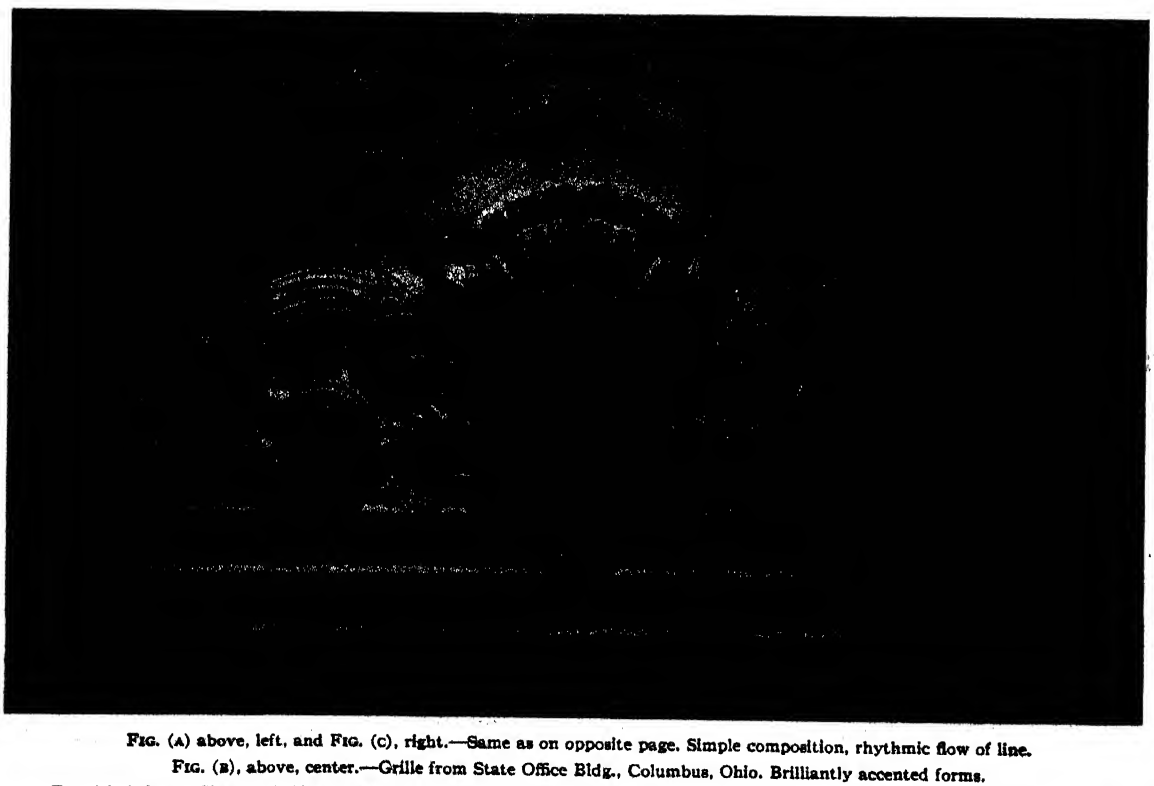


Fig. (A) above, left, and Fig. (C), right.—Same as on opposite page. Simple composition, rhythmic flow of line.
Fig. (B), above, center.—Grille from State Office Bldg., Columbus, Ohio. Brilliantly accented forms.
Fig. (D), below.—City Bank Bldg., New York. Lintel of door. Reminiscent of the simplicity of Greek art, but more conventional.

Much of the Romanesque ornament is based upon that of the Classical. The capitals, pilasters, and panels, with their mouldings and carvings of vines, beasts, and men—often in the form of grotesques—are coarse adaptations of borrowed motifs. Crouching lions supporting columns are typical of some phases of the Italian movement (see Fig. 100 A), while figure sculpture decorates the jambs of the doors in southern France and the tympana over the openings in England (Fig. 99 B). The geometrical designs of the billet, chevron, and diaper patterns, developed from the straight line, enrich the mouldings of these last two countries, as in Fig. 134 A and 134 B. Mosaics and frescoes add color to the interiors of many of the Italian churches.

While the Gothic was essentially a structural style, ornament and decoration were used in a lavish manner as the movement progressed toward its climax. The jambs and arches of the openings, the pinnacles of the buttresses, the choir stalls and shrines—in fact, almost every element of the entire cathedral received some attention from the stone mason or the wood carver. The mouldings were decorated with such typical ornament as the dogtooth, oak leaf, and Tudor rose, as in Figs. 131 J and N, while crosses, bosses, gargoyles, and crockets gave sparkling accents to other parts of the building. These details were usually of the conventional type during the early part of the manifestation of the style in the various countries, but the representation of vines and leaves became more naturalistic in the later Gothic. This change from conventionalism to naturalism also applied to the figure sculpture which was attached to the columns of the entrances and contained in the niches. The stained-glass windows, which were the glory, particularly, of French cathedrals, underwent the same transition from archaic designs to those which were more pictorial and realistic in character.

In order to complete our discussion chronologically, let us again mention the ornament of the contemporary movement. The subject-matter is usually abstract or conventional, and the painted or carved treatment often consists of a series of simple planes. Simplicity symbolizes the precision of the machine and harmonizes with the veneered surfaces of modern buildings. Ornament of a geometrical or conventionalized type is usually concentrated at strategic points in order to emphasize the structural lines of the architecture. Different metals, woods, and marbles are often combined to give contrasting patterns of color and texture, as in Figs. 212 C, 165 C, and 198 B. Architectural sculpture tends toward simplification (as on page 143), the handling of the features and drapery being reduced to a convention for their execution in stone and metal. Low relief and flatness of treatment seem to be more prevalent than figures in the round, and where the latter exist they often grow from the structural piers and buttresses, as on page 141.

PART THREE

THE MATERIALS OF ARCHITECTURE

CHAPTER VII

THE NATURE OF MATERIALS

Man may picture in his own mind the shelter in which he is to live, and nations may visualize their cities of the future, but all such hopes must remain unrealized without the aid of the physical substances with which aspirations are translated into structures. A sketch presents an idea; but materials make it possible to construct the building which represents the conception of the creative mind of the architect.

The materials with which modern man builds are many and varied. Those of the earlier periods are still in use, their application often modified by present-day needs, while many new ones have been added. In spite of the length of the list, it is still possible to divide our building materials into two groups with reference to their source and their preparation for use. First, there are those which are the direct product of nature, such as wood and stone. These come to the hands of man as a gift from the forests and the quarries and require only shaping and minor conditioning for the place they are to occupy in the building. Often it may be possible to use these two materials directly without preliminary work of any kind, except that of transportation. Those of the second group, constituting the majority of our building materials, require manipulation by the hands of man before they acquire their finished form. Nature has given us clay and ore, but they are simply the raw products and must be manufactured into usable commodities. Materials may, then, be classified as follows:

Materials of
- NATURE (direct product of nature).
  - Stone—limestone, marble, granite, etc.
  - Wood—structural and decorative.
- MAN (manufactured by man).
  - Ceramics—brick, terra cotta, tile, glass.
  - Concrete.
  - Metal—steel, iron, lead, copper, aluminum, alloys.
  - Plastics.

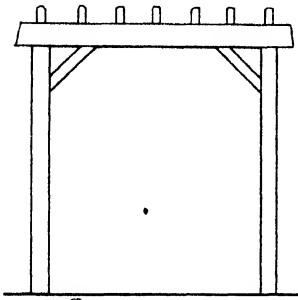
It will also be noticed that there are marked differences in the ways in which these various building materials are prepared. The materials of nature—wood and stone—are secured by only cutting and dressing the surface. Others must be manufactured. Brick, terra cotta, tile, plastics, and the cast metals are moulded. Concrete is poured into place at the building site. Wrought iron is pulled and hammered into the desired shape and design. Some of the new materials are manufactured by mixed processes.

MATERIALS AND DESIGN

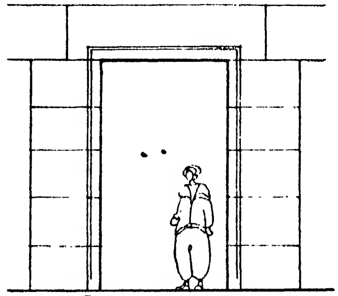
The great epochs of architectural development are the heritage which the past has given to the present. The temples of the Greeks and the Romans, and the churches of the Gothic and Renaissance periods, are the direct outgrowth of the then prevailing social conditions and of the use of materials which were produced by the people of each civilization. Construction has grown out of materials—which may be further divided according to their use, structural or decorative—and from these have developed types of architecture and related principles of design.

When primitive man emerged from his caves or moved to a locality where caves did not exist, it was necessary to erect a shelter from the available materials. He constructed conical huts or he set wooden posts in a vertical position and spanned the distance between with poles laid in a horizontal direction. The latter method was the beginning of the post and lintel. When man ceased to be nomadic, he discovered that stone was more permanent and that, in addition to its use as a barrier or wall, it could be laid up to form a post and lintel. This type of construction served him well, except that the width of the opening was regulated by the length of stones at his command, as in Fig. 147 B. Experiments took place and the stones were corbeled out until a triangular head was added to the opening, and from this grew the idea of the round arch with all its significant influence upon architectural design. (See Fig. 147 D.) Now the builder could span a much greater distance —either with the arch proper or the development of the arch, the vault—than was possible with the post and lintel. The pointed arch with its slender supports and with the weight or thrust carried to isolated buttresses was the next modification in stone construction, as in Fig. 147 J. The Gothic style, with all its beauty and variety, was thus made feasible. Brick, on account of the small size of the individual units, did not find an expression in the post and lintel, until the modern steel channel made possible the somewhat illogical arrangement seen in Fig. 147 E. On the other hand, Roman and Romanesque builders used brick arches in ways both structural and decorative (Fig. 147 F), and the effects secured were so satisfactory that their influence has been felt at recurring intervals.

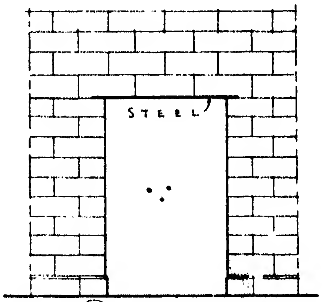
These uses of materials marked the limit of the development of types of construction until late in the last century of our present period of civilization when steel and concrete came into use as building materials. The character of structural steel terminated the restrictions placed upon the designer by the limitations of masonry construction by old methods, but at first few were brave enough even to attempt to visualize the effect which might be obtained with this new product. The real function of the steel columns and girders was at first concealed behind the stone and brick walls and pilasters of the past. Only in certain recent phases of contemporary design has there been evidence of a desire to allow the significance of the structure to be revealed and also to use these new materials for the purpose of enclosing the building. Steel and concrete may carry the weight of the structure by means of the post and lintel or by arches and vaults, resulting in hitherto unrealized sizes and shapes. Fabricated steel trusses, as in Fig. 147 G, or parabolic concrete arches, as in Fig. 147 H, may span great halls and auditoriums. The steel column and the transverse beam may form the structural scheme of an office building with its veneer of stone, brick, or terra-cotta piers and alloy panels, illustrated in Fig. 147 I; or an enclosure may be made by the use of metal itself, plain, burnished, lacquered, or enam-



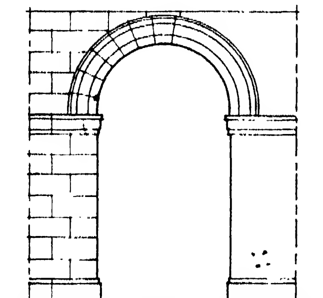
·FIG·(A)·POST·AND·LINTEL·
·WOOD·



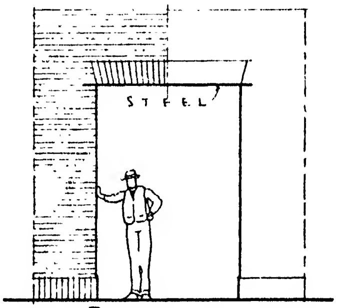
·FIG·(B)·POST·AND·LINTEL·
·STONE·



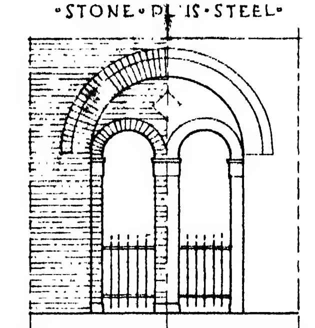
·FIG·(C)·POST·AND·LINTEL·
·STONE·PLUS·STEEL·



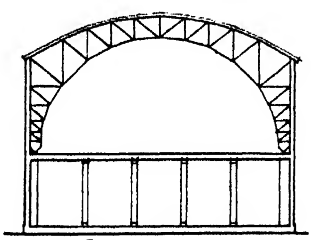
·FIG·(D)·ROUND·ARCH·
·STONE·



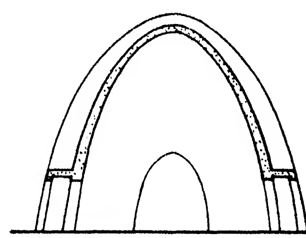
·FIG·(E)·POST·AND·LINTEL·
·BRICK·PLUS·STEEL·



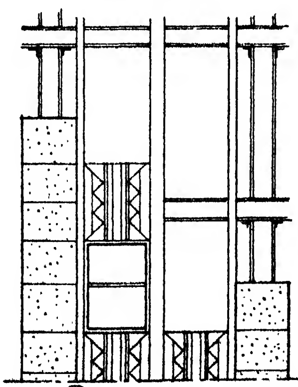
·FIG·(F)·ROUND·ARCH·
·BRICK·



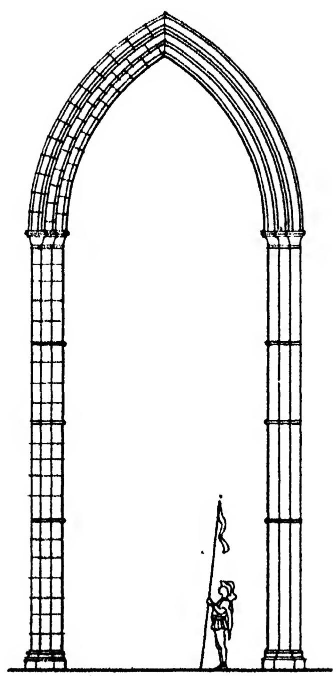
·FIG·(G)·ROUND·ARCH
·STEEL·



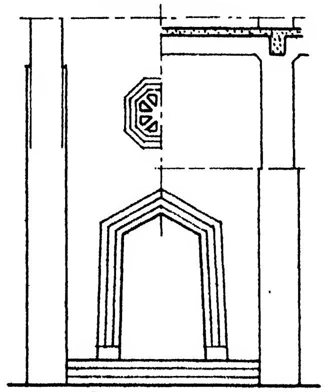
·FIG·(H)·PARABOLIC·ARCH·
·CONCRETE·



·FIG·(I)·POST·AND·LINTEL·
·STEEL·PLUS·ENCLOSING·SHELL·



·FIG·(J)·POINTED·ARCH·
·STONE·



·FIG·(K)·POST·AND·LINTEL·
·CONCRETE·

eled. Concrete may be substituted for the steel post and lintel, or it may be monolithic and provide both the skeleton and the covering, as in Fig. 147 K.

Materials have thus dictated types of construction, and out of the limitations and possibilities of wood, stone, brick, steel, and concrete have grown the post and lintel, and the round, pointed, and parabolic arch, vault, and dome. These forms have influenced the appearance of buildings of all the ages of the past and present. Design has, thus, developed from materials. And so, as we approach contemporary architecture, we should realize that the composition and construction of a building should be derived from function plus the properties of the different building materials of this century. The skeleton, the mass, and the surface treatment of a structure should come from:

1. Measure of materials.
   Size, weight, shape.
2. Quality of materials.
   Durability, hardness, rigidity, flexibility of use.
3. Character which materials impart.
   Strength, lightness, gracefulness.

It is only through a sympathetic consideration of these qualities of materials and their relation to the function of the building that progress in architecture can be made.

CRAFTSMANSHIP. During the great period of the Gothic influence, several generations witnessed the building of a single cathedral. The lives of the inhabitants of a village were devoted to the erection of the great church which dominated the community in both the spiritual and the physical sense. The blocks of stone which became walls were laid up with a feeling of reverence and acquired beautiful textures and interesting carving under the careful hands of the stone masons. If the spirit of ribaldry sometimes entered into the sculptured decoration, it did not detract from the skill with which the work was executed. It was the age of craftsmanship, and stone doorways, wooden choir stalls, and wrought-iron hinges were made beautiful because of the unhurried interest and devotion of the workmen.

Unfortunately, in more recent years, there has been a steady decline of craftsmanship. This is the machine age. Mass production, precision, and economy are more important than the individuality imparted by hand work. However, the machine can be made to serve man rather than to dominate his activities. Machine-made objects may be beautiful if attention is given to good materials and workmanship and to satisfactory design. The fault with the machine is the fact that too often there is an attempt to imitate hand work by mechanical methods. The historic styles do not lend themselves to mass production because they were developed during a time when the machine was unheard of and are, therefore, the product of a different attitude of mind. It is in the contemporary movement that we find a sympathetic understanding between the design and the machine. Hand work is sensitive and personal—machine work is precise and impersonal. The practice of using conventional and abstract forms makes possible the place of the machine in art. There is no virtue in the mere fact that an article is made by hand. Hand work can very easily be clumsy and awkward. It is the beauty and refinement of good craftsmanship that are important—the beauty that comes from sufficient time for thorough study and careful execution. The best work in the metals and glass of the decorative arts and in the brick and concrete of architecture is coming from those in the United States who are undisturbed by the modern tendency to build rapidly and from the craftsmen in those other countries where the placid natures of their people allow them to give thought to the beauty of materials and design.

TRUTH. It is hoped that the preceding and the following remarks of this chapter will place an emphasis upon the necessity of paying more attention to the quality of workmanship, and to the nature of materials and their possible effect upon design. Each material has its own characteristics, and the architectural designer should allow these to influence the appearance of the building instead of uncompromisingly bending the material to the will of the structure. Too often a design is considered without reference to the medium in which it is to be executed. It is arbitrarily decided that the building should be English, Georgian, or "modernistic." The design is developed, and the material, selected later, is often incompatible with the design. The choice of material should be an early consideration after site and function. If the material selected is in sympathy with the character of the building, and if all other contributing factors are given proper consideration, the results should be satisfactory. If a heavy, rugged material is chosen when a feeling of lightness and gracefulness is desired, the design will be lacking in proper character; the material should be changed for another more appropriate. Character and materials have a relationship which may not be disregarded.

The designer is often cautioned to use materials honestly. This can become a rather trite saying unless there is a real understanding of its meaning. Since materials have their own individual qualities, these should be permitted to play their parts truthfully in the design of a structure. Wood is light and semi-rigid; stone is heavy and hard; brick is colorful and gives a pleasing pattern; concrete can be poured into interesting forms. The architect should recognize these qualities and should make less effort to disguise them. Too often, terra cotta has been used to imitate stone even though it has beautiful decorative values of its own. Unfortunately, concrete has been scored with joints to make it look like stone or painted with grains and knotholes to resemble wooden beams. Stone details are sometimes executed in wood without changing their scale, and brick is twisted into tortuous shapes or given a treatment which is incompatible with the material. The contemporary use of metals and wall boards will not make much progress until they are used for themselves alone (see Fig. 165 A) and not to imitate surfaces of the past. It is possible that these attempts to use materials in a manner which is not honest may not offend those people who are not sensitive to such practice. But this indifference and even encouragement have produced disastrous results. Too often architecture itself is no longer truthful. Apartment hotels look like overgrown manor houses; filling stations are Colonial taverns. Houses have meaningless gables and roof ridges artificially depressed to imitate the effect of time. Half-timber is no longer structural but is applied decoration. Elevations do not express the plan; a theatrically composed exterior conceals the purpose and arrangement of the interior. The cause of architecture suffers when truth is suppressed. Reactions and dissatisfactions are bound to result as the consciousness of a people awakens to the imperfections and increased costs of such mistakes. The architecture of a city or a nation will contribute to progress only when materials are used in such ways that their characteristics may take an active part in its development. Beautiful and enduring forms and surfaces are the result of honesty in the use of the materials of man and nature.

Chapter VIII

THE MATERIALS OF NATURE

Stone

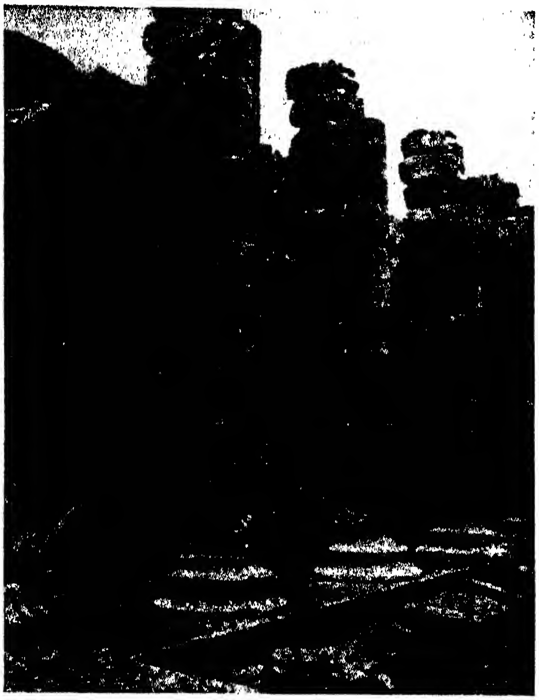
Stone is truly the great building material of nature. The forces of nature—the periodic upheavals and the burying of sea beds and continents under pressure for centuries and centuries—have made it possible for man, scratching the surface of the earth in his feeble way, to remove in almost finished form this most magnificent of building materials. Stone is one of the oldest and perhaps the most permanent. From Stonehenge to Egypt, from the Greek to the Gothic, from the Renaissance to the contemporary, stone has been the majestic material.

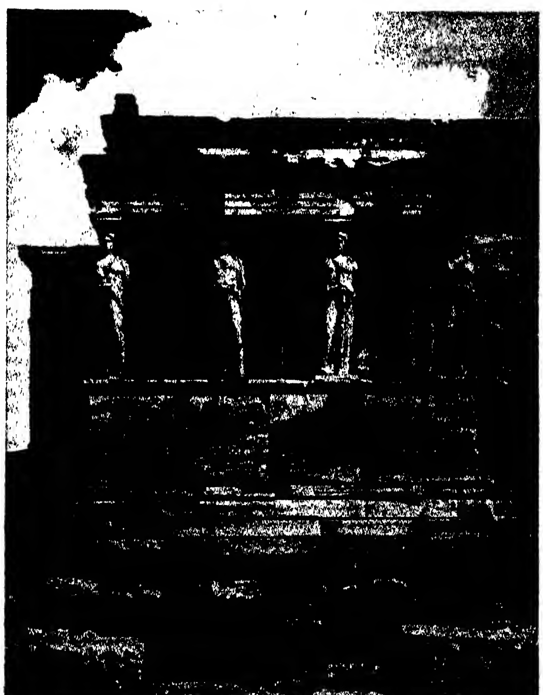
When primitive man used stone, it remained just stone. When the artisans who erected the Parthenon, the cathedrals of France, or the palaces of Florence worked with stone it ceased to be an inanimate object and took on the personality of the community which put it in place. These workers laid it up in courses, and they carved its surface until it told the history of their religion and civilization. It became an object of beauty.

HISTORY. Writing a history of the use of stone is the equivalent of compiling a history of architecture. However, it is possible to mention briefly the way in which stone has been used in the representative periods and also to indicate its relation to design. During the time of Greek civilization, marble was a plentiful and native stone. It could be quarried in large blocks and had to be moved only a short distance. These heavy, wide stones were usually laid up with equally distributed pressure on level beds and with closely fitted joints requiring no mortar, as in Fig. 151 C. This type of construction imparted to the buildings of Greece a feeling of solidity, and the close grain of the white marble encouraged a refinement of line and detail.

When the Roman Empire came into existence, its builders continued to use the Greek method of construction. However, their engineering minds soon realized some of the possibilities of concrete, and they employed this material for the cores of their walls, vaults, and domes, facing it with brick and stone laid up in various patterns (Fig. 151 D). This encouraged less massive stonework and made it necessary to use mortar. When only smaller stones were available, arches were developed to span the more ambitious areas of the Romans, and their architecture became more flexible than that of the Greeks.

In Italy, during the Romanesque period, stone had to compete with brick for supremacy as a building material. However, in central Italy where colored marbles were available, marble facing was used on the walls to secure geometrical patterns, as in the cathedral at Pisa, Fig. 261 B. The stone was also often carved with elaborate details, and stone buildings acquired a more refined character than was possible in those of brick. When the Romanesque movement developed in France, it found plenty of good building stone which was used freely. The Caen stone of the north was fine grained and light in tone, whereas the volcanic stone of the south was colored and coarse. Each imparted a





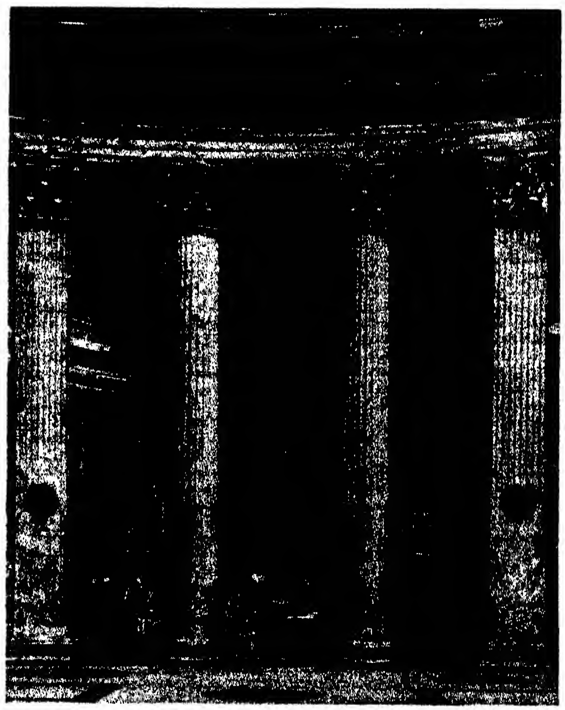
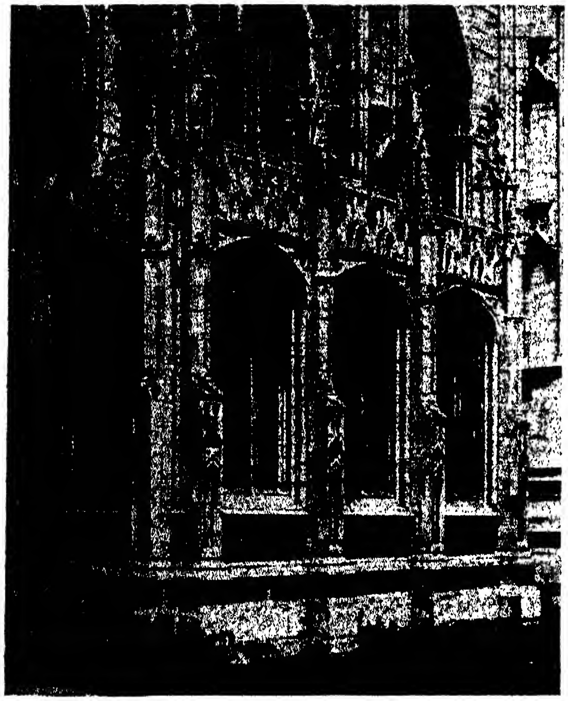


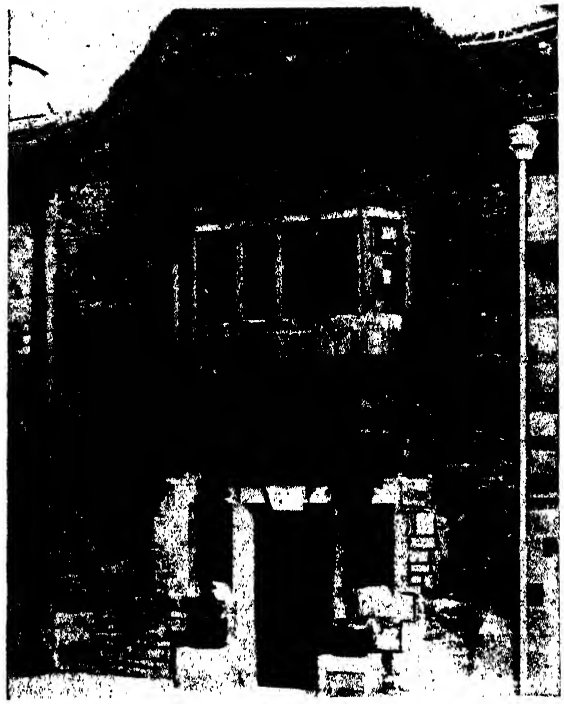
FIG. (A), above.—Greek stonework, heavy and static. Engaged columns of naos. Limestone. Temple of Apollo Epicurius, Bassae.

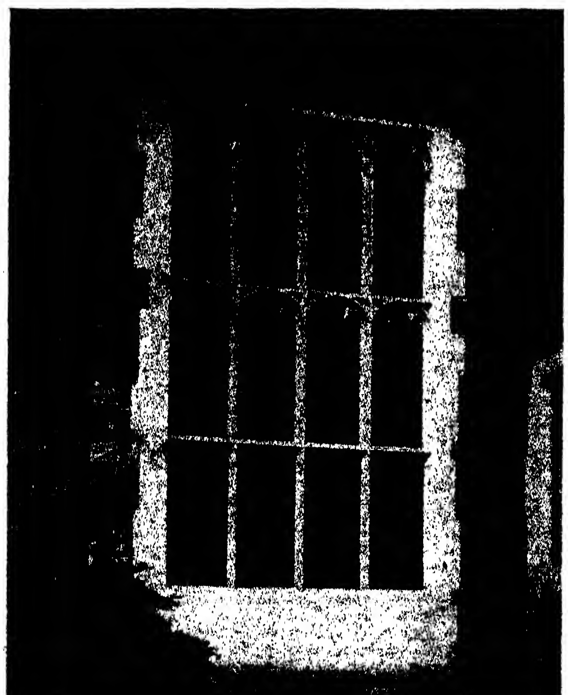
FIG. (C), below.—Large blocks of Grecian marble. Monumentality. The Caryatid portico, The Erechtheum, Athens.

FIG. (B), above.—Similarity of Mayan stonework. Structural. Temple of the Warriors, Chichen Itza.

FIG. (D), below.—Roman use of stone. Concrete faced internally with marble and porphyry. The Pantheon, Rome. See Fig. 29 B.







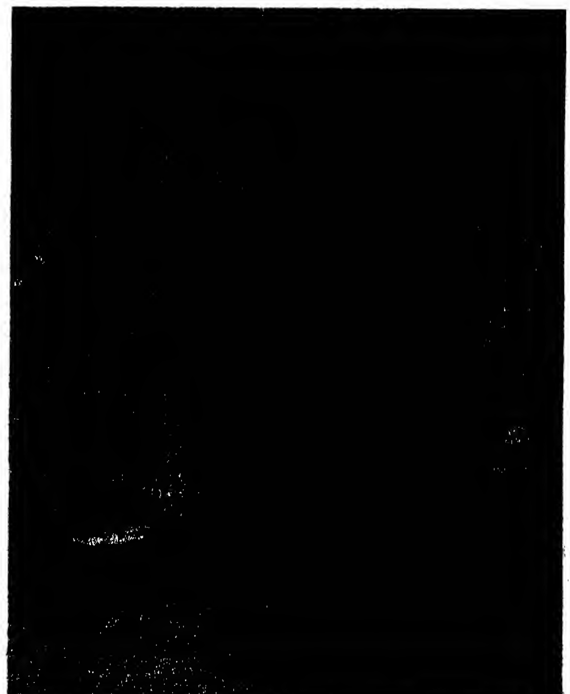
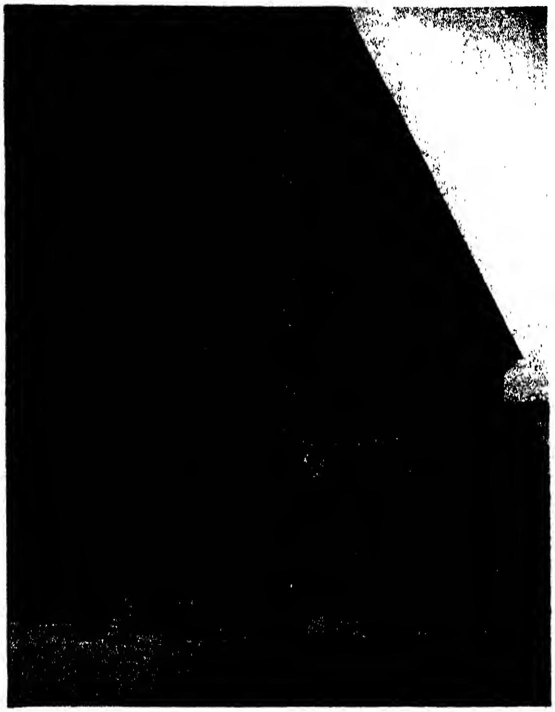


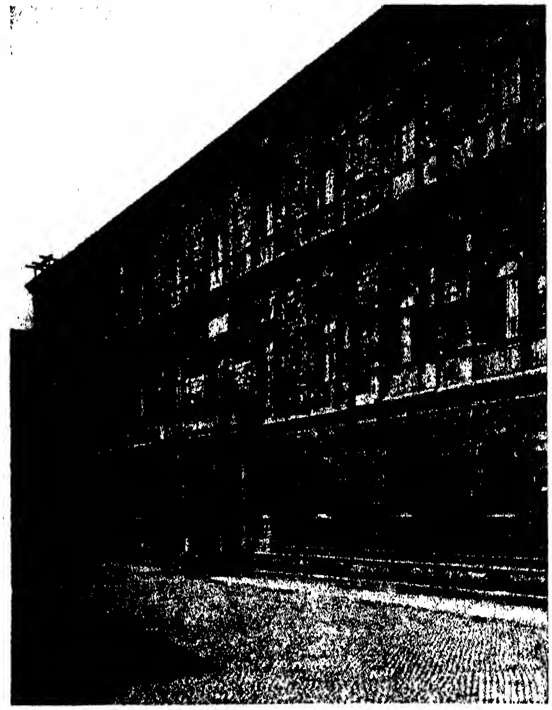
FIG. (A), above.—Stone contributing to the complexity of the Gothic. Decorative verticality. Lincoln Cathedral.

FIG. (C), below.—Modern version of the Gothic. Stone—structural and decorative—glass, and lead. Random coursed ashlar.

FIG. (B), above.—Mediaeval grouping of architectural elements. Small stones and domesticity. Chipping Camden, England.

FIG. (D), below.—A Cotswold doorway. Informal stonework mellowed by age. Intimacy and hospitality.





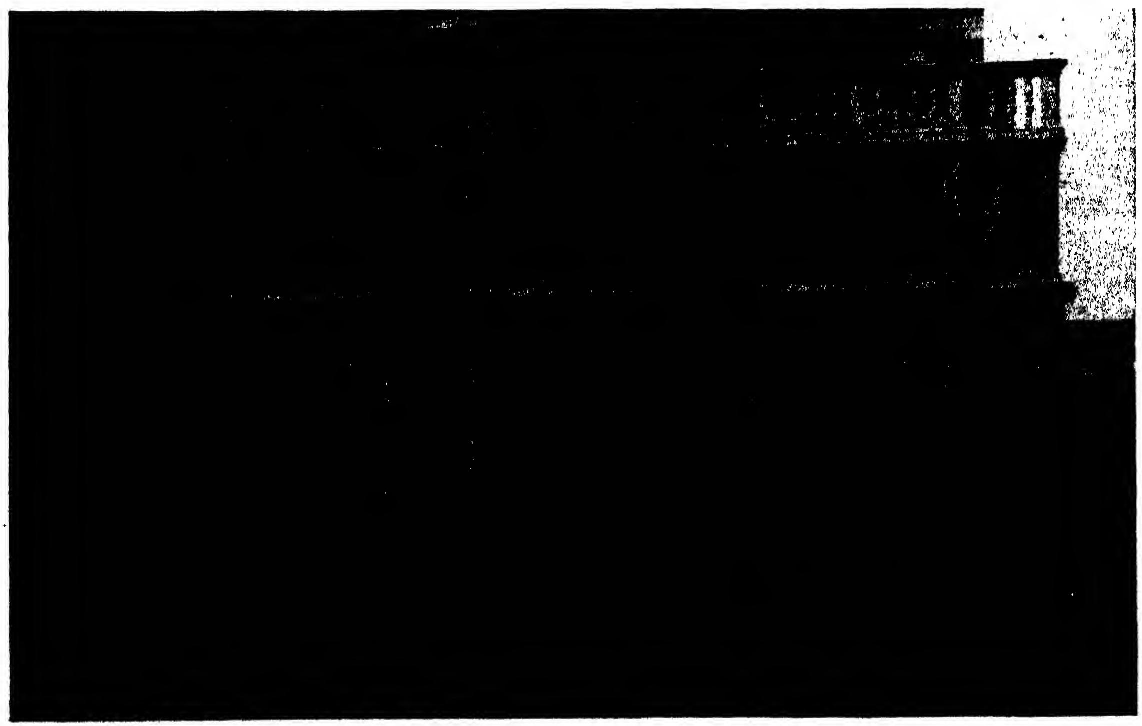


FIG. (A), above.—Astylar treatment. Gradation in size and treatment of stone. Rustication. Palazzo Riccardi, Florence.

FIG. (B), above.—Pilaster treatment. Coursed ashlar. Less heavy than in (A). Palazzo della Cancelleria. Rome. Fig. 105 D.

FIG. (C), below.—Stone joints and courses subordinate to details. Colored marble. Building is 50 ft. wide. Piazzetta, Venice.

definite character to the buildings in which it was used, but massive walls and heavy arches and vaults remained typical of the Romanesque style.

The builders of the Gothic cathedrals used stone in the most marvelous ways known to history (Fig. 69 A). They discovered the qualities of elasticity and equilibrium in an architectural sense. Instead of laying up large stones to form a massive, static wall, they piled up small stones in an amazing manner to produce a light, dynamic architecture. The direction of the Classical is horizontal; that of the Gothic is vertical. The mediaeval builders soared to dizzy heights with their vaults and pinnacles, and accomplished these results by maintaining a complete adjustment of thrust and counter-thrust (Fig. 70 B). This type of construction was the outgrowth of the use of these small stones, the size of which was often determined by the distance of the quarry from the building site and the need for ease of transportation to the cathedral city. The stone courses in a Gothic building are usually small and often irregular, as on page 152. The stone is frequently laid up in random courses, and flexibility, rather than formality, rules.

The Italian Renaissance and the reflections of this style in other countries of Europe are essentially expressions in masonry. One has only to call to mind the palaces of Rome, Florence, and Venice to realize the importance of stone as a building material. The walls were usually laid up in regular horizontal courses as contrasted with the irregularity and freedom of the stonework of mediaeval architecture. Surface decoration played an important part in the interest given to the façade of a building and also indicated the structural qualities of the wall. There were two common methods of treating the exteriors of Renaissance buildings. The first is called the astylar method and was borrowed from the secular buildings of the Middle Ages. A wall of this type was free from columns and pilasters and depended upon the stone courses and the disposition of doors and windows for its effect. (See Fig. 153 A.) The belt courses marked the floor levels or the lines of the windows, and a heavy cornice terminated the wall. The second method may be called the pilaster style. It was based upon the architecture of the Romans and derived its name from the use of pilasters or columns which enclosed plain or rusticated wall areas of stone, as in Fig. 153 B.

With the advent of modern steel and concrete construction, there has been a change in the conception of the purpose of stone. No longer is it necessary to have masonry walls several feet thick to carry the load of the floors above. Instead, columns of steel or concrete take care of the superimposed weight, and stone is used simply as an enclosing material. It may be laid up in courses to resemble in size those associated with an earlier type of construction, as in Fig. 157 A, and in this way may convey the impression of a true masonry building. If we wish to be franker in our acknowledgment of the use of a skeleton structure, the stone may be cut into large, thin sheets and hung upon the framework as a veneer (Figs. 156 A and 158 A). This makes possible the introduction of many interesting and novel effects and offers a challenge to the imagination of the designer. The emphasis in modern work should be upon the character of the particular stone which is being used and the interesting ways in which it can be applied to exteriors as a space-enclosing medium. The architect and the artisan should take delight in the beauty of a well-laid wall with simple courses and pleasing textures. Whether the stone is marble for a monument or native fieldstone for a country home, the beauty of the material, together with its physical properties, should be allowed to influence the design.

GRANITE is a coarse-grained stone and should be used for large, bold forms with little carving. It is the hardest and perhaps the most durable of the building stones. It is often applied to base courses where protection is desired (Fig. 212 C). In a polished form it is frequently employed as shafts of columns with limestone or terra-cotta capitals and bases. The nature of the material makes it very adaptable to monumental work.

SANDSTONE. The various sandstones range in color from white to the different tints of red and brown or blue and gray. Sandstones are quite popular for use in buildings whose characters lean more to informality than to formality. They give variety and interest, and the textures of their walls have found favor in structures as different as the Trinity Church in Boston and the Harkness Quadrangle of Yale University.

MARBLE is a limestone which is sufficiently close in texture to admit of being polished. It may be divided into two classes, depending upon its formation. (1) Brecciated marble is composed of angular fragments of crystalline structures cemented together to form a material which is very durable, particularly in a dry atmosphere. The lustre of polished marble is due to the penetration of light for a short distance and its reflection from the surface of the inner crystals. The fine texture of marble offers unlimited opportunities for the refinement of detail (see Fig. 159 A). (2) The serpentine marbles are prized for the variegated patterns which they display and are often used in large, flat planes for decorative work both inside and out, as in Figs. 159 C and D. Marble, whether white, gray and black, or yellow, brown, red, or green, is conspicuous in contemporary architecture.

LIMESTONE is one of the most important building stones of this country. It has a fine, even texture, and its colors range from a light cream to a buff and from a light gray to a darker, bluish gray. It is a free stone with a cleavage face, so that it is possible to take it out of the quarry in pieces of even size and shape. It is an excellent wall or exterior stone and lends itself very well to carving, as in Fig. 157 B. Its many and diverse qualities are well known and account for its popularity.

TREATMENT. After nature has endowed stone with various characteristics, it is quarried by man and prepared for its place in the buildings of the nations. The methods of preparation are many and varied, and depend upon the effect desired and the limitations of the stone itself. If a rather rugged character is to be given to the wall, the stone is left with a rock face. If a more finished surface is needed, especially with the harder stones, the face is "pointed" by taking off the rough projections with a chisel (Fig. 152 C). Various artificial textures are also imparted by hammering the surface of the stone to produce vertical or horizontal channels or a stippled appearance. Some stones are also rubbed with abrasives which grind down the sawn surface until the face is quite smooth and shows no tool marks. Because of the popularity of limestone, a number of methods of treating the surface of that material and of adding to its interest have been developed. One of these is the practice of rough sawing the stone and using it as it comes from the gang saws with the marks showing.

After stone has been prepared for use it may be laid up in a wall in a number of ways. In fact, the possibilities in this connection are so numerous and technical that we can mention in this discussion only a few of the most common. Fieldstone or undressed stone is usually put into place in a random manner, with a careful eye, however, upon the arrangement of sizes, shapes, and colors. This is called rubble masonry and is often employed for architecture which is domestic in character. Dressed stone is laid up in a more regular manner but

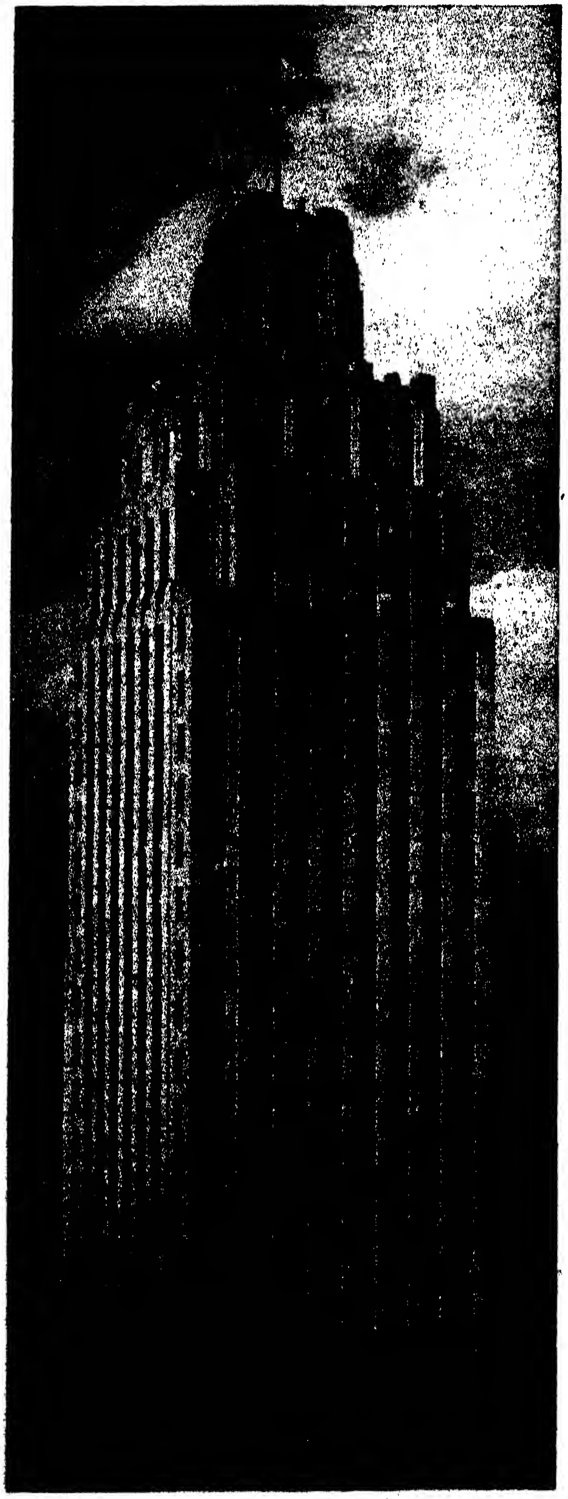
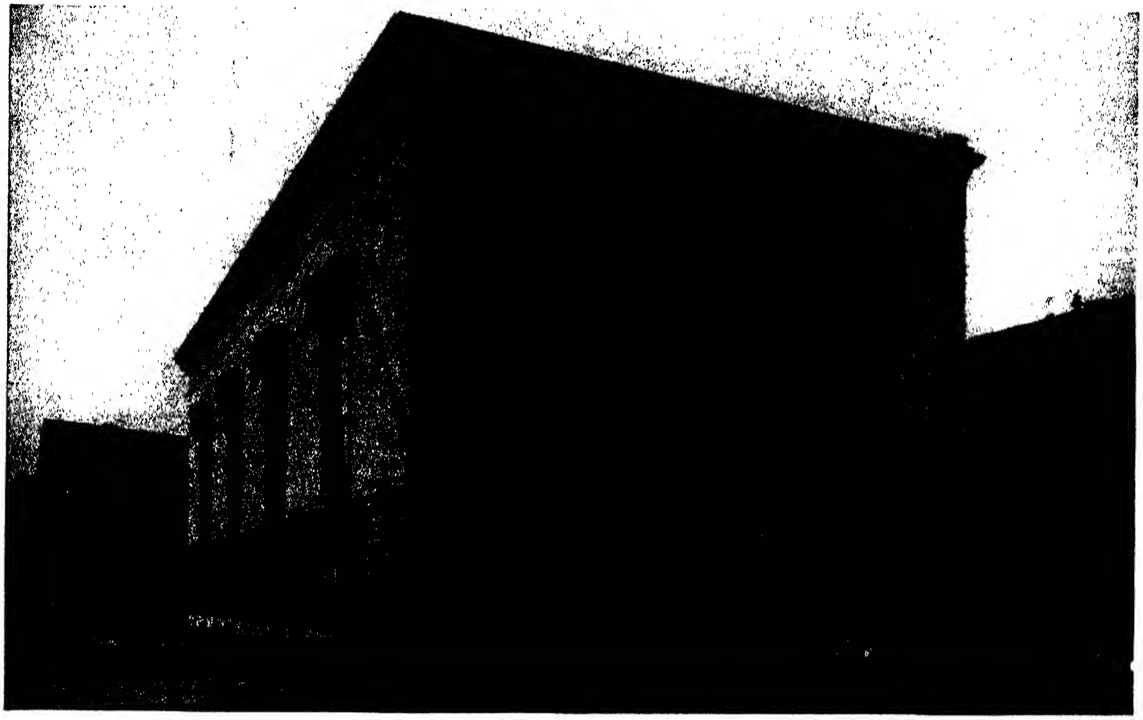


FIG. (A).—Limestone and steel. Structural system expressed upon exterior. Reynolds Bldg., Winston-Salem. Shreve & Lamb, Archts.

with a great many variations in the size and arrangement of the courses. The courses may be even in their spacing and the individual stones may tend to be uniform in size. This results in a formal and often monumental type of wall, as in Fig. 153 B. This type of treatment is called coursed ashlar. If what is known as broken range ashlar is desired, the horizontal joints are still carried through in an uninterrupted fashion but the width of the courses and the lengths of the stones are varied to produce a wall with a less regular pattern. When the stone comes to the job in sizes which vary to a considerable extent, or when an effect less formal than coursed ashlar but more formal than rubble masonry is desired, then a method of setting called random coursed ashlar is employed. Here the stones retain their rectangular shape and are laid in horizontal beds, but no effort is made to continue these horizontal joints through in an uninterrupted manner, as in Fig. 152 C. Large stones are combined with small ones in a convenient and, if possible, an interesting way. A variety is secured which is not possible with regular coursed ashlar.

Rustication is another treatment which is often used with walls which are regular in coursing and heavy in character. This consists of the practice of allowing heavier stones, or areas of stone, often with a distinguishing surface pattern, to project beyond the normal face of the surrounding wall or of the joints themselves. This forms a contrast with the rest of the façade and often assumes the familiar forms of quoins, pilasters, bases, courses, etc., as in Figs. 153 A and 157 A. This treatment was quite popular during the various phases of the Renaissance, and is still often employed when a building is designed in the spirit of that period. It should be used for the purpose of creating accents, for emphasizing the importance of doors and windows, and for strengthening the corners of a building.



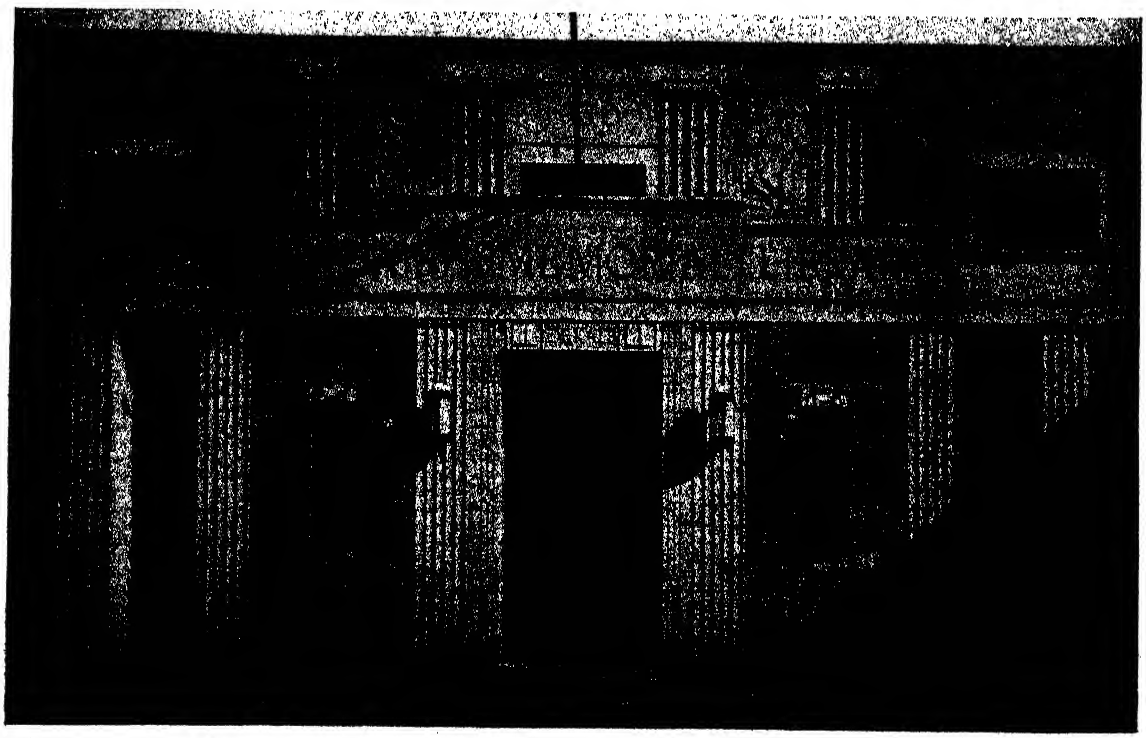
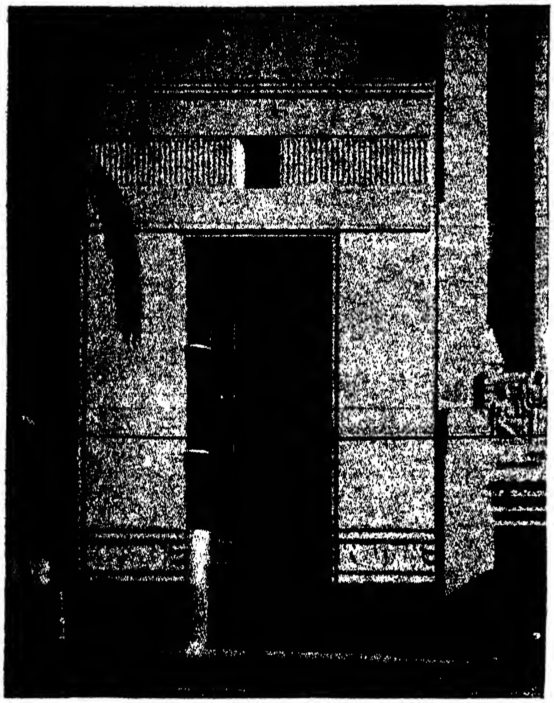
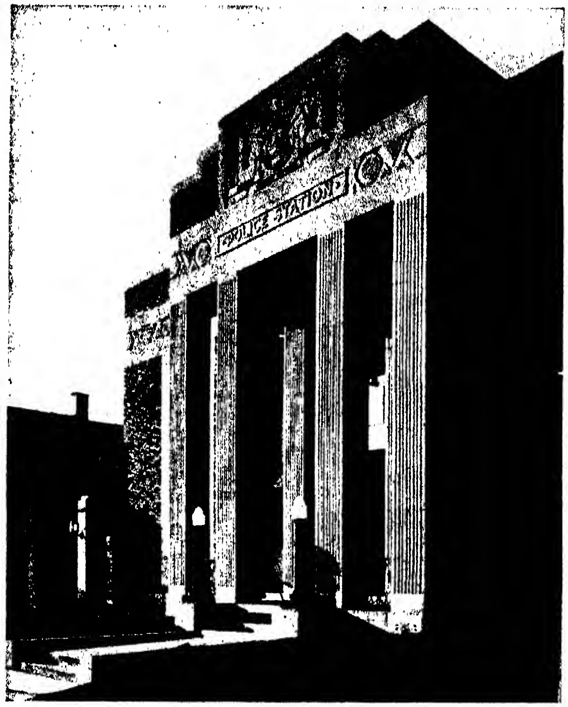


FIG. (A), above.—Italian Renaissance treatment. Entrance accented by rustication. Bank, Phila., Pa. Mellor, Meigs & Howe, Archts.

FIG. (B), below.—Modified Classical treatment in limestone. Simplicity and monumentality. Large courses. Compare freedom of interpretation with (A), also in limestone. Library, De Kalb, Ill. White & Weber, Archts. (Photos. of limestone by Indiana Limestone Co.)





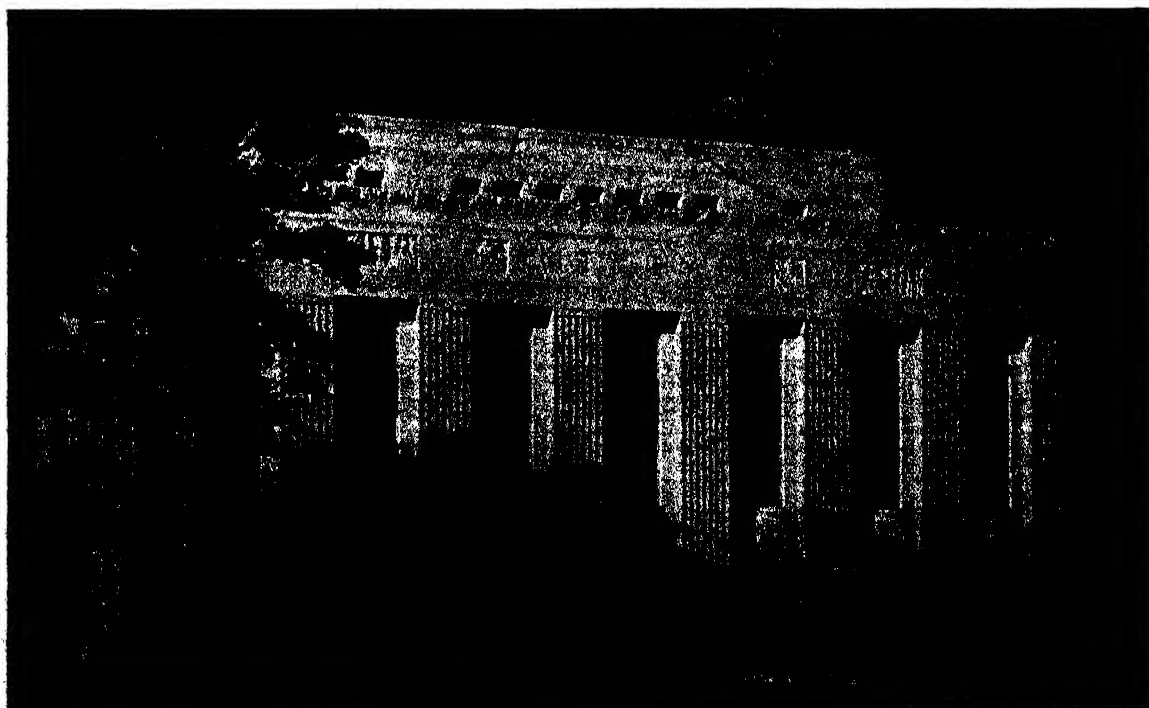
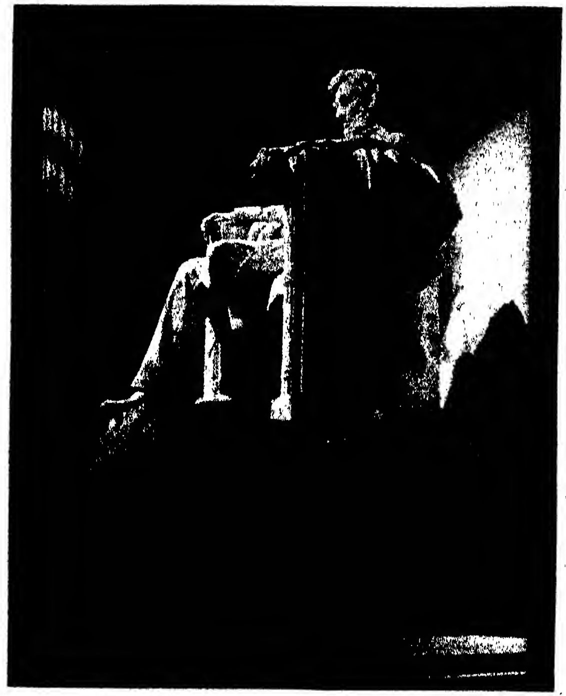


Fig. (a), above.—Buff limestone veneer, joints not staggered to imitate structural wall. B. & L. Bldg., Los Angeles. W. Richards.

Fig. (b), above.—Limestone and brick used in traditional-modern manner. Police Station, St. Louis. Mauran, Russell & Crowell.

Fig. (c), below.—Intricate carving in limestone. Flat decoration and surfaces. City Hall, Kalamazoo. Weary & Alford, Archts.



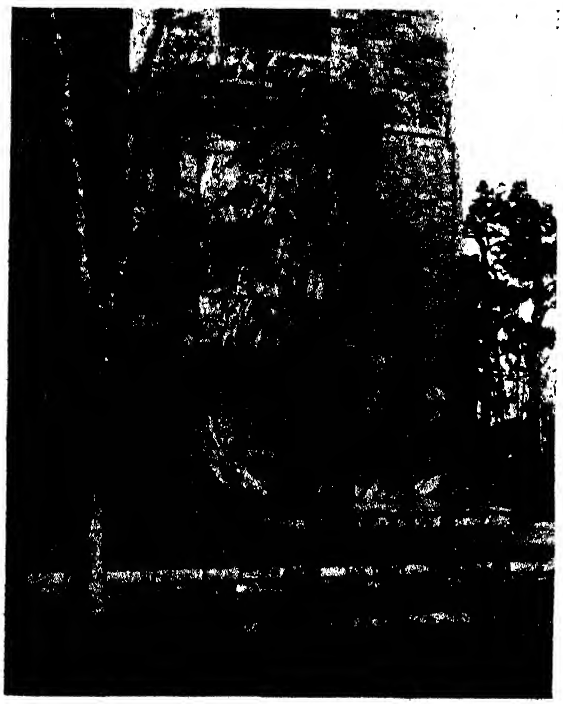


FIG. (A), above.—Delicacy of detail expressed in marble. Simplicity. Livingstone Memorial, Detroit. Albert Kahn, Archt.

FIG. (B), above.—Light and shade. Dignity. Marble. Lincoln Memorial, Wash., D. C. Daniel Chester French, Sculptor.

FIG. (C), below.—Decorative quality of colored marble. Rich patterns. Base of Bok Tower, Florida. Milton B. Medary, Archt.

FIG. (D), below.—Marble for interiors. Contrast. City Bank, N. Y. Cross & Cross. (Photos. of marble by Georgia Marble Co.)

Wood

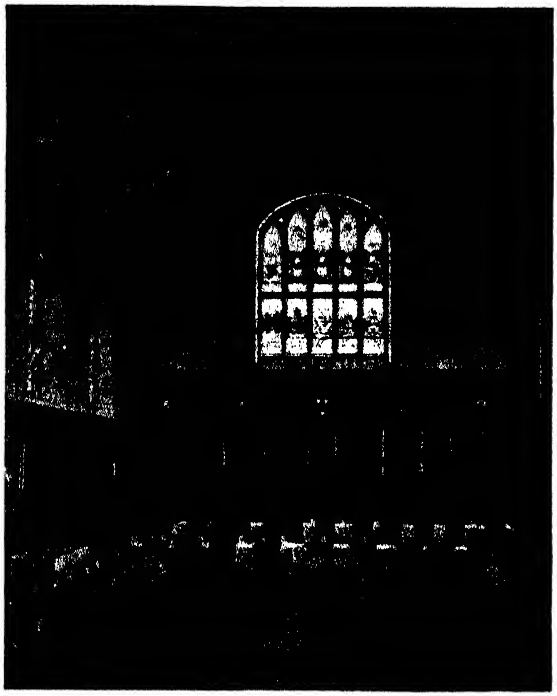
Since man first set up poles of wood to form—with the aid of branches or skins—conical or rectangular enclosures, wood has been used as one of the important building materials of the human race. It is not so permanent as masonry but with proper care has been known to last for centuries. The basic principle of wood or frame construction is quite different from that of stone. The latter is laid up in courses and remains in place by reason of its weight and the bond of the mortar. A frame building must have vertical structural members spaced rather closely together and covered with horizontal boards or siding which strengthens the framework and encloses the interior. Stone construction is heavy; frame construction is light.

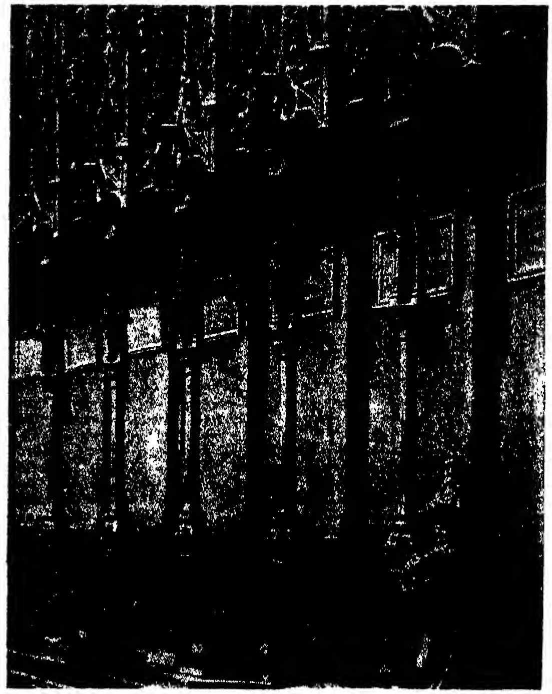
HALF-TIMBER. Much of the knowledge of wooden structures of antiquity is lost to the present age. It is not until the Middle Ages present some of their minor buildings for inspection that we are able to study existing examples in which wood was employed as an important material. The domestic buildings of England and France were often built in what is called the half-timber style—a treatment which was quite logical and beautiful as it was then used, but one which has often been very badly interpreted in the twentieth century. In these delightful old structures the framework was made of heavy members of wood with vertical, horizontal, or diagonal bracing of smaller timbers. The areas between were filled in with brick or cement which offered a contrasting color and texture with the structural members of wood, as in Fig. 161 C. Used in this manner, the wood or half-timber was truly functional, and it had a feeling of informality which is often lacking in modern buildings. In much of the present so-called half-timber work, the latter is a veneer of surface decoration and has no relation to the construction—again insincerity and untruthfulness in architecture.

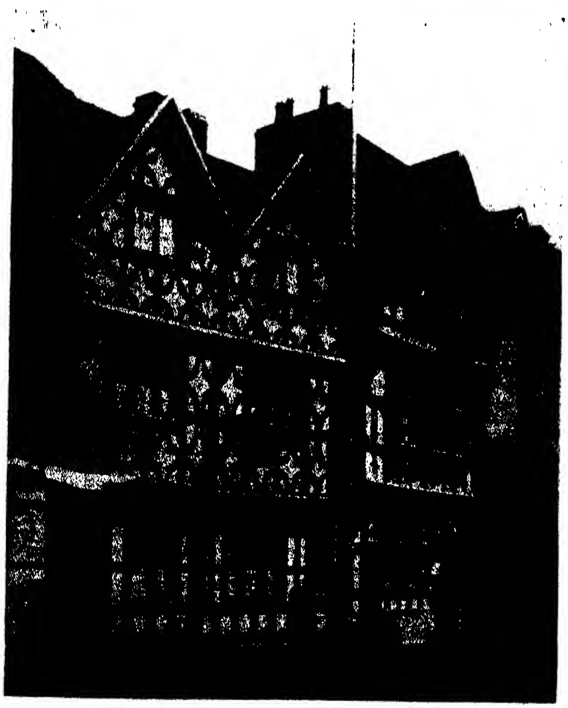
ROOFS. Another use of wood during the mediaeval period, especially in England, was in the construction of the open timber roofs of the parish churches, manor houses, and castles (Fig. 161 A). These roofs gradually developed from variations in design secured by the use of the beams and rafters and were known as tie-beam roofs, trussed rafter roofs, hammer beam roofs, and collar braced roofs. Their chief characteristic was the use of some kind of horizontal beam, or at least a suggestion of one, together with exposed rafters—all often carved and painted with gold and colors. This was a lighter type of construction than the stone vaulting of France, and permitted the omission of flying buttresses.

CARVING. The character of wood made possible its use in many ways upon the interiors where carving was desired. Notable examples are to be found in the minor elements of the cathedrals and manor houses of the Middle Ages, in the chimney-pieces and friezes of Grinling Gibbons of the English Renaissance, and in the intricate details of the Orient. Wood is fibrous and lends itself to the execution of slender, attenuated shapes and crisp, delicate details. Often the screens and choir stalls of France and England are among the most magnificent features of these cathedrals and present a richness of ornament which is legitimate in wood. The designs may be intricate, but they maintain the proper relation to the grain of the wood (see Figs. 161 B and 136 C), and the material has been asked to do nothing which is not within its power to perform.

ORIENTAL. Although wood is used throughout most of the world, varying with its accessibility, still it has remained for China and Japan to develop it into similar na-







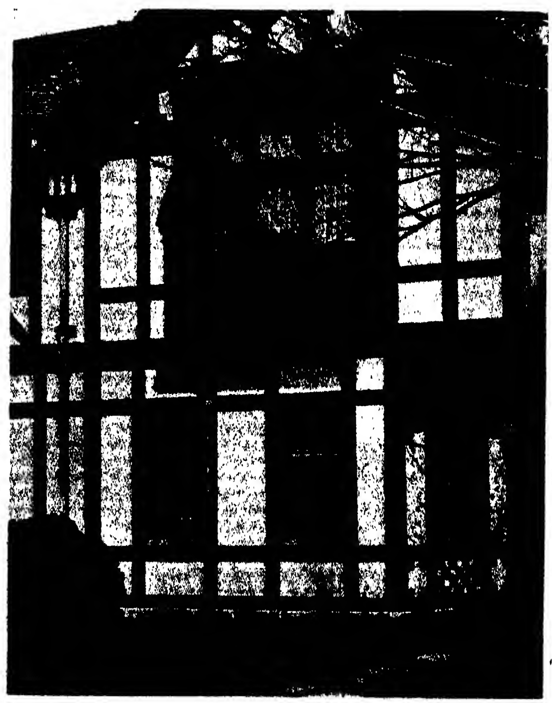


FIG. (A), above.—The decorative and structural qualities of the hammer-beam roof. Dining Hall, Caius College, Cambridge.

FIG. (C), below.—The charm of mediaeval half-timber. Structural. Harvard House, Stratford-on-Avon.

FIG. (B), above.—Intricate carving in wood. Rich, complex. Choir stalls, Lincoln Cathedral.

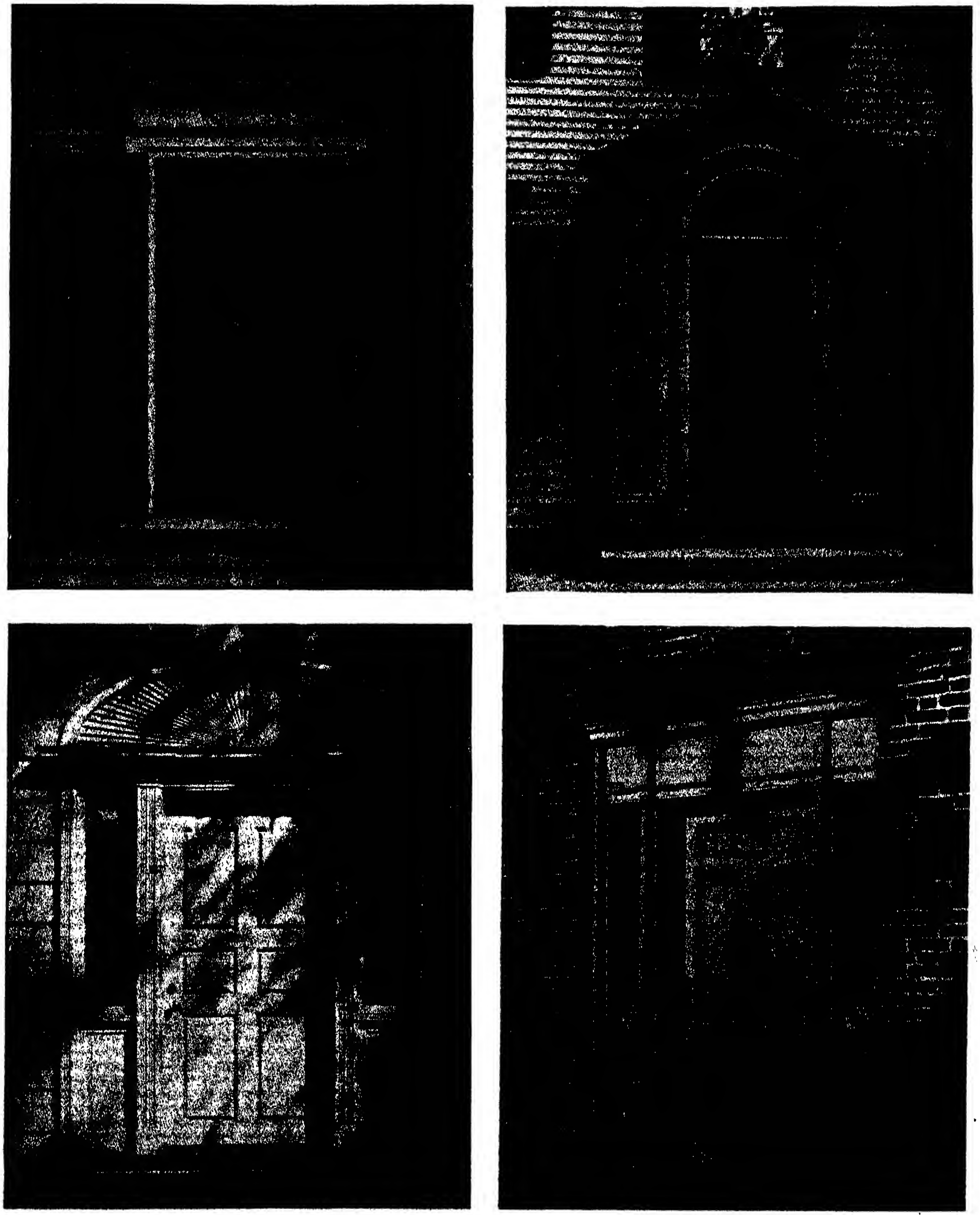
FIG. (D), below.—Satisfactory modern interpretation of half-timber. Wood, stucco, glass, slate, and lead.

tional styles of design and types of construction. The social, religious, and economic attitudes of the Chinese do not encourage permanence in their structures, so that they have been satisfied to use wood, which is more easily erected than the stone, which is plentiful. Japan has several reasons for favoring wood as a building material. The frequency of earthquakes makes it unwise to build of stone, and, in addition, the latter material is not so common as wood. It is logical that timber posts should form the structural members of many of the native buildings of Japan. The roofs are the most ornate and conspicuous elements of this Oriental architecture, and are carried on wooden rafters, the ends of which, together with brackets and horizontal beams, form very ornate cornices. The light walls are used simply to enclose—like those of Gothic cathedrals and contemporary steel-framed structures. All this results in an extremely decorative type of the post and lintel, as in Fig. 165 D.

COLONIAL. We may pass over other periods in which wood was used extensively—notably the domestic architecture of Switzerland with its chalet—and come down to our own Colonial buildings. In Pennsylvania they were often constructed of stone and in Virginia of brick, but in the forested New England states it was natural to employ the native product, wood. The early frame houses were mediaeval in character, Fig. 30 B, with heavy structural members often filled in between with brick and later covered with siding. As the Georgian style grew in popularity in England, its influence was felt in this country, and Colonial architecture took on the formality of that of the mother country. Porches and entrances with their Doric or Ionic columns were derivatives of English examples. Walls of siding, modified cornices, shuttered windows, and pitched roofs completed the composition, as in Fig. 164 A. However, the carpenter-architects (the unknown and unsung artists of those early days) were sensitive to the limitations and the advantages of their material—wood. They realized that it was lighter than stone and fibrous instead of brittle. They refused to be governed entirely by the handbooks of Italian architecture which showed columns and cornices designed for masonry. Their columns of wood were often slender and attenuated. The mouldings were small in scale, and the carving and decoration had a refinement and grace which were quite suited to the character of the material. (See page 163.)

These early ventures of our forefathers into the field of frame construction were so satisfactory that they have had a profound influence upon American domestic architecture. The Colonial style has lived and has been adapted to modern conditions, because it is so simple and logical. It has fostered the development of other kinds of wooden architecture, until now many of our smaller communities are essentially of frame construction. Much of this is nondescript, but it exists and presents a problem for future solution.

CONTEMPORARY. In the actual construction of our larger buildings, wood plays very little part, except for forms and scaffolding. Upon the interior and exterior, however, wood still finds favor as an enclosing and finishing material. Plywood, applied in vertical or horizontal bands or sheets, makes possible a new character in architectural design. Modern designers rely also upon the beauty of exotic woods to produce an effect by the use of large, polished surfaces. Many novel interiors may be created by the employment of contrasting grains and colors. This means the elimination or subordination of mouldings, and the use of veneering and inlaying of woods and metals, as in Fig. 165 C. This produces an interior which combines the spirit of efficiency with that of beauty.



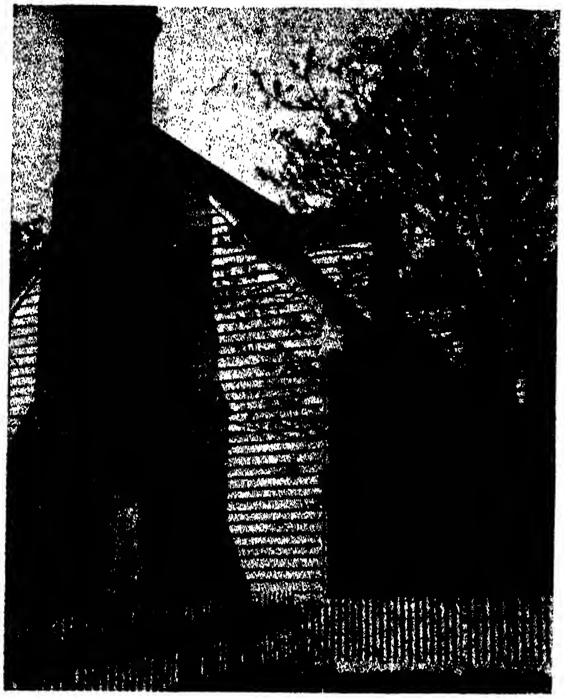
Four examples showing proper scale of circulatory elements executed in wood. (A) and (B), Colonial. (C) and (D), modern.

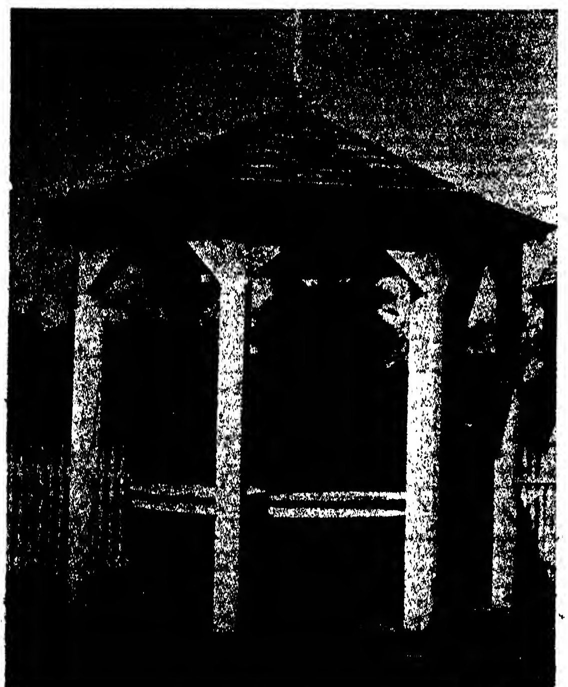
Fig. (A), above.—McKenney house, Newburyport, Mass.

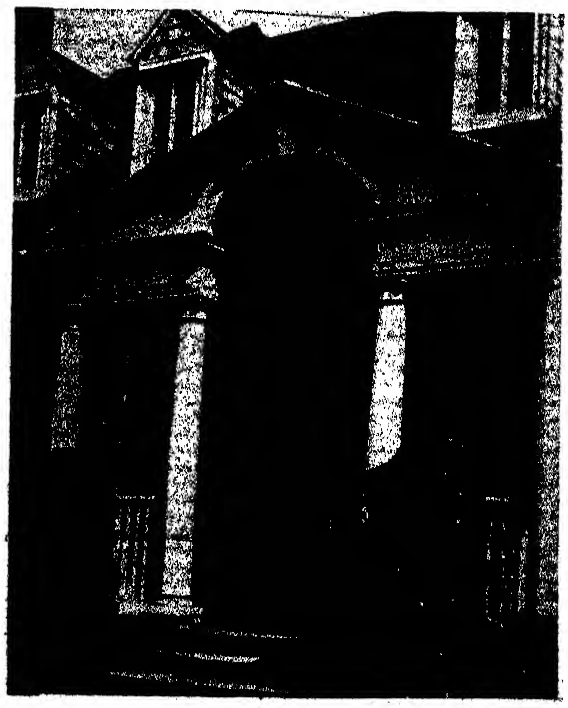
Fig. (B), above.—22 Essex St., Newburyport, Mass.

Fig. (C), below.—House in Maryland. Graceful, delicate.

Fig. (D), below.—House in New York. Brick and wood.



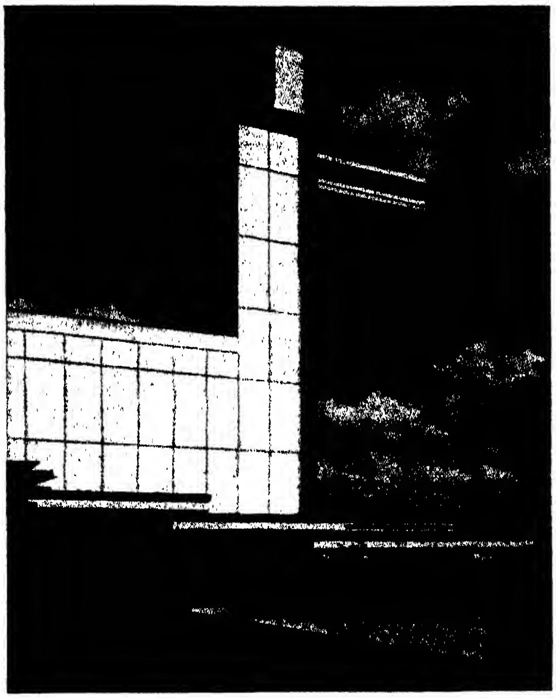


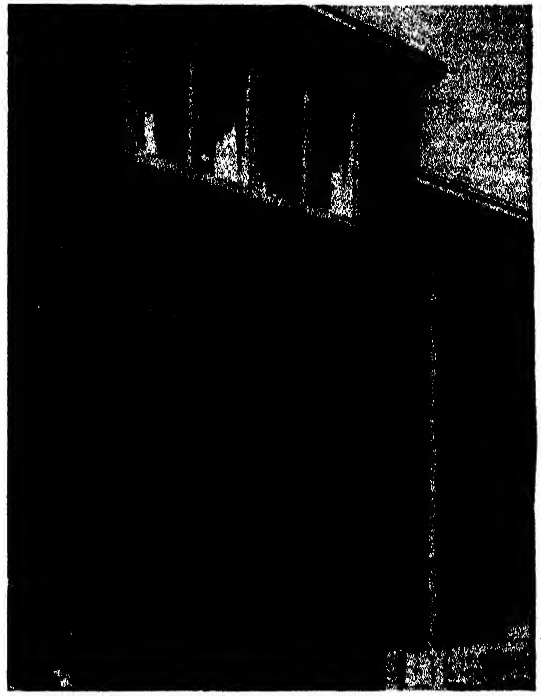


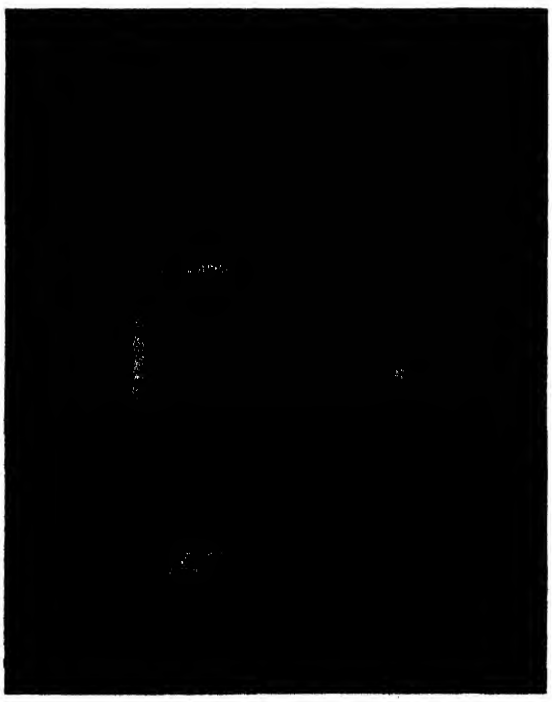
FIGS. (A) and (B), above.—Colonial houses in Williamsburg, Va. Note scale and proportions of siding, cornices, and windows.

FIG. (C), below.—Covered well, Williamsburg, Va. Post and lintel timber construction with bracing. Simple, elementary forms. Sturdiness and strength.

FIG. (D), below.—Entrance porch to Gunston Hall, Va., showing use of Roman Doric Order, with arch, interpreted in wood. Scale of mouldings suitable to character of wood.







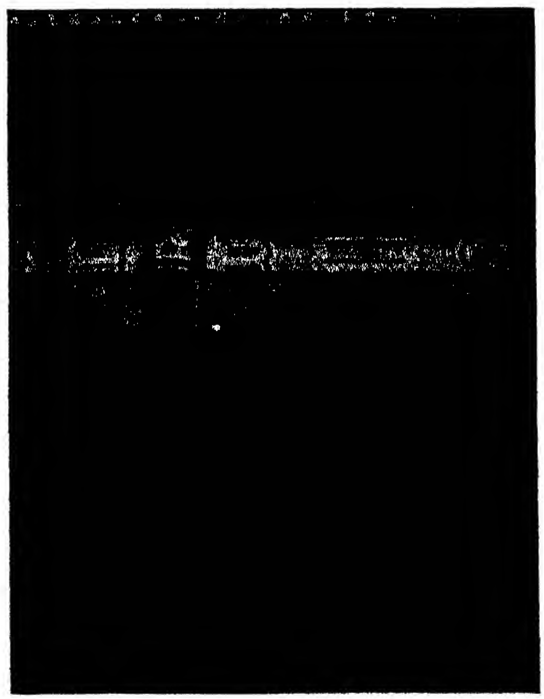


FIG. (A), above.—Wall board, 6-ply Douglas fir, used frankly as a veneer. Detail, Hall of Science, Chicago.

FIG. (C), below.—Wood veneer on steel. Doors, vermilion leather. Black and silver metal inlay above. Roxy Theatre, New York.

FIG. (B), above.—Redwood siding used in decorative manner in contemporary domestic architecture. California Redwood Assoc.

FIG. (D), below.—Oriental use of wood. Ornate post and lintel and screens. Forbidden City, Peking.

Chapter IX

THE MATERIALS OF MAN

Brick

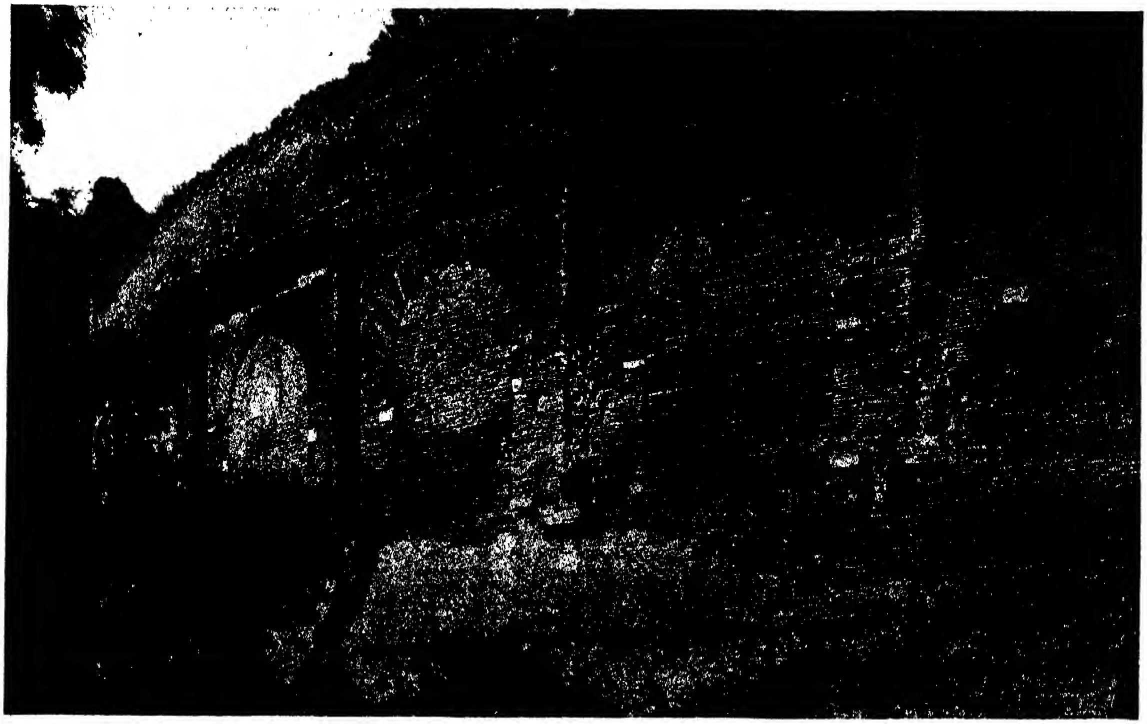
HISTORY. Competing for popularity with the materials of nature—stone and wood—is a product of man, brick. Its use is due not only to its present favor but also to the age and proved worth of the material. The art of making brick dates from the civilized nations of antiquity, the earliest burnt brick known being found on the sites of the cities of Babylonia. The Romans used brick extensively in the construction of their vaults and walls, as shown on page 167, carrying their knowledge into western Europe and also leaving it for the Early Christian and Romanesque builders of a later date. The tall towers of Romanesque churches, Fig. 169 B, with their arched openings and corbeled cornices, illustrate brickwork of an interesting and logical character. Brick was also used quite freely elsewhere upon the interiors and exteriors of these churches, as shown in Figs. 29 C, 65 A, and 65 B.

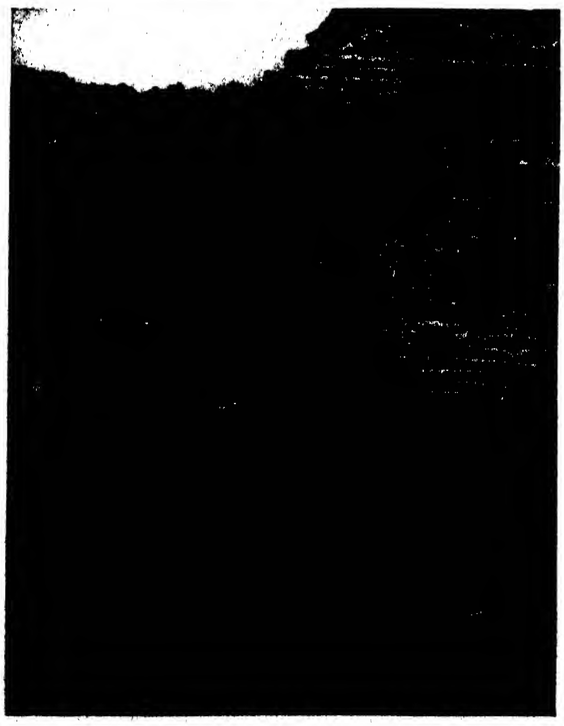
The Dutch were the most important brick makers of Europe during the late Middle Ages, because of the scarcity of stone in the Netherlands and the presence of a satisfactory clay which came in adequate quantities from these lowlands. The buildings of the Dutch Renaissance were colorful, with ornate gables and walls constructed of red brick and stone trim. The Italians also carried on the traditions of brickwork during the Renaissance, and interpreted many Classical forms in terms of this material (Fig. 169 A).

During the sixteenth century, brick making in England was popular, probably because of the presence of workmen from Flanders and Holland. The Tudor and Georgian periods which followed witnessed the building of many important structures of brick. One of the outstanding characteristics of Tudor brickwork was the use of the diagonal or diaper pattern (Fig. 169 C) which was obtained by the use of headers of a darker or lighter color arranged to give this particular design. Corbeling, or the projecting of brick courses to form cornices, belt courses, and mouldings of the material were common during this period. Ornate chimneys of cut and moulded brick were conspicuous in such buildings as Hampton Court Palace, Fig. 169 C.

The development of the Georgian style was largely due to the influence of Inigo Jones, who studied in Italy and brought back the teachings of Palladio. The work of Inigo Jones made it possible for Sir Christopher Wren to rebuild London, after the fire of 1666, in the Renaissance manner but with a marked English flavor. The houses of the middle classes were noted for their use of brick, partly accounted for by the presence in the English court of William of Orange, who brought with him a fondness for the brickwork of the Netherlands. This preference continued under the reigns of the Georges, I to IV, hence the name of Georgian architecture.

The most characteristic details of this brickwork were the flat rubbed brick arch for small openings and the elliptical arches for larger spans. Heavy brick cornices and





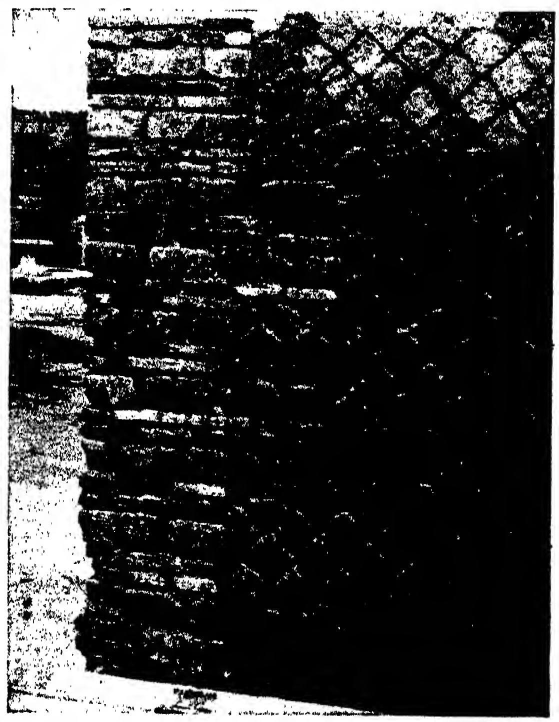


FIG. (A), above.—Walls, columns, arches, and capitals of yellow, red, and brown brick. Castrensian Amphitheatre, Rome.

FIGS. (B) and (C), below.—Roman walls of concrete faced with brick and stone. This rougher type of construction, as compared with the marble walls of the Greeks, was the result of slave labor. (Photos. of brick by American Face Brick Association.)

projecting belt courses, together with rusticated quoins, were also features of the style. The colonists who came to the eastern shores of this country carried with them a knowledge of this kind of architecture, and the eighteenth century witnessed the development of the Colonial style interpreted in brick as well as frame and stone construction, Figs. 170 A and 171 B. Thus it is to the Georgian movement that we are indebted for the many fine brick adaptations of this phase of the Renaissance.

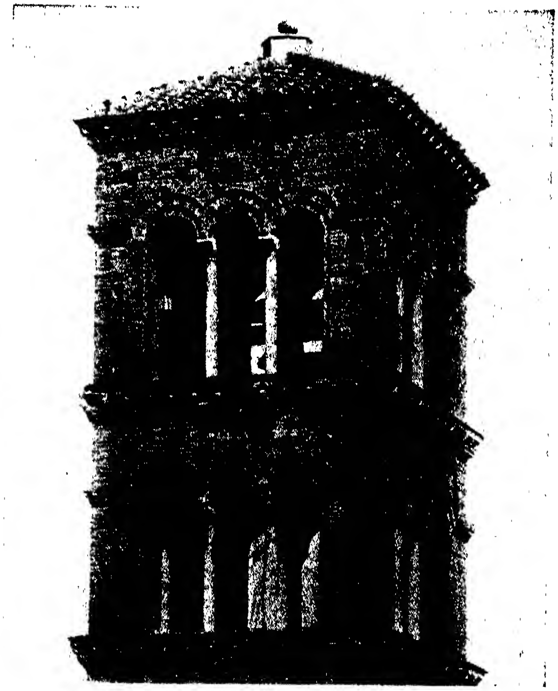
MANUFACTURE. Except for the facts that brick is made from clay and that various effects may be obtained, much of the process of manufacture remains a mystery to the layman. Three kinds of clay are used in making this ceramic product, and they may be designated according to the color which they produce. One clay is the red-burning, which contains iron oxide and produces the red, brown, and purple shades of brick. Another type of clay is called the buff-burning, and has in its composition lime and iron which give the brick a light buff or cream color. If the clay contains magnesia and iron, the result is a deeper buff. There is also the gray-burning clay which contains no lime or magnesia and produces a less colorful gray brick.

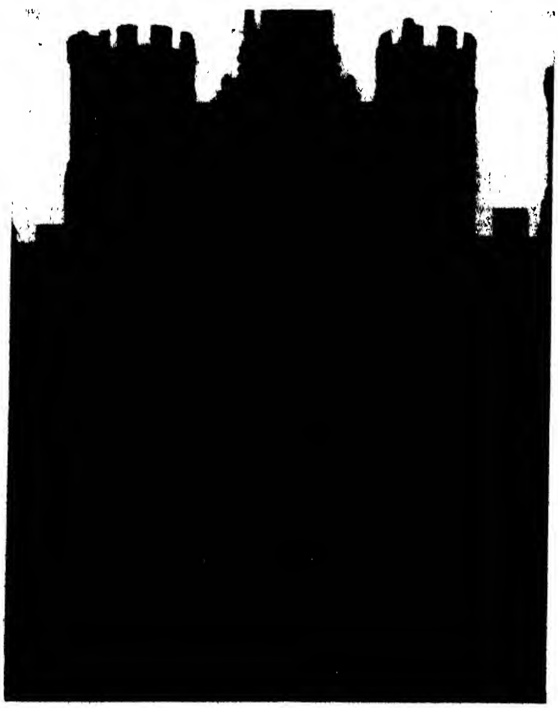
The most conspicuous quality of clay is its plasticity, which permits it to be moulded into various shapes for the firing. In manufacturing brick, the clay is crushed, screened, and mixed to the consistency of mud or left in a semi-dry condition. It is then pressed or cut into shape, dried if necessary, and fired or burned in a kiln until a strong, hard brick is obtained. It is fortunate that the several partially unsolved factors of clay mixtures and burning enter the process and keep brick from being too uniform in color and texture. It is this variation (quite conspicuous in earlier brick) which gives interest to a brick wall, a quality which may be heightened by the skillful handling of the material by the craftsman.

Nature gives us clay or the raw product. A mere technician may produce a strictly utilitarian brick, and a workman with no imagination may lay up a wall which is uninteresting or even ugly. It remains for the manufacturer who is sensitive to the possibilities of good brickwork and for the skilled and creative artisan to produce a beautiful brick exterior. It is in this latter phase of brickwork that we are interested, and we may well study the various methods of using brick in order to secure a satisfactory expression of the material.

USE. Bond in brickwork is the manner in which the material is laid up in mortar so that the bricks in any course cover the vertical joints of the course below. A pattern is thus formed, and the entire mass is knit together into a cohesive unit. If the bricks are laid up with the long sides exposed—with frequent courses bonded by turning the ends to the outside—and with the joints staggered, we have the simplest type of bonding. It gives, however, a wall which is less interesting than some of the other types. In the so-called English bond, there are alternating courses of stretchers, or bricks with the long side exposed, and of headers, or bricks with the ends to the outside. In other words, every other course consists entirely of stretchers or of headers. The Flemish bond is an arrangement in which the courses are similar to each other but with alternating headers and stretchers in each course, a header occurring above the centre of the stretcher below, as in Figs. 170 A-B.

The two systems of bonding just mentioned are among the most common and are the most satisfactory for ordinary use in the brick wall. But the character of brick makes





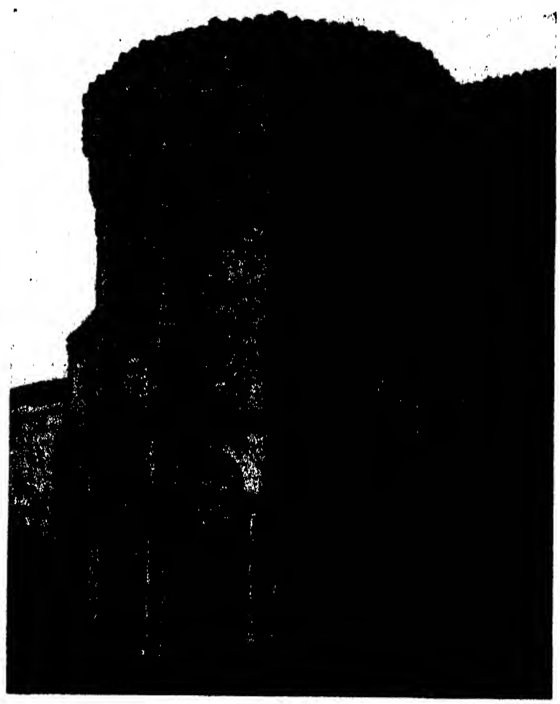


Fig. (A), above.—Italian Renaissance use of brick. Brick walls and pilasters. Formality. S. Pietro, Modena.

Fig. (C), below.—Brick and terra cotta combined according to the Tudor Gothic manner. Diaper pattern. Hampton Court Palace.

Fig. (B), above.—Typical Romanesque brickwork. Accents created by projecting courses. S. Pudenziana, Rome.

Fig. (D), below.—Illustrating the flexibility of Romanesque brick treatment. Simple but effective. S. Fosca, Venice.

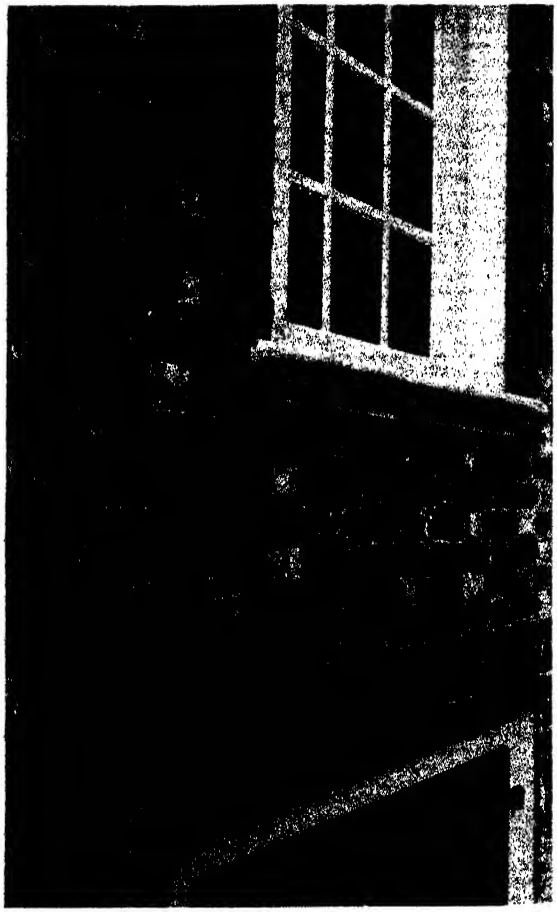


FIG. (A).—Flemish bond—header above a stretcher. Also flat brick arch, forming a lintel. Note radiation of brick.

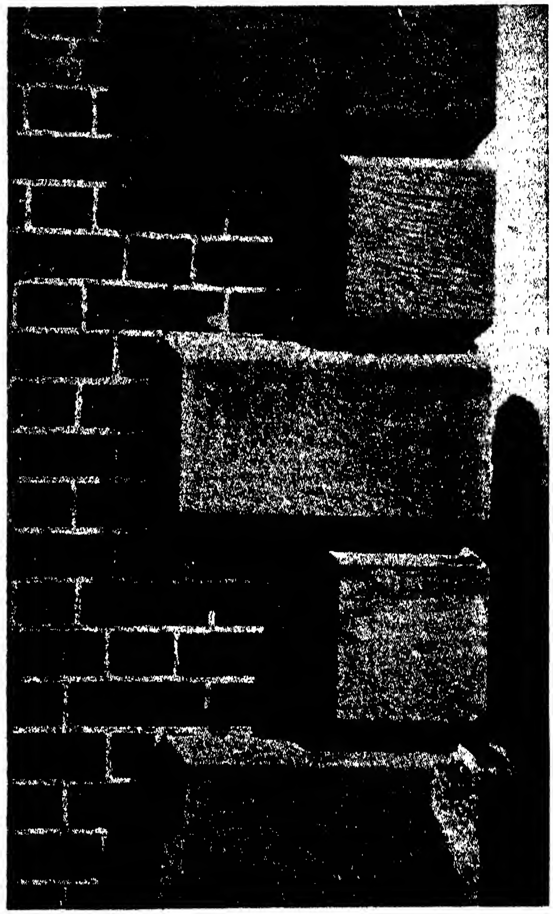
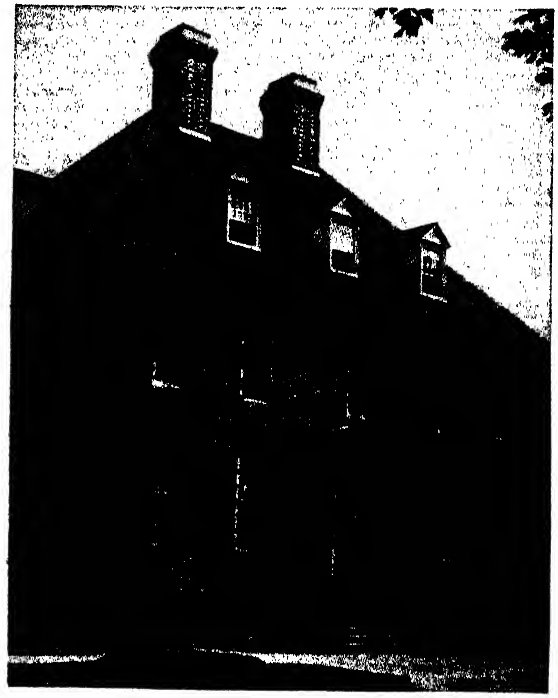
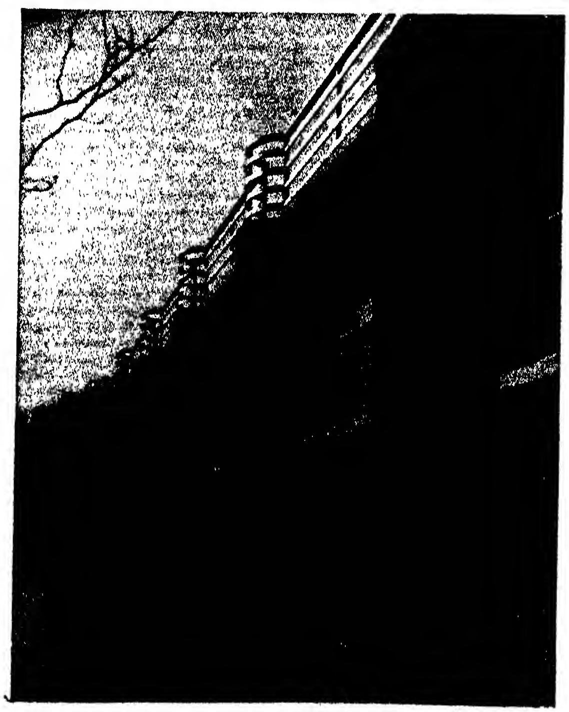


FIG. (B).—A brick wall with stone quoins. Contrast of size and materials. (A) and (B), Colonial houses in Virginia.

possible many other interesting and ingenious combinations. It must be remembered that although bricks vary slightly in their dimensions, nevertheless the size of the average brick used in this country is about 8 by 2¼ by 3¾ inches. It is this small size, as compared with stone, which gives it the flexibility of use which is its outstanding characteristic. Brick is an intimate type of building material. It is informal, rather than formal, and carries with it a feeling of cheerfulness and welcome which some of the other materials may lack.

It has remained for contemporary architects of this country and of Germany, Holland, England, and Sweden, to use brick to its fullest extent. Plain but interesting walls of brick produce vigorous masses which are relieved by door and window trim, piers, and belt courses of the material—effects secured by the many methods by which brick may be laid in place. Accents caused by contrasting shapes and shadows give variety to façades. Some of the results obtained are bizarre and perhaps exceed the limitations of the material. The best and more conservative examples give evidence of a thorough study of the possibilities of a ceramic product which is so old in time and still so new in its modern application, as in the buildings shown on page 171, Figs. A, C, and D.





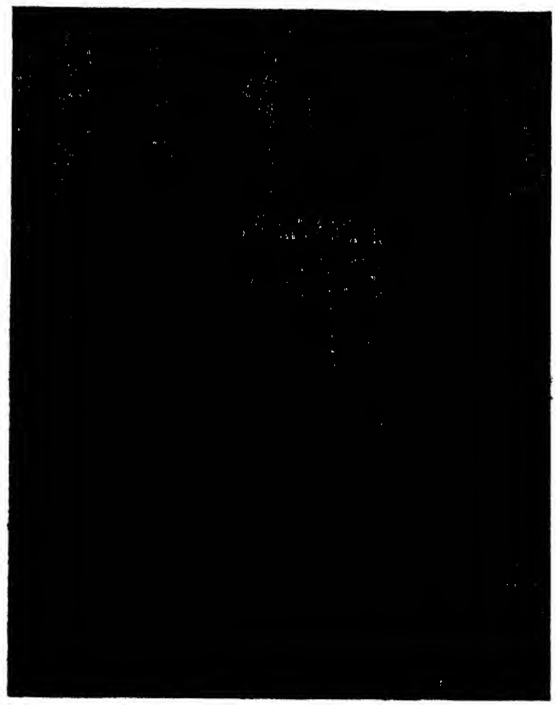


FIG. (A), above.—Simple areas of brick arranged to produce contemporary Swedish architecture. School, Stockholm.

FIG. (C), below.—Contemporary use of brick. Flemish bond with projecting leaders. Bath house, Staten Island.

FIG. (B), above.—Reflection of Georgian style in this country. Note pattern of wall. House, Williamsburg, Va.

FIG. (D), below.—Church, Berlin. Window heads corbeled. Cornices and trim show contrast of direction of brick.

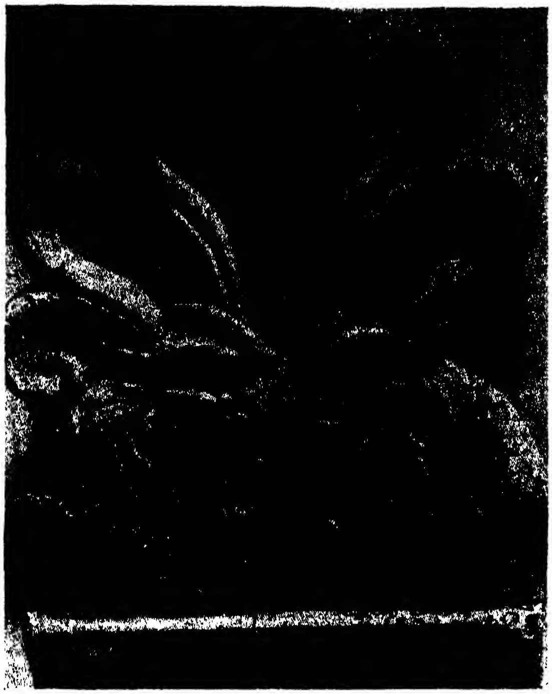
Terra Cotta

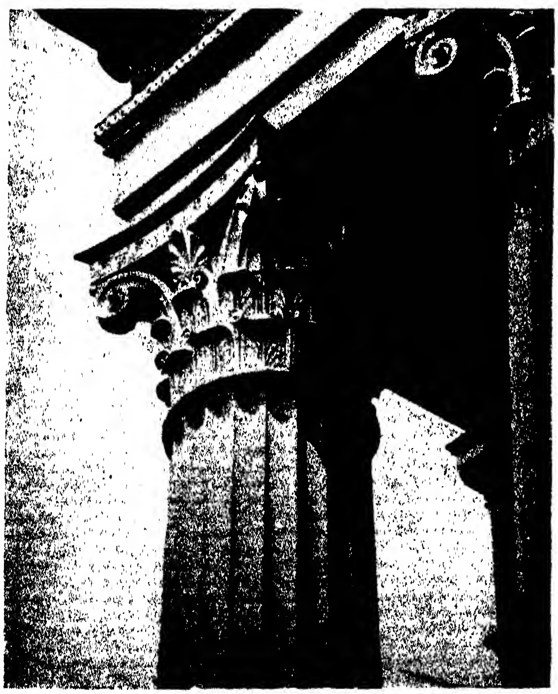
HISTORY. The age of terra cotta as a man-made building material is comparable to that of brick, for it was used upon the temples of ancient Egypt and Assyria many centuries before the Christian era. The Greeks borrowed it for the enrichment of their temples (see page 173), but it was not until the time of the Italian Renaissance that it found its most complete expression. Some of the great sculptors and architects of this golden age, particularly the della Robbia family, produced magnificent decorative examples of terra cotta in color, as in Figs. 174 B and C. Doorways and windows, cornices and belt courses, arcades and pilasters received this architectural adornment (Fig. 174 A).

From sunny Italy, terra cotta was carried into the more gloomy climate of England when Henry VIII, in the sixteenth century, appointed Trevisano to the position of royal architect. He brought along the knowledge of the use of this clay product, and the Tudor period saw the very pleasing combination of terra cotta and brick, as in Fig. 169 C. Unfortunately, this was the end of an interest in the manufacture and use of terra cotta, and there was a decline in the application of the material until less than a hundred years ago. In the nineteenth century there was a revival in the production of terra cotta, but for a number of years it was limited in color to the natural reds and buffs. After considerable research, other colors were added to the palette, and in 1906 the first elaborate polychrome building since the Renaissance was built in New York City. It was the Madison Square Presbyterian Church, designed by Stanford White, the pediment of which is shown in Fig. 175 A. Since that time, the use of terra cotta in this country has steadily increased, and today it is one of the important building materials which has contributed to the progress of this age.

MANUFACTURE. There are two types of terra cotta: one that is used as a covering material, and another that is structural. In that respect it resembles brick, which may also be employed both to enclose and to support. In the manufacture of brick and terra cotta there is an additional similarity. A wall surface which is to be covered with terra cotta or a window which is to be executed in this material is detailed by the architect in such a manner as to allow the division of the area or motif into sections of a size permitting ease of manufacture and handling. A brick wall is shown in the working drawings with the size and number of brick courses indicated for its different portions. At the terra cotta factory, pliable clay is placed in moulds to give the required shape, sprayed or painted with colors, then glazed or left unglazed, and finally fired in a furnace in a manner similar to that used for brick. The result is a light, permanent material possessing an insulation value against heat, cold, and sound, and, in respect to appearance, having the fullest range of possibilities.

USE. The flexibility of the material has led to many abuses in its use. Terra cotta has been made to imitate many other products and has been used as a substitute for brick, stone, and wood. If this substitution is a legitimate one, the results may be satisfactory, but too often the material has been employed simply to resemble other products which are quite unlike terra cotta in their physical and aesthetic properties. Terra cotta has qualities which are distinctly its own, and ~~these characteristics should be allowed~~ to influence the design. Terra cotta can be simple or elaborate, quiet or colorful, space enclosing or simply accenting. ~~However, its comparatively light weight~~ and its fire-resisting





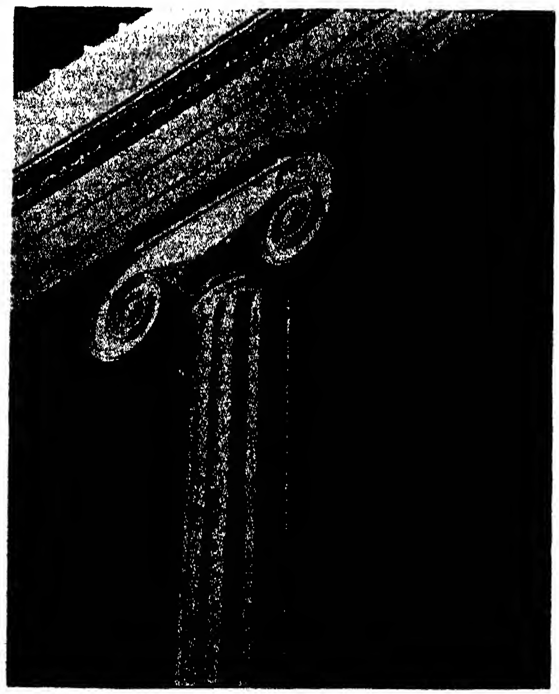
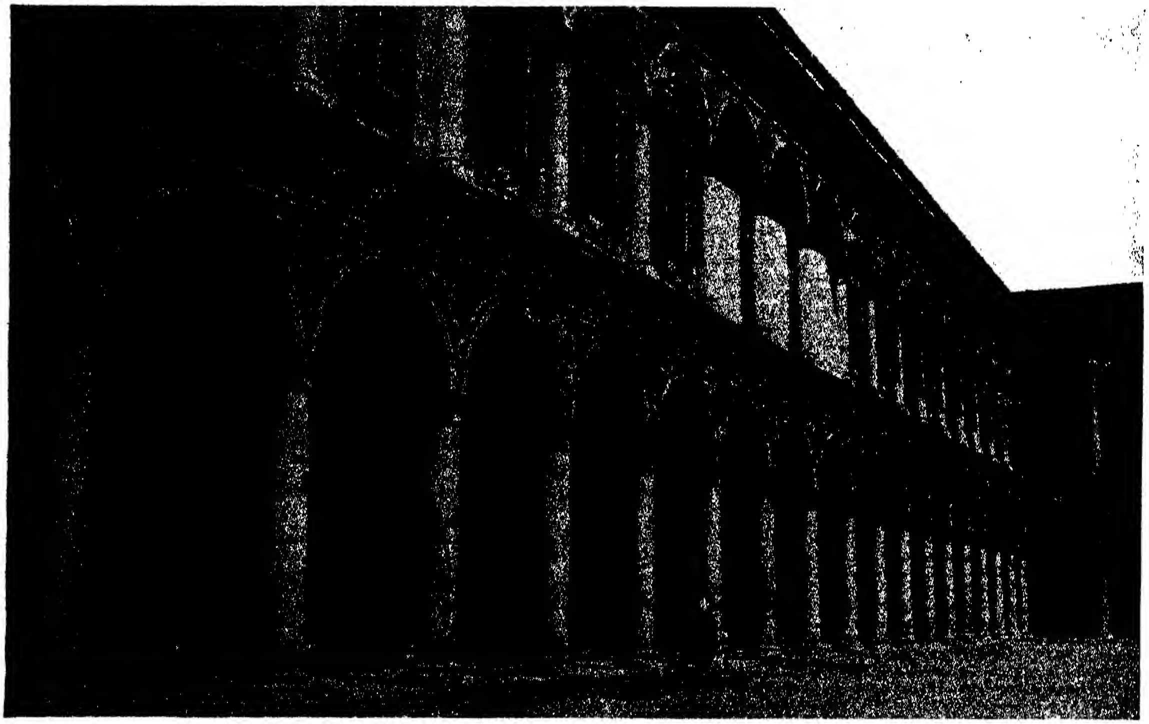


FIG. (A), above, left.—Antefix of goats' heads. Greek terra cotta. FIG. (B), above, right.—Relief with dancing satyr, Roman. Courtesy Metropolitan Museum. (Photos. of terra cotta by Atlantic Terra Cotta Co. and National Terra Cotta Society.)

FIGS. (C) and (D), below, are modern interpretations of Greek details executed in polychrome terra cotta. Philadelphia Museum of Art. Illustrating the use of color in architecture. (Photos. S. Fischer.)



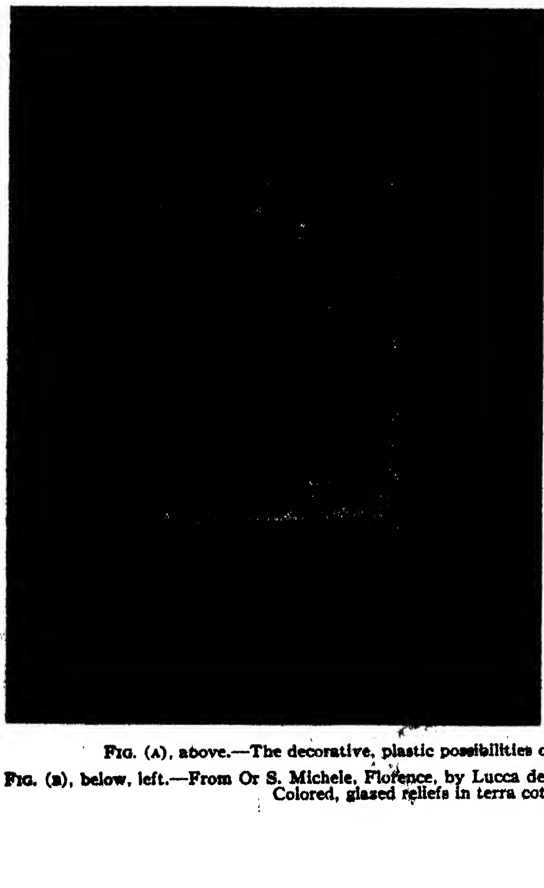


FIG. (A), above.—The decorative, plastic possibilities of terra cotta; Italian Renaissance. Ospedale Maggiore, Milan.

FIG. (B), below, left.—From Or S. Michele, Florence, by Lucca della Robbia. FIG. (C), below, right.—Same as (B), by Andrea della Robbia. Colored, glazed reliefs in terra cotta. Usually white, blue, green, or yellow.

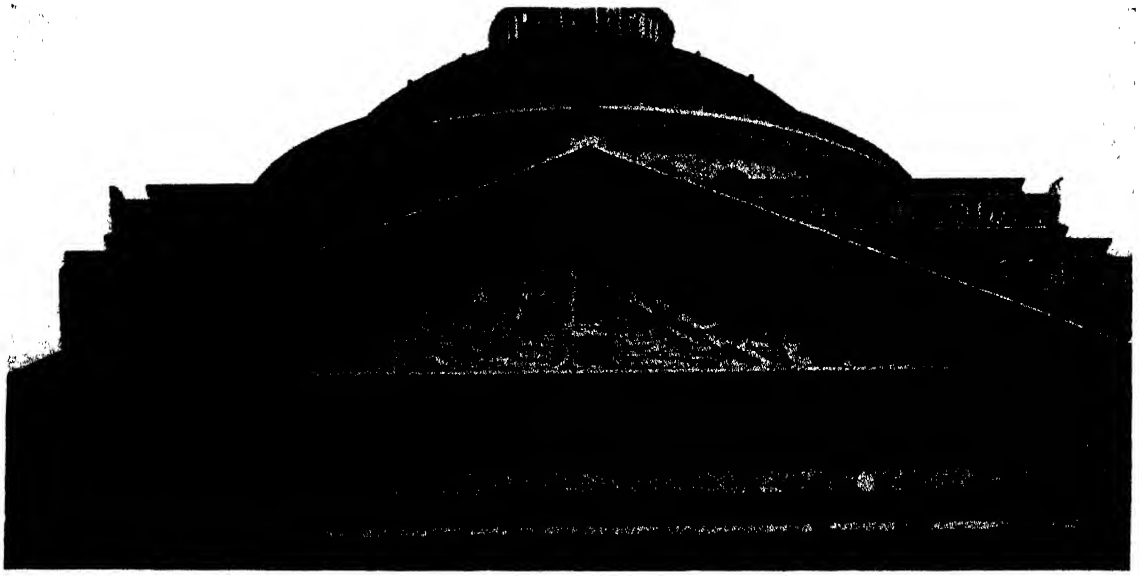
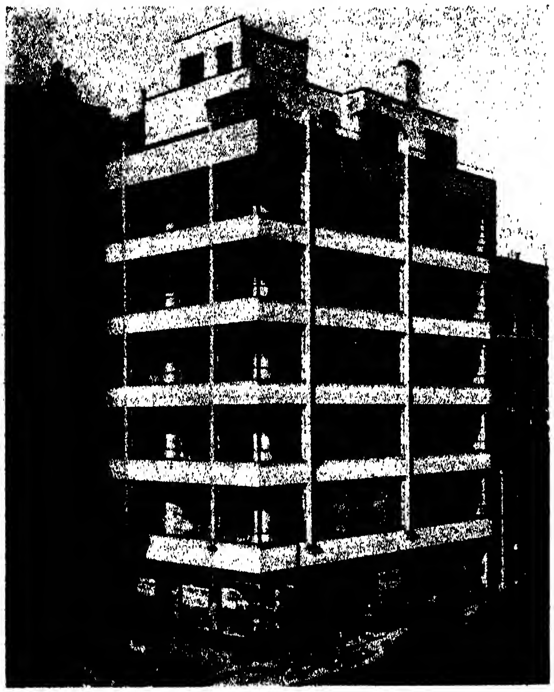


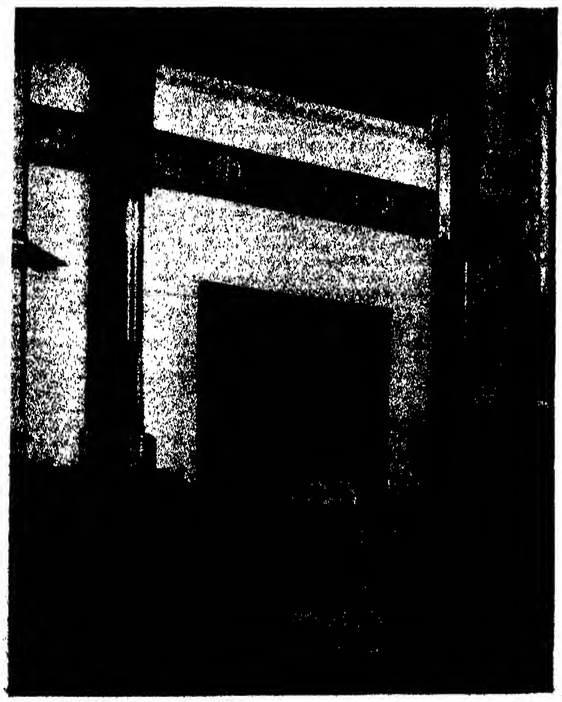
FIG. (A).—Early use of polychrome terra cotta in this country. Pediment, Madison Square Presbyterian Church, N. Y.

nature, together with its ability to bring color into architecture, are its chief contributions to the art and science of building.

The drab architecture of the past few decades is rapidly being changed through the intelligent use of color. The pages of history reveal the presence of color in the buildings of other civilizations. The Greeks used it profusely upon what are often regarded as perfectly white marble temples, and the Persians, Chinese, Japanese, and Spanish were quite gay in their application of colored ceramics. Even the churches and castles of the Middle Ages had their sombre interiors and exteriors relieved with touches of brilliant mosaics or painted decoration. Thus we have plenty of precedent for the timid who would hesitate to depart from the monotony of the nineteenth century. If terra cotta is to be used in this decorative manner, the work of the Italians and others who understood it so well should be consulted. In addition, a knowledge of color harmony and color values should supplement an understanding of the principles of design. With unlimited technical skill at our command, there is a danger of allowing the composition and color range to become too ambitious, and the result may be confusion rather than simplicity and unity.

When terra cotta is combined with other materials, it should form the accent and give emphasis to the design. Its decorative value and the possibility of inexpensively repeating a pattern over and over again insure it a definite place in our scheme of building construction. This is particularly true of the modern structural system, with its steel skeleton and a veneer of some weather-resisting material to enclose the building. Here the problem is that of sheathing the vertical and horizontal members with a light-weight, permanent envelope which will harmonize with the treatment of the window openings between. Terra cotta, used in this form, is not weight-bearing; it is a protective element. It fulfills its duty of enclosing space—space made possible by the steel column and beam or by the concrete cantilever, as seen on page 176. Here are illustrations of the honest use of a material.





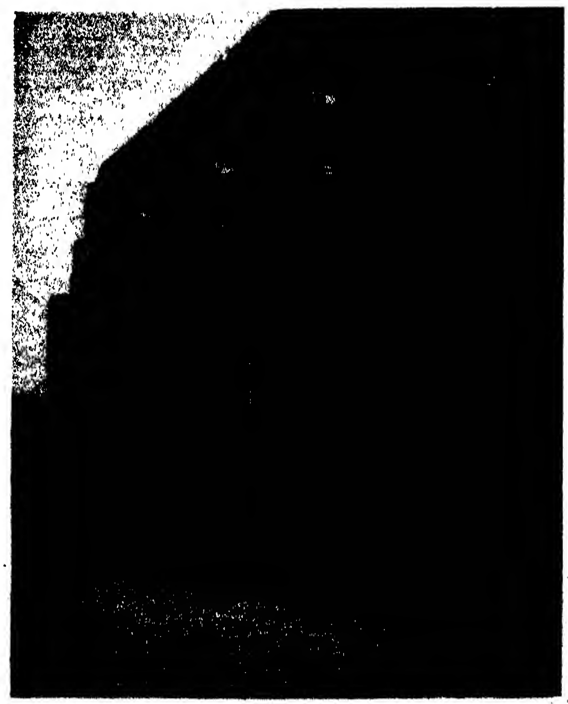


FIG. (A), above.—Tan and green terra cotta walls; aluminum mullions and sills. Cantilever construction. Loft bldg., New York.
FIG. (C), below.—A modern exterior in polychrome terra cotta, with shades of silver and gold. Cafeteria, New York.

FIG. (B), above.—Colored terra cotta used to enclose structural system. Expressive. Department Store, Los Angeles.
FIG. (D), below.—Simple planes and details executed in dark terra cotta. Note jointing. Bank Bldg., Los Angeles.

Tile

HISTORY. Although tile is used extensively today to give color to architecture, it is not a product of the modern age. It also dates back to the civilizations of Babylonia and Egypt, but after these early evidences, this phase of ceramic art languished and was not revived until the twelfth century. It was at this time that the artisans of Persia and India began giving to the world this product of utility and beauty. The manufacture of tiles with geometrical patterns in color was encouraged by the religion of the Mohammedans, which forbade the presence of human and animal forms in the mosques of the Prophet. The use of tile itself was further stimulated by the crude and flimsy construction of the buildings of the followers of this faith—buildings which must be enclosed with a material to compensate for the quality of the structural system. The fatalistic religious attitude of the people encouraged a lack of interest in the present and in an enduring architecture. Colorful effects to bring joy to the hearts of the living were more important than the permanence of the monuments erected to the memories of the dead.

After this revival, the art spread to Spain (Fig. 178 C), Holland, and Italy, although in the latter country it assumed, in most cases, the form of terra cotta. Its influence has been felt in the United States chiefly through our contact with Mexico (Fig. 178 A) and through the early Spanish invasion of California and Florida. If the Spanish Colonial style of architecture is adaptable to these southern states, then the ornament which accompanied it must be just as appropriate. The plain stucco walls and simple arcades need the relieving touches of color which may be applied to the floors, wainscots, and fountains of these Mission and Spanish buildings, as in Figs. 179 A to D.

THE MANUFACTURE of tile is very much the same as that of terra cotta. Although we are primarily interested in its use, production influences its appearance and character to such an extent that it will be desirable to mention it at this time. For the sake of convenience, and on account of the nature of the material and the incorporated designs, tile is pressed from the clay into small geometrical areas or shapes. This "biscuit" is then sprayed or painted with the various colors and glazes which, upon firing, become an integral part of the surface. Tiles may be dry-pressed or wet-pressed; they may have plain surfaces or designs pressed into the surface; the glaze may be uniform or uneven in thickness and color, it may be crystallized or crackled; the effects in tile making are many and varied. The decorative quality of the colors and of the design is the chief contribution of tile to architecture. Roofing tile is also conspicuous in Mediterranean architecture.

USE. Tile was once employed only in a purely utilitarian manner for covering floors and walls. The white-tiled bath rooms of earlier years have done much to discourage the use of tile as a colorful, intimate material. Fortunately the building public is awakening to the possibilities of tile as an object of beauty and interest. The decorative quality of tile may be secured in three ways, as follows: (1) the use of solid colors approaching uniformity, which gives areas of blue, green, yellow, etc.; (2) the use of conventionalized ornament, which may consist of areas confined to and contained upon a single tile or of larger and more complicated patterns which require several tiles to complete; (3) scenes involving the use of landscape and figures, the design of which has little reference to the units of the tile themselves. It seems that geometrical forms which have a definite relation to the shape of the individual tiles are more expressive of the material.

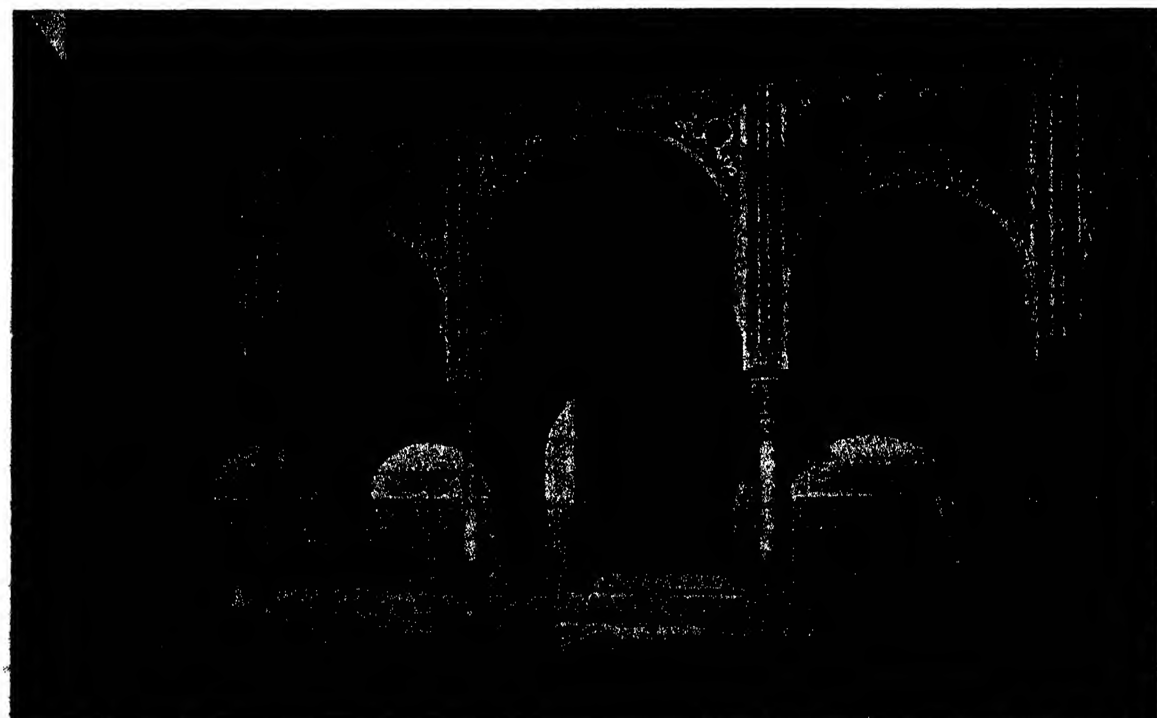
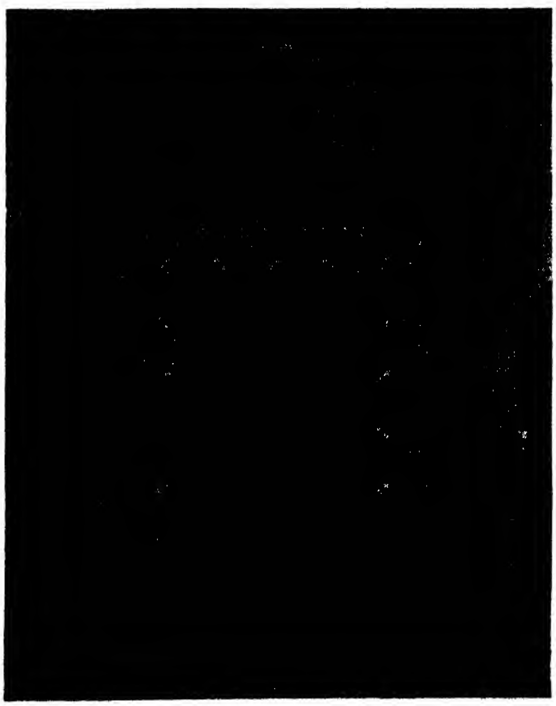
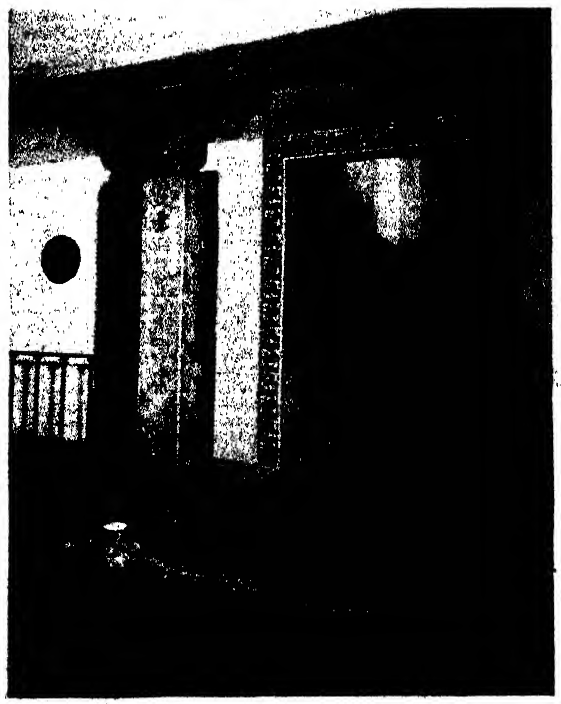


FIG. (A), above.—Tile dome and decorations. Color in keeping with ornate details. Holy Well, Guadalupe, Mexico.

FIG. (B), above.—Tile domes. Spanish Renaissance in the United States. San Diego Exposition. Bertram G. Goodhue, Archt.

FIG. (C), below. Arcade, The Alhambra, Granada, Spain. Saracenic ornateness. Plaster decoration; tile wainscot.





FIGS. (A) and (B), above.—Climate, nature, and architecture combined. Light stucco walls with contrasting accents of tile, stone, and plants. Sunshine and color. Los Angeles.

FIG. (C), below.—Doorway with tile trim, showing relation of geometric patterns to individual tiles. Conventional.

FIG. (D), below.—Tile used upon interior; floors, stairs, and trim. Wood, plaster, and tile. (Photo. Assoc. Tile Industries.)

GLASS

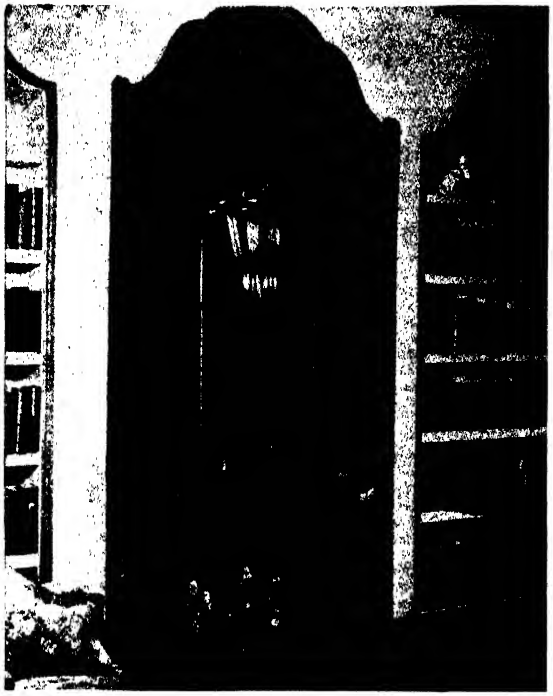
NATURE. Glass is a hard, brittle, and usually transparent substance manufactured by fusing together some form of silica and a base of lime or lead oxide. It is another ceramic product, made possible by that powerful element of fire which is responsible for our brick, terra cotta, tile, and metals. However, glass has been used with more of a feeling of interest and romance than the above scientific definition would indicate. Glass has made possible the development of cheerful interiors. When the need for fortified castles passed, livable palaces took their place, encouraged by the architectural use of glass. If it had not been for the peculiar qualities of this material, it would have been difficult to admit the light and to keep out the rain and cold. Glass has made possible the open, flexible plan and has promoted the close relationship which exists in the present generation between the interior of a building and nature out-of-doors.

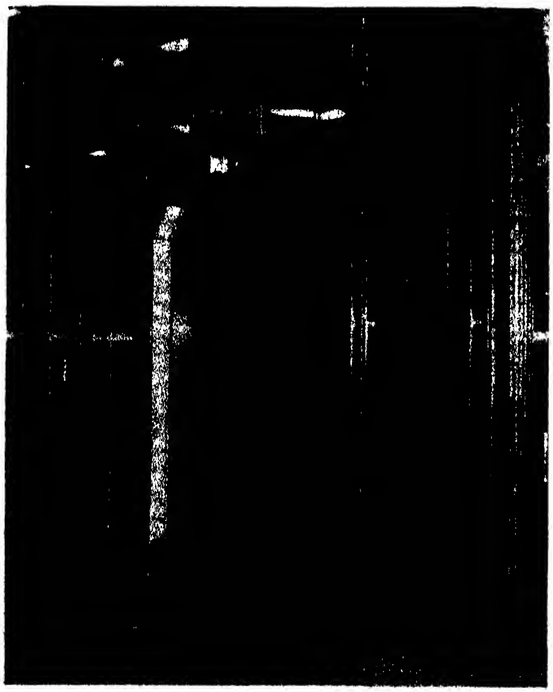
USE. The modern use of glass has assumed so many forms that we can only indicate the general character of some of these interpretations. Glass has been colored and rolled into various shapes for many architectural uses in a building. Combined with metal, it is made into furniture and equipment. Where a sense of cleanliness is desired, it is used for wall coverings and paneling. Where a decorative note is needed upon the interior, its black, shining surface may assist in producing a mantel, a fountain, or the trim of a door. (See page 181.) Upon the exterior, it shows promise of becoming one of the important building materials. It is already collaborating with steel to form a time-resisting structure of metal and glass, as in Fig. 181 D. Its light weight and its production in large, thin sheets with permanent colors and textures recommend it as an enclosing medium. It may be used in the form of glass blocks which admit light but retain privacy, as shown in Figs. 182 A and B.

By way of contrast, let us discuss glass from a more romantic point of view. For centuries, light has been directed through colored glass. The product is the stained-glass enclosures of the mediaeval cathedrals. The glory of Chartres lies in its beautiful windows with their scintillating beams of ruby and blue, which, by contrasting with the dark piers, relieve an otherwise sombre interior.

In designing stained-glass windows, there are three factors to be kept in mind. (1) The character of the glass should be established by the nature of the surrounding architecture, which may be Gothic, Renaissance, or even modern. (2) The dominance of color or design will depend upon the effect desired. As a rule the pictorial quality of a window should be subordinate to the color. Realism is not expressive of the conventional combinations necessary with glass and lead. (3) The position of the window and the source of the light should materially affect the choice of colors. If the window is on the north, there should be more of the transparent or light-admitting colors; if upon the south, more of the darker tones.

In the construction of a stained-glass window the individual pieces of colored glass are held together by lines, or cames, of lead, and these strips of metal should contribute to the design in addition to being structural. The pattern of lead should be interesting in its decorative appeal and should be related as closely as possible to the different elements of the composition. The cames should follow the contours of the various figures in the design, and the pleasing combination of dark lines and brilliant areas should be the chief objective of the designer. (Page 183.)





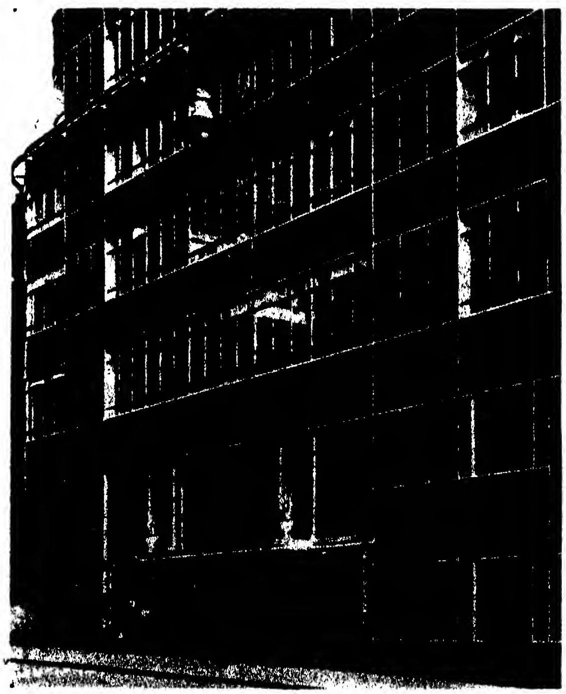


FIG. (A), above.—Mirrored and colored glass used in a decorative manner. Mantel in living room. Apartment, Chicago.

FIG. (C), below.—Elevator alcove of Allegheny metal and panels of steel-blue glass. La Salle-Wacker Bldg., Chicago.

FIG. (B), above.—Contrast secured by a combination of glass and marble. Drinking fountain in a theatre.

FIG. (D), below.—The all-metal-and-glass exterior. Transparent glass and opaque black glass. Daily Express Bldg., London.

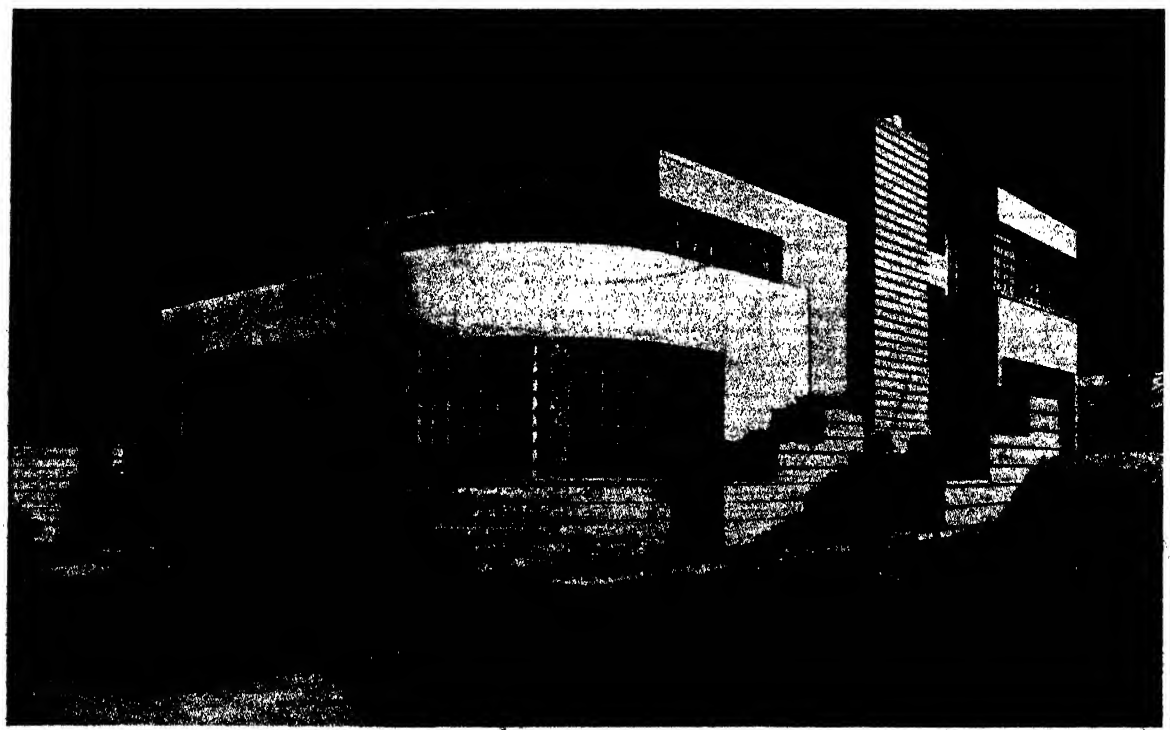


FIG. (A), above.—Museum of Modern Art, New York. Utilitarian exterior of stone, glass, and glass block. Streamlined efficiency.
FIG. (B), below.—Dental office. Satisfactory use of glass block and corner windows in interesting architectural massing.

FIG. (A), inside, and (B), outside.—Views of portion of stained-glass window from Strasbourg, late twelfth century. Decorative quality of colored glass and lines of lead. (Photo. Charles J. Connick and Worcester Art Museum.)

There is an opportunity at this point to digress in order to emphasize again the necessity of allowing the character of the material to influence the design. Regardless of the medium, a close imitation of nature is to be avoided. Modern photography provides the latter, or the original may be available for enjoyment. If one wishes to produce a vine motif in a tapestry, the design should be made to fit the warp and woof of the fabric. If human and animal forms are to appear in a stained-glass window, the geometrical patterns of the lead lines and small glass areas should dominate the treatment.

It is necessary that these areas of color be small in order to secure the desired brilliant effects. In modern practice, sketches of the window, similar to Figs. 183 B and C, are first made in color in order to study the design and judge the color values. The glass is then cut to fit the areas decided upon and assembled for leading. The many single pieces are then surrounded and held in place by the strips of lead, which are H-shaped in section, and which give the dark accents to the design. The entire composition is then placed in a structural metal frame fitted for the window.

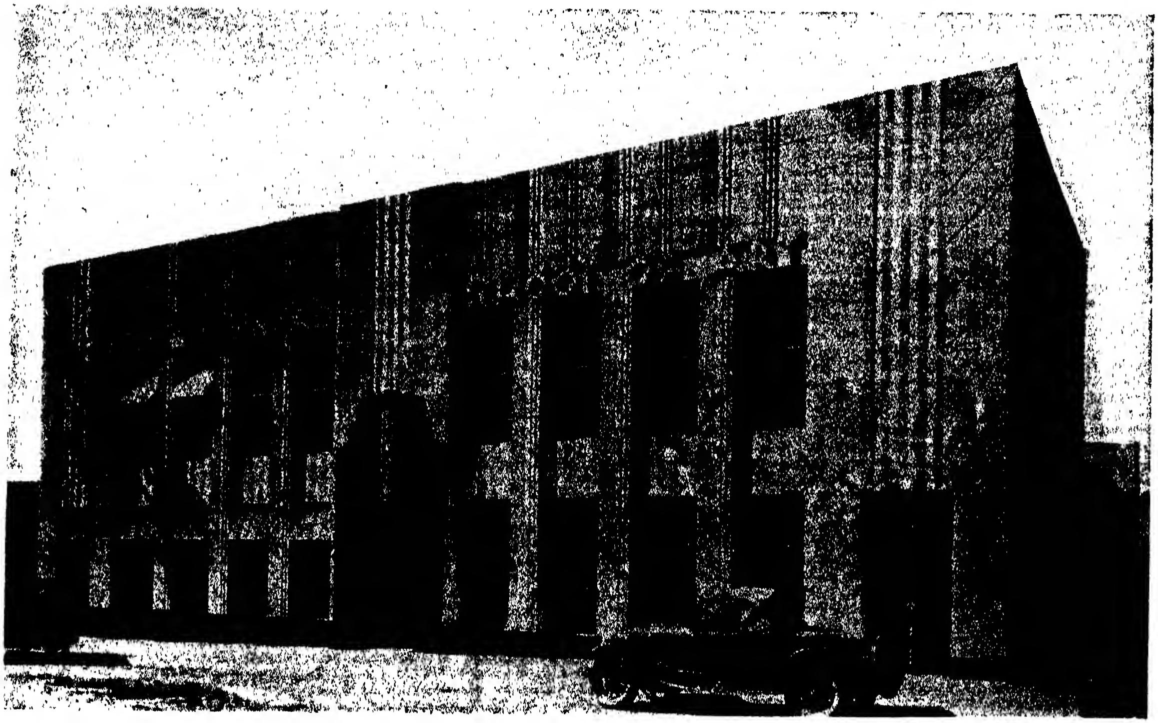
CONCRETE

HISTORY. The use of concrete is generally hailed as one of the great accomplishments of the twentieth century. We think of it in connection with vertical office buildings or horizontal factories. It makes possible the spanning of areas small and large with the post and lintel or the pier and arch. It is used in startling ways, and belongs, we believe, to this civilization. Reinforced concrete is the product of this period of industry and commerce, but it had its beginnings centuries ago. The Romans used concrete with great boldness and understanding. They were engineers as much as architects, and their practical minds saw the advantage of mixing a composition of stones and cement to form a core for the thick walls and vaults of their palaces and baths. The process was more economical than the slow dragging into place of large stones, which was the method employed by their teachers, the Greeks. The Romans were thus able to roof their ambitious buildings with daring concrete vaults combined with brick or stone. The character of Roman architecture is different from the Greek partly because of the influence of this material.

USE. After the end of the Roman supremacy in matters political and architectural, concrete remained unused until its revival late in the last century. Previous to this, concrete had been employed only as a rubble, an infilling material. Now it became a structural system in the form of ferro-concrete, with steel rods to take care of the tension while the mass of the aggregate itself resisted the compression. At first it was hampered by the traditions of the past. It served simply to back up and support an architecture which was essentially one of stone. The piers and beams were hidden behind columns and walls, which were developed by those who had had only masonry with which to build. If, at any point, the concrete was left exposed, it had to be painted to look like wood, or have its surface tooled to resemble stone. It could not be just concrete.

In recent years it has been discovered that concrete, in addition to its structural utility, may possess interest and beauty in itself. It has strength, and a surface and texture capable of contributing to the aesthetic quality of a building. Its most important characteristic is its fluidity. It is the only important building material that can be poured into place and made to assume a variety of shapes. In the older forms of construction, gravity necessitated a vertical arrangement of units, unless, as in the vault, the delicate adjustment of thrust and counter-thrust was maintained. Brick, stone, and wood favored either the post and lintel, the vertical wall, or the arch. Ferro-concrete can be cast into these shapes, and, in addition, can escape from these limitations and carry on with the imagination of the designer. Marble may come from Georgia or Carrara, wood from Washington or India, tile from Ohio or Holland. They are local and retain a local flavor. Concrete is international; it requires only stone, sand, and cement. These coarse materials, available throughout the world, unite to create utility and beauty. Only under the guidance of the architect does concrete assume national characteristics.

From the structural shapes of earlier years have been developed the monolithic structures of the present day. These latter seem to be a truthful expression of the material. Here the walls, floors, and roofs are one homogeneous substance with a unity of character and appearance. The effect may be one of strength and bulk, or one of fluidity and lightness. Since it is plastic, its shape depends upon the use of forms. These wooden or metal devices for holding the concrete in place until it hardens should be simple in their planes



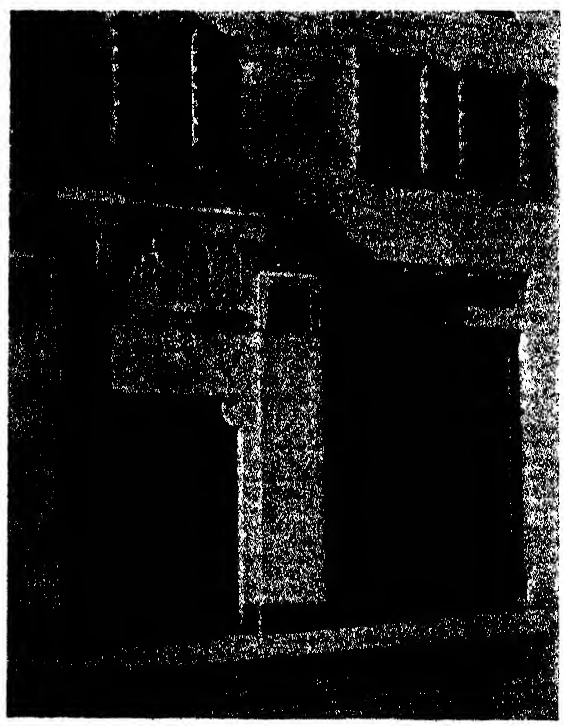


FIG. (A), above.—Concrete. Simple planes with vertical and diagonal lines. Monolithic quality. School, Los Angeles.

FIG. (B), below.—A frank expression of concrete. Simplicity from simple forms and moulds. Bank, Huntington Park, Calif.

FIG. (C), below.—Concrete cast into walls and decoration. Design and material compatible. Architects' Bldg. Los Angeles.

and direct in their arrangements. The surfaces which are produced by these forms may be treated in a number of ways. They may be left as they come from the forms, with the marks showing, a practice which calls for a scrutiny of the size and quality of the boards which are to be used. Wide boards mean similar divisions on the surface and give a feeling of heaviness. If the form marks are too conspicuous, the surface may be ground or rubbed until the desired effect is obtained. In many cases, it is necessary to apply a stucco or cement finish to the concrete walls. This application, with its various trowel finishes and tints of color, makes possible a wide variation in treatments. The latter should vary with the climate; the atmosphere of a New England manufacturing town is not so lenient to a stucco wall as is the sunshine of California. In addition, good workmanship is especially essential. Much of the success of European concrete work is due to the care given to the mixing of the material and the placing of it in the forms. If concrete is to become more popular in this country, the practice of hasty construction, based upon structural rather than finished work, should be avoided. Designs executed in concrete require the same careful study as those employing marble.

If decoration in the form of reliefs, column fluting, etc., is desired, it can be cast as an integral part of the wall, as in Figs. 185 A, 188 A, and 188 B. This is done by the use of waste moulds of plaster of Paris which are built into the wooden forms and filled at the same time as the latter. When the design is to be repeated a number of times, this is an economy of time and money. Such unity between the structure and the surface adornment is suggestive of only one of the many possibilities of the material. The nature of the concrete should be allowed to express itself. If the designer is tempted to mark the surface with lines to resemble stone joints, it is a proof of his inability to use the material with the sincerity which it deserves. Simple horizontal or vertical planes, with interesting decoration and texture, such as are to be seen in Figs. 185 B and 188 A, illustrate logical and sensible applications of concrete to modern architecture.

One of the outstanding accomplishments of the "concrete style" has been the development of the parabolic arch. Usually a curve has more pleasing proportions and harmony of line than an angular arrangement. The parabolic arch is structurally correct—satisfying those individuals whose inclinations lean toward this particular approach. The thrust of an arch carrying an equally distributed load is parabolic in its direction. More important at the immediate moment, however, is the fact that the parabolic arch is beautiful, satisfying those whose first interest is aesthetic. It has the height and soaring quality of the pointed nave arches of the Gothic cathedrals, as in Fig. 188 C. Its uninterrupted flow of line, beginning at the lowest point on one side and ending at a similar point on the other, is powerful and dramatic in its appeal. This type of design and construction seems to be the most truthful expression of the plastic quality of concrete. It represents style growing from materials.

We have emphasized the arcuated and the plastic characters of concrete, but there still remains the pre-cast type. Instead of being poured into place, concrete is sometimes cast in moulds to produce units which can be laid up in a wall in a manner similar to stone. If this is done simply for the purpose of imitating stone, it may become a laborious process and one lacking in good taste. If this pre-cast concrete is treated with a repeating surface pattern which is difficult to obtain in other materials, the results may be quite legitimate and satisfactory as shown on page 187.

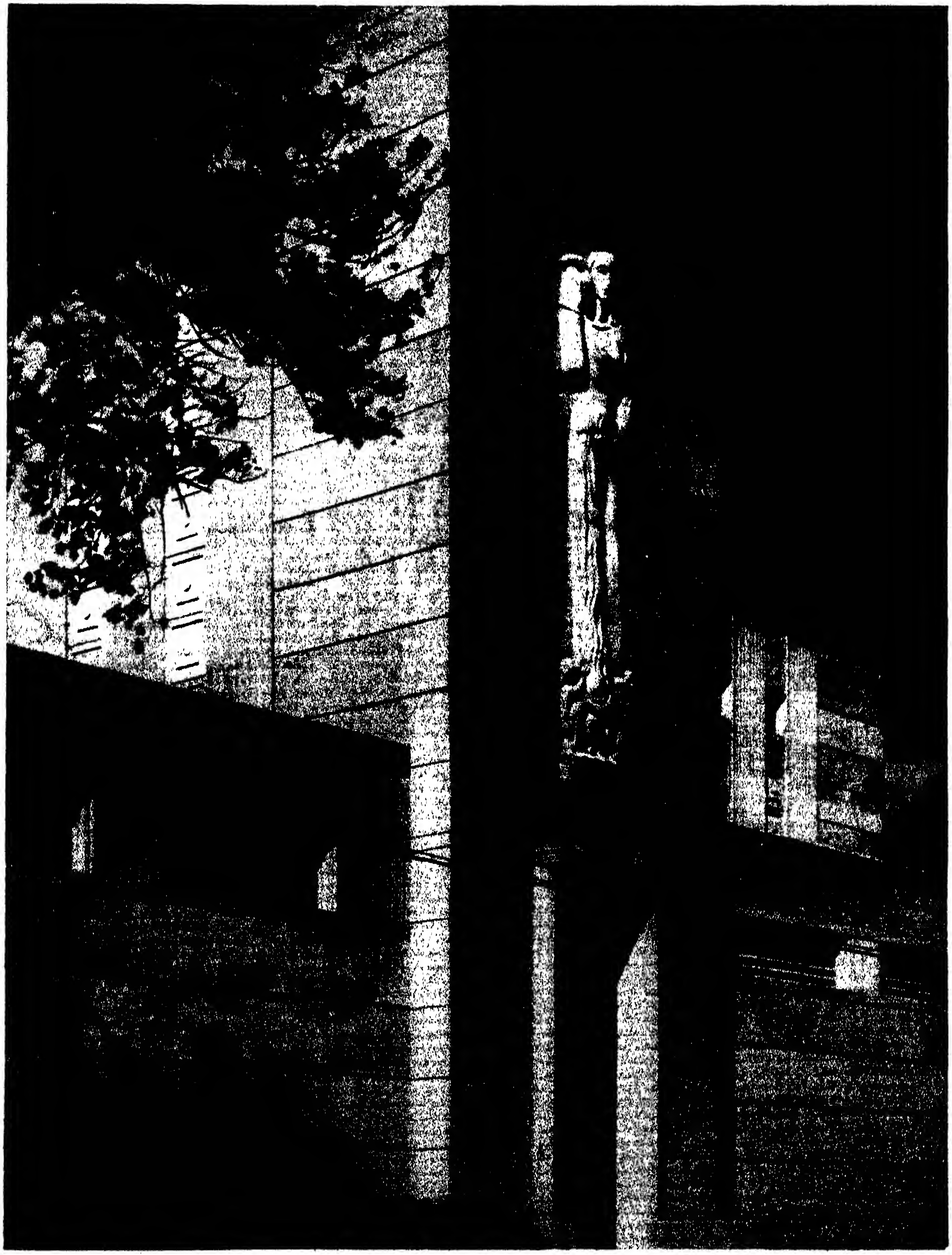
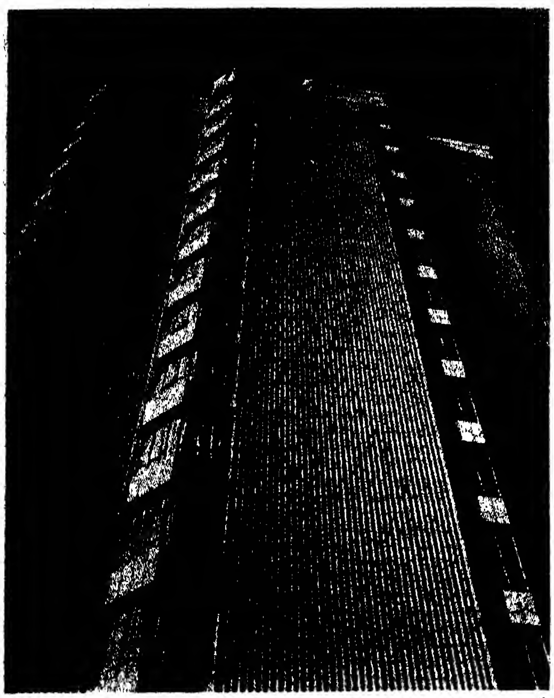
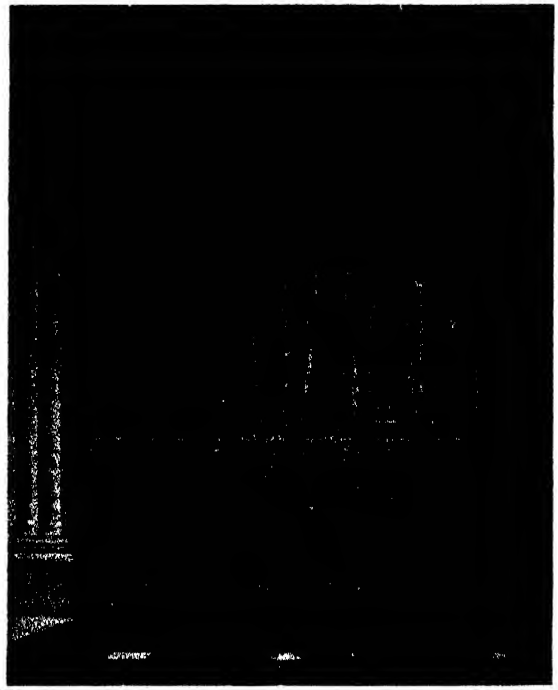
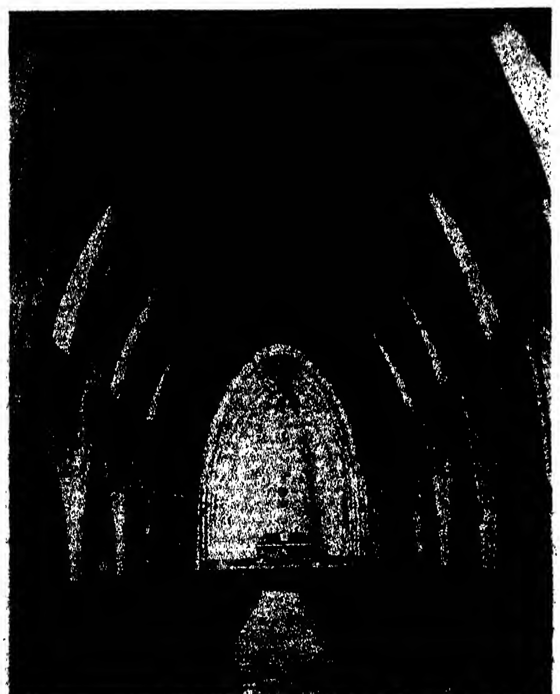


FIG. (A).—Contemporary movement successfully interpreted in concrete. Simple ornament and sculpture. Water-conditioner plant, Lansing, Mich.







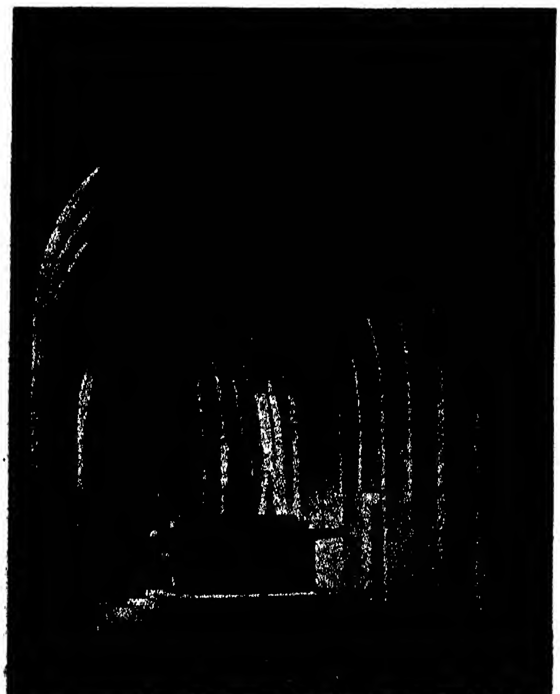
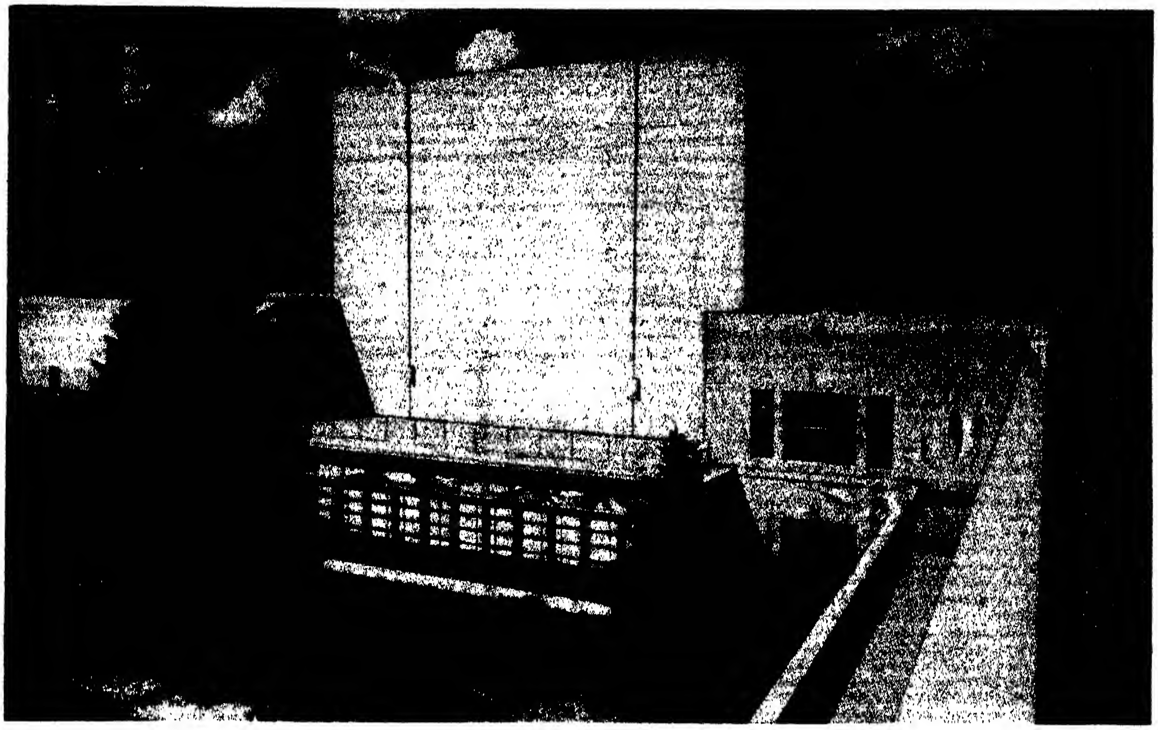


Fig. (A), above.—Beauty and functionalism. The vertical and horizontal. Concrete expressed. Simplicity. Meany Hotel, Seattle.

Fig. (C), below.—The parabolic vault in concrete. Harmony of line and direction. Church, Limburg, Germany.

Fig. (B), above.—Monolithic concrete. Sculpture cast with wall from waste moulds. Unity of character and surface. San Francisco.

Fig. (D), below.—The plastic quality of concrete, illustrating flexibility of possible shapes. Church, New Ulm, Germany.



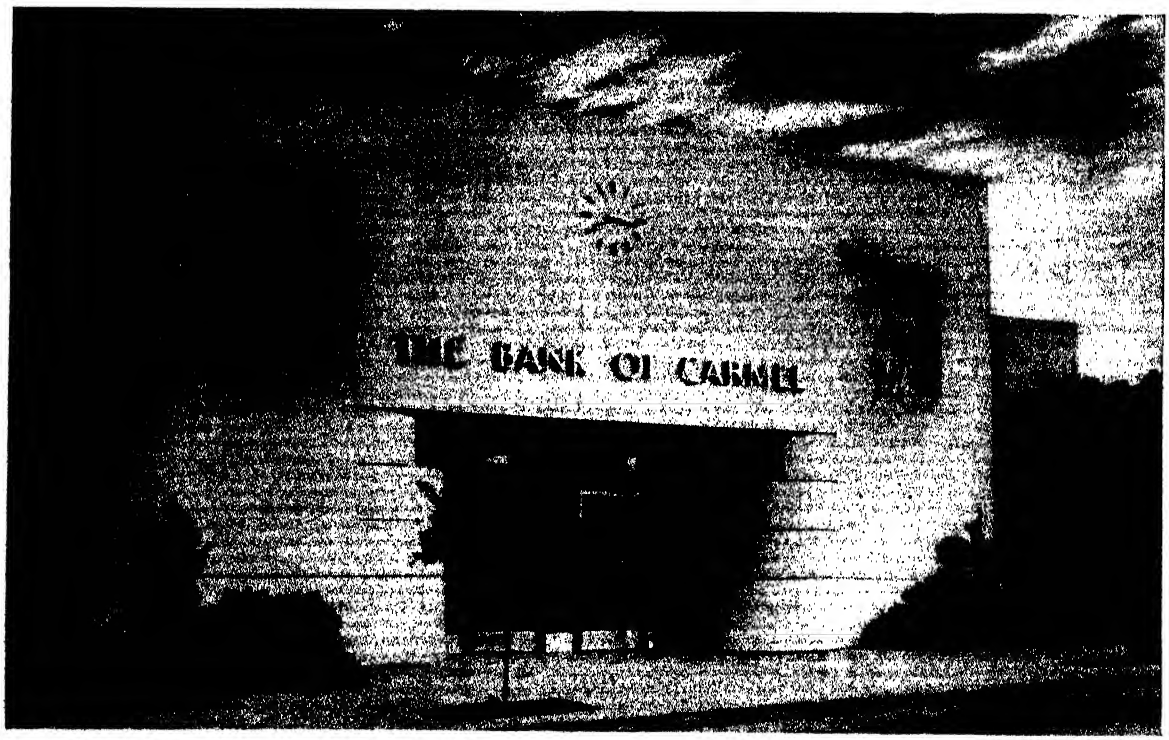


FIG. (A), above.—Vigorous massing executed in concrete. Satisfactory expression of the material. Art Academy, Colorado Springs, Colo.
FIG. (B), below.—Interesting composition of plain concrete walls, decoration and glazed openings. Bank, Carmel, Calif.

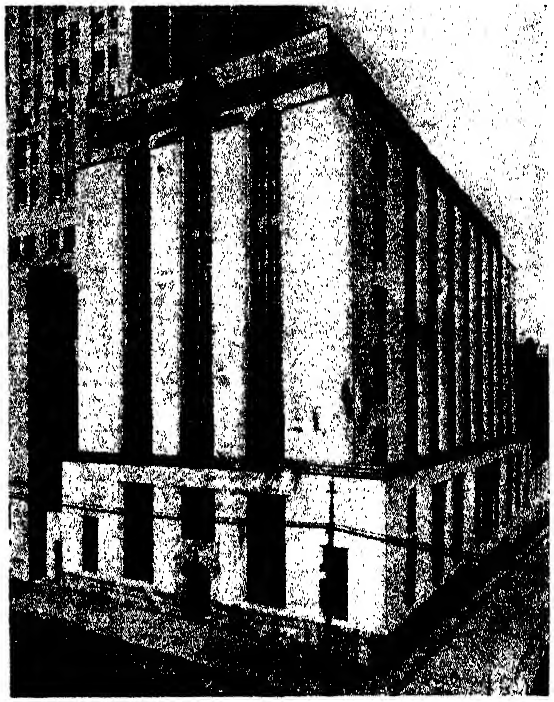
Metals

The materials with which man has worked during the early periods of his development have been so important that the various stages of his progress have been named after these materials. Early man lived in the stone age when he used pieces of sharp, hard rocks with which to cut and carve. Accident, no doubt, first brought together the metal resources of the earth and that powerful element of fire, and man emerged into the bronze age. His intelligence and perception developed, and the discovery of the use of iron was perhaps not accidental. The iron age was another step forward in his spiritual and physical dominance. Since those early days in the history of the human race, the knowledge and use of metals have increased. The accomplishments of past and present civilizations are the direct result of the supremacy of man over metal and of metal over other materials. If the more important metals had not been discovered, we would be experiencing a more primitive existence.

HISTORY. If we look back over the historic periods of development, we find in the buildings of the Greeks and Romans an early use of metal in architecture. The wooden ceilings of the temples were covered with bronze plates, and the same material was employed for the construction of the doors and gates. In the Middle Ages the steepness of the roofs and spires did not encourage the use of tile, and lead found favor as a roofing material, having as a competitor, in recent years, the lighter-weight copper. The lead-covered flèche of the Gothic cathedral was an important decorative motif of that age, as in Fig. 69 A. For the large windows of this period, stained glass was developed, because lead was available to hold it in place. During the Renaissance, lead was again used as a covering, this time upon the domes of the churches. Richly decorated bronze doors were much in evidence, Fig. 198 D, and wrought iron was borrowed from the hinges and lighting fixtures of the mediaeval period to form screens, grilles, and balconies.

STEEL has, no doubt, influenced our present civilization more than any other metal. The steel framework for tall buildings grew from early experiments with iron columns and beams, and has made possible many of the ambitious building projects of the twentieth century. Even though the skeleton steelwork of a building is usually enclosed by some material which protects it from its enemies—corrosion and fire—and prevents it from being seen, still this type of construction has had a profound effect upon contemporary design. Prior to 1870 the buildings of our country were limited in height to five or six stories. During the next decade the more daring designers reached heights of eight or ten stories with their structures, but the masonry walls of the first floor were so thick that light could scarcely be admitted to the interior. Then began experiments with metal columns, the forerunner of the steel frame of today. At first these iron columns were placed in the brick piers to give added strength to the walls, and this had little effect upon the appearance of the building. Later, cast- and wrought-iron columns and beams were used more independently, which led to an iron framework, and finally to the steel skeleton.

The pioneers of any movement often act with timidity and caution, failing to realize the importance or meaning of their discovery. And so it was with the early workers in structural steel. They still lived in an atmosphere of stone architecture, and for years an attempt was made to hide the presence of the structural members and to create designs based upon walls of masonry. Gradually the walls became thinner and thinner, with the



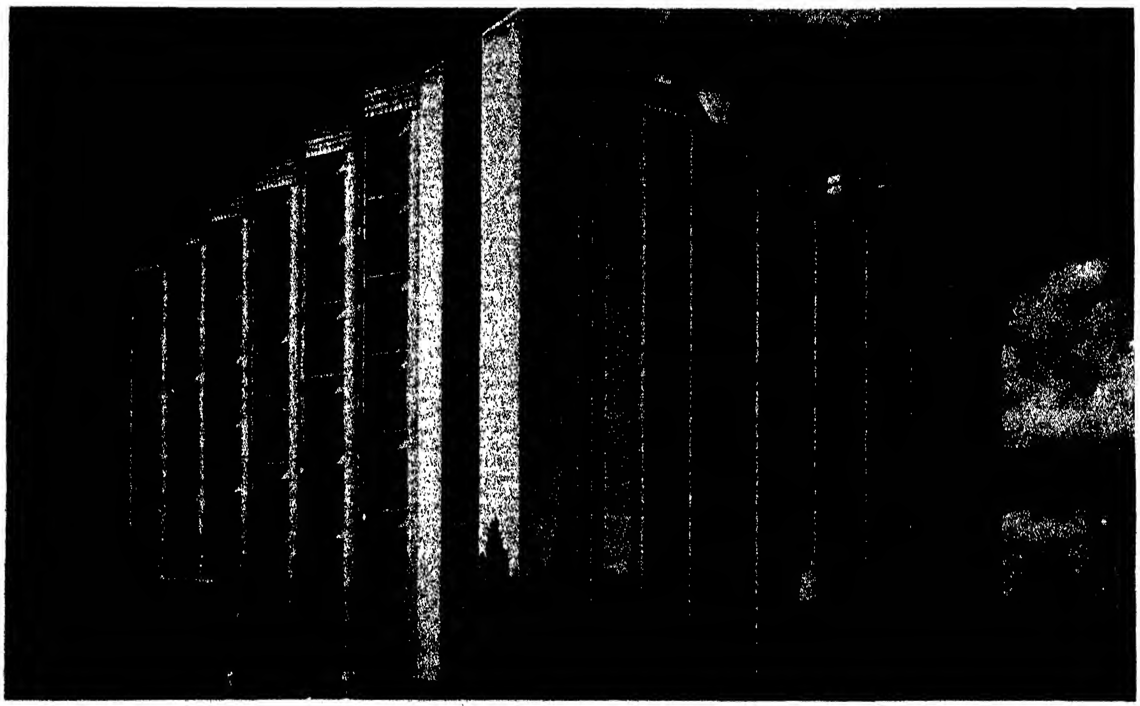
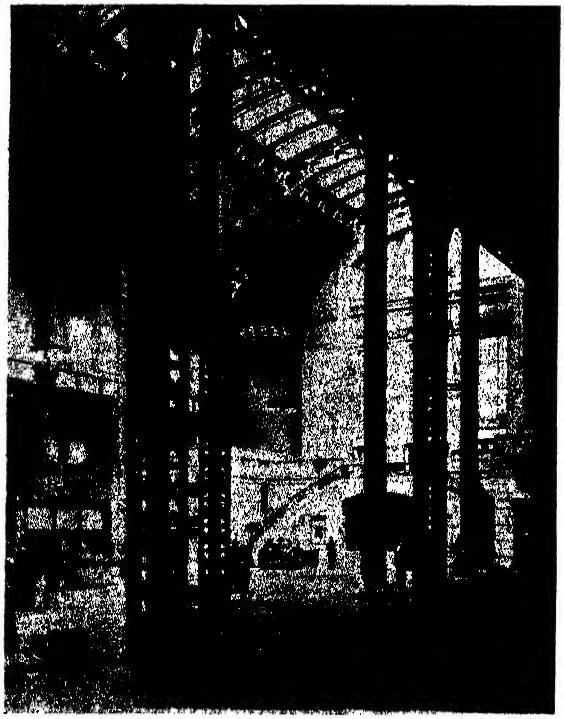


FIG. (A), above.—Panels between windows, together with cornice, are sheets of copper. Dierig House, Berlin.

FIG. (B), above.—Aluminum used for top floor, roof, window spandrels, mullions, and ornament. Bank Bldg., Pittsburgh.

FIG. (C), below.—Limestone piers with window structural and decorative members of aluminum. A. O. Smith Bldg., Milwaukee.



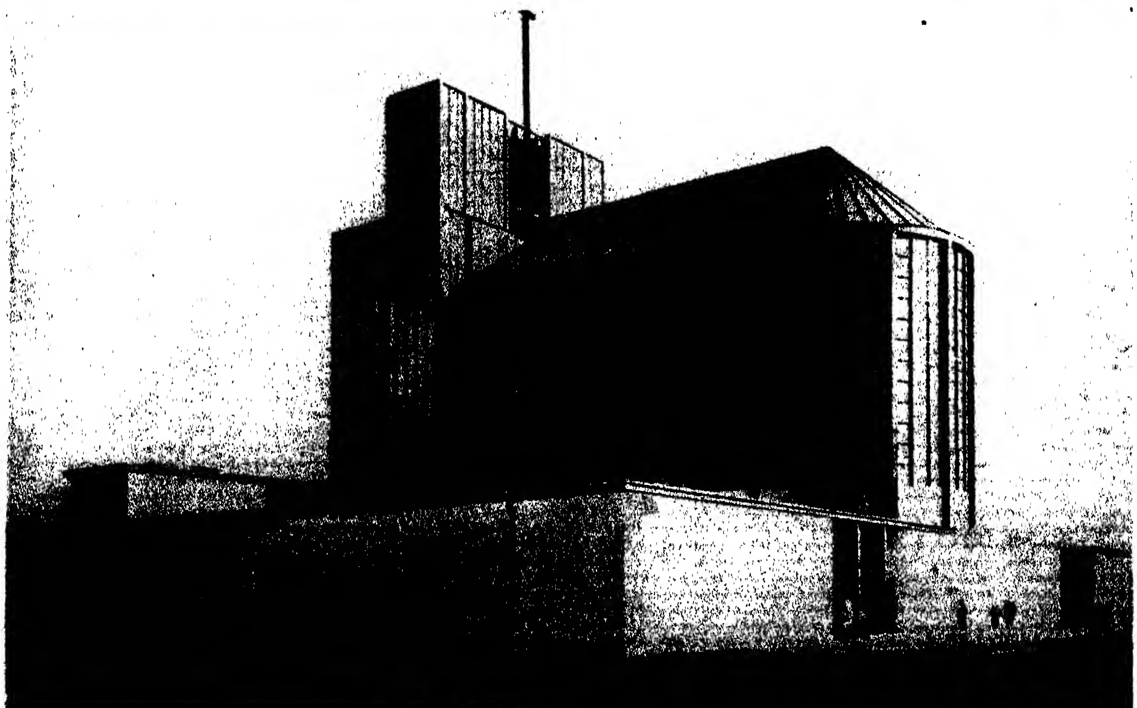


FIG. (A), above.—Showing the decorative character of exposed structural steel. Arch and pier. R. R. Station, Chicago.

FIG. (B), above.—Steepness of roof necessitates use of light-weight copper covering. Chinese Theatre, Hollywood.

FIG. (C), below.—Copper-covered structural members and roof. All-metal-and-glass church. Essen, Germany. See Fig. 282 C.

realization that the stone, brick, and terra cotta which enclosed the desired space were simply hanging upon the skeleton of steel. No longer was the masonry of tall buildings structural—it was merely protective.

It was not until the decade beginning with 1920 that there was witnessed a concerted attempt to allow the structural system of a building to be conspicuous. This evidence may be actual or implied. Steel may be exposed, particularly if it is fabricated of interesting shapes and contributes to the design. Examples of this treatment were found several decades ago in Paris in the reading rooms of libraries (Fig. 32 A) and in the ornate rotundas of department stores, and more recently in this country, in convention halls, armories, and concourses of railroad stations (Fig. 192 A). If steel is concealed, for fire-proofing reasons, the design of the building should reflect its presence, as in Figs. 281 B and 156 A. The popularity of steel is due to qualities which materials of the past did not possess. It is strong but light. It requires less area than solid masonry. Its structural design may be computed accurately, a saving in space and cost. It permits pre-fabrication in the shop, so that less labor is required upon a crowded site. In addition to the rolled sections of steel used for structural purposes, slabs and thin sheets of it and other metals have been developed for surface coverings. This opens up the possibility of the all-metal and glass building, Fig. 192 C, where there is a desire for this reflection of the machine age.

BRONZE. Returning now to the oldest of metals, we find that bronze is one of the alloys, and is composed chiefly of copper and tin. It is cast into shape and lends itself to the treatment of many architectural features. Its use by past civilizations insures its successful application to modern architecture. Its permanency and beauty have stood the test of time. Today it is employed in so many different ways and is so familiar to the architect and layman that it needs no description. Banking screens and shop fronts, doors and grilles, hardware and lighting fixtures, are constructed of this material. (See Fig. 198 B.) It is capable of receiving numerous textures and colors. It, together with some of the newer metals, is a rich, sophisticated material as compared to wrought iron, which is simple and unassuming. The splendor and polish of bronze require fine marbles and formal architecture as a setting. The delicacy and spontaneity of wrought iron harmonize with rougher surfaces and informality.

WROUGHT IRON is distinguished from other metals by the manner in which it is produced and by the final effect obtained. Instead of being cast, as is bronze or cast iron, it is worked upon the anvil while it is hot or cooling. Iron bars, rods, and plates are heated and then hammered and twisted into the attenuated forms so characteristic of wrought iron. It has a quality all its own which should be reserved for it. The heavy effects of cast iron should not be attempted with wrought, nor should the drawn character of wrought iron be interpreted in cast. Wrought iron is elastic and fibrous; cast iron is brittle.

The human element enters very largely into the production of wrought iron. In its manufacture the artistry of the craftsman predominates. So much depends upon the skill of the worker, just as the success of a painting hinges upon the ability of the artist. Wrought iron is honest and frank in its appeal. The workmanship is apparent, the hammer marks may be seen, the joints and structural elements are part of the design, as in Fig. 194 A.

Wrought iron was used by the builders of mediaeval cathedrals for brackets and grilles, and for the hinges and locks of their wooden doors, Fig. 194 B, but it was not until the time of the Renaissance that it found its fullest expression. In Italy and Spain the

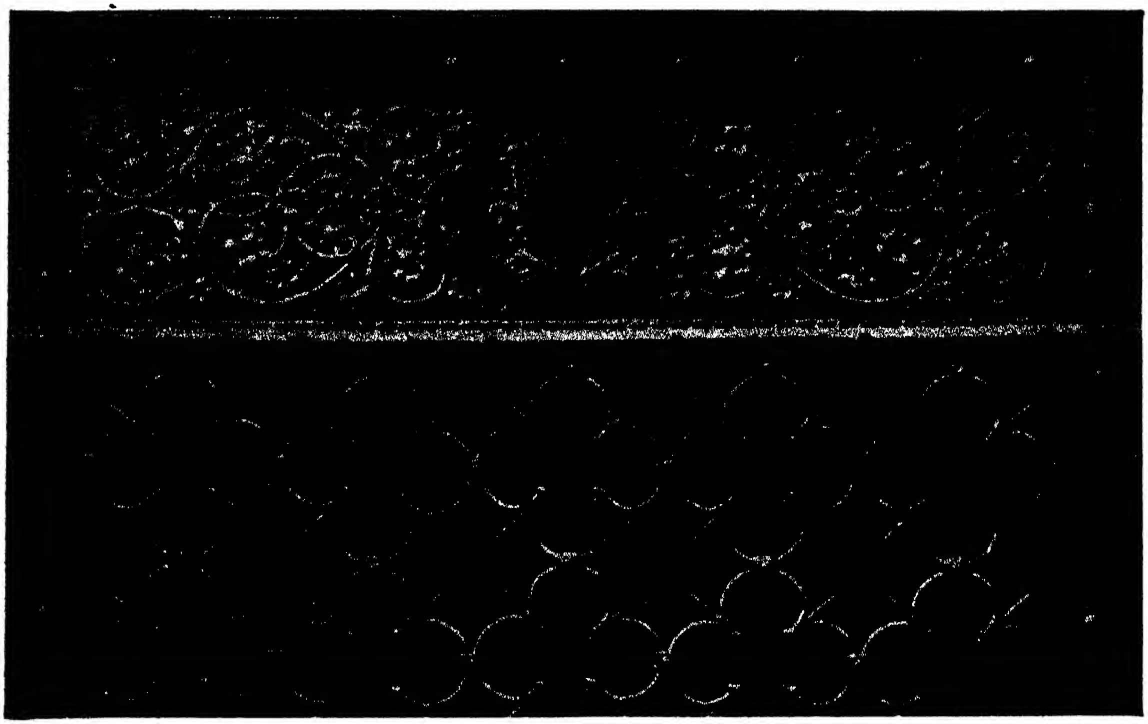


Fig. (A), above.—Showing the delicacy and grace of a wrought-iron screen. A truthful expression of the drawn and hammered quality of the metal. S. Trinita, Florence.

Fig. (B), below.—Wrought-iron hinge from main door of S. Trophime, Arles. Sturdy combination of wood and metal.

many beautiful (simple or complex) gates, grilles, and balconies attest to the skill and imagination of the workers in this metal. Its use has continued down to the present time, and today it contributes to the decoration of our buildings.

COPPER. Although copper is one of the major constituents of bronze, it is important for itself alone. The ductility of copper makes it particularly adaptable for cornices, spandrels, roofing, etc., as in Figs. 191 A and 192 B. The protective green carbonate which forms upon the surface gives an interesting quality to the material.

LEAD. The early uses of lead are lost in the mists of antiquity, and it is not until the Gothic period is ushered in that lead is important as a building material. In the church architecture of England and France lead was used on the exterior in covering the roofs and spires and in executing finials and gargoyles. On the interior, baptismal fonts were decorated with this flexible material. Lead formed the structural-decorative members of the stained-glass windows. The manor houses and palaces of the Tudor period in England also received their share of the application of lead. Leaden downspouts and gutters (Fig. 210 A), and garden sculpture added to the interest of this phase of domestic architecture.

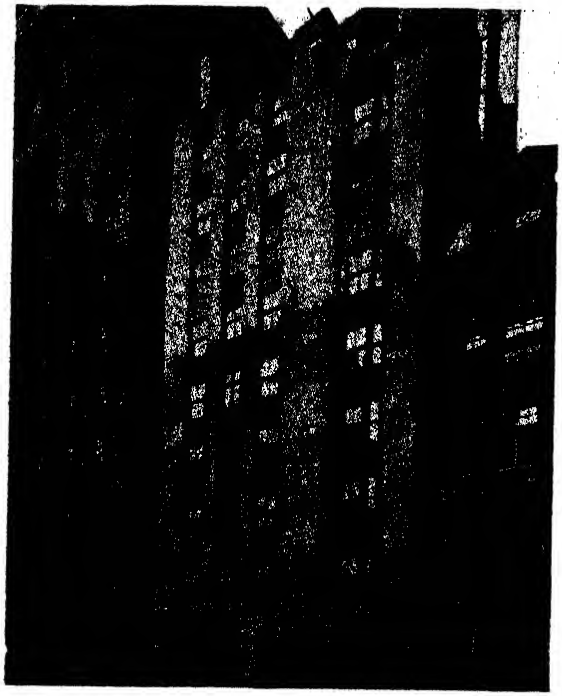
The chief recommendations of lead are its permanency and the ease with which it can be worked. Lead may be cast, rolled, or hammered. Patterns may be beaten into its surface, or it may be poured into interesting shapes. It should be used, however, with a proper regard for the limitations of the material. It is essentially a surface material, and not one to be pulled into bars and bent into the forms of wrought iron. It is best used in sheets to cover or enclose and, as such, may be decorated in a fitting manner. Since it is a soft material, the detail of the ornament should be simple in character.

The introduction of hard lead, an alloy of lead and antimony, has increased the use of this metal. It has eliminated the objection to its former great weight. It may now be cast into grilles for openings. (See Fig. 81 A.) Also lead-covered copper may be pressed into shape to serve as spandrels between piers and windows upon the exterior of a building. (See Fig. 196 C.) The construction of a large building depends upon lead in many instances, as it does upon brass and copper, for those hidden but essential pipes, vibration- and water-proofings, and equipment.

THE NEW METALS, the modern alloys, are the result of the machine age. The demand for mass production has required new surfaces and techniques. New effects are desired to harmonize with polished marbles and daring textures. Our striving for what is called functionalism has led to an attempted elimination of the non-essentials in architecture. Contemporary designers are searching for new methods of expressing the simplicity of the present movement. Consequently new materials have been produced so rapidly that architects have not had time to try them out and give them their proper place in the process of building. Therefore, our chief interest lies not in the achievements that have been attained with their aid but in the possibilities which they offer for future development.

The white metals represent those metals and alloys which are today, along with older forms, enjoying popularity as adjuncts to the stone and brick of past ages. They include aluminum, chrome steel, chrome nickel steel, monel metal, nickel silver, etc. They present many interesting textures and surfaces, and may be rendered usable by the various processes of casting, drawing, stamping, extruding, and hammering.

Chrome-Nickel Steel comes to the builder under various trade names. It is a hard, non-corrosive metal and can be worked like many others, lending itself to welding, stamp-



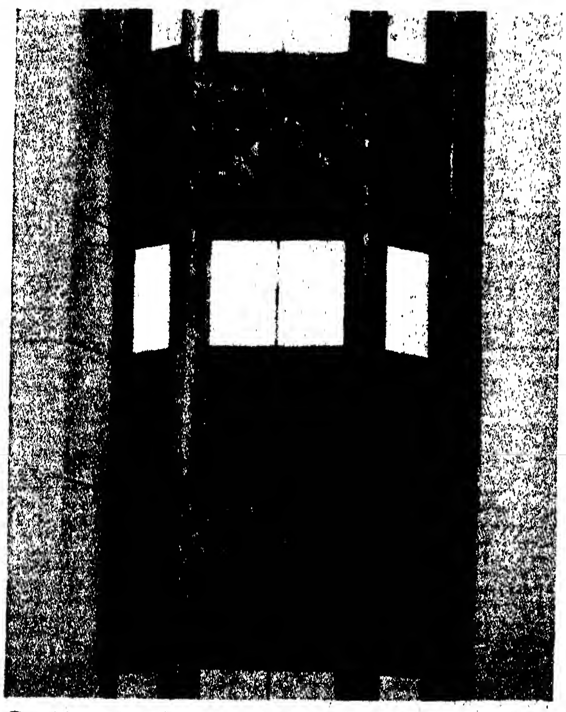


FIG. (A), above.—Illustrating relation of lead-coated copper spandrels to masonry piers. Apartment house, New York.

FIG. (C), below.—Detail of (A). Design stamped in ductile material. Tones may vary from metallic gray to antique gray.

FIG. (B), above.—Restrained modernism. Bronze spandrels and window frames. Vertical angularity. Scherl House, Berlin.

FIG. (D), below.—Detail of (B). (Photos. of copper and bronze by Copper & Brass Research Association.)

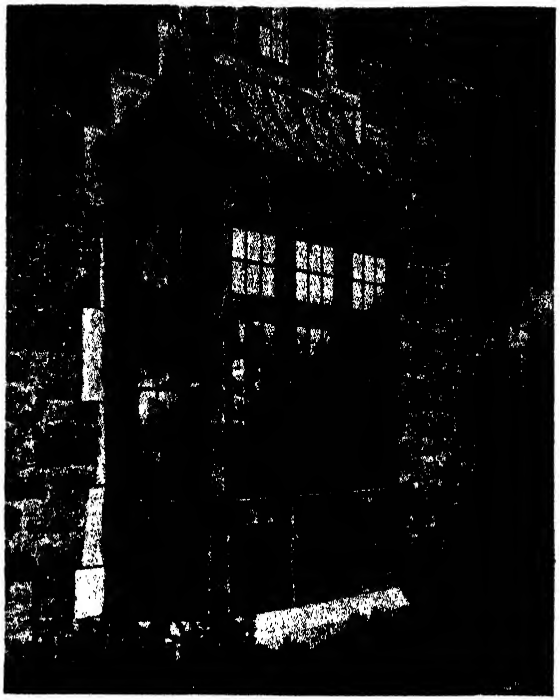


FIG. (A).—Flexibility of lead makes it adaptable to surface covering; color harmonizes with rugged walls. (Photos. of lead by Lead Industries Association.) Wurts Bros.

FIG. (B).—Light-weight aluminum spandrels anchored to steel beams. Limestone piers. Rockefeller Center, N. Y. (Photos. of aluminum by Aluminum Company of America.

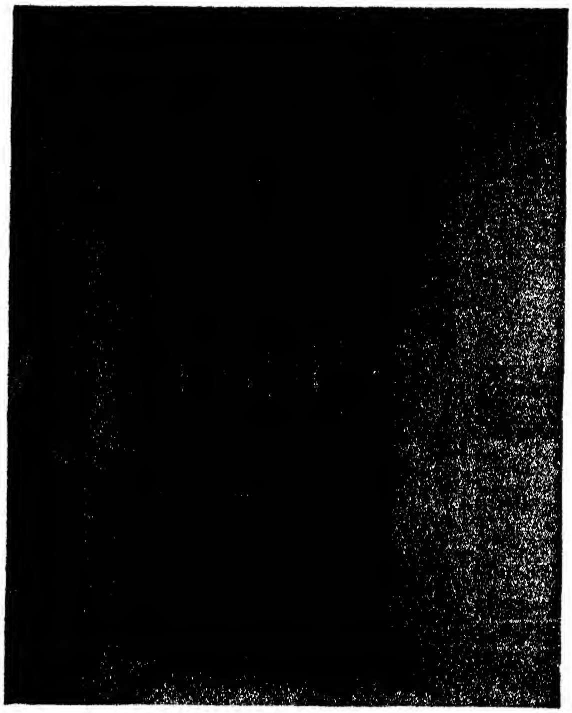
ing, and forging. It may be polished or left dull, or even enameled in color. It is used in interiors for doors, panels, grilles, or railings. It gives a brilliant, shining surface which is compatible with the spirit of contemporary architecture. In addition, it may be employed upon the exterior for the construction of the all-metal building. The steel framework may be enclosed with riveted or welded sheets of this permanent material, insulated to give protection against heat, cold, and sound.

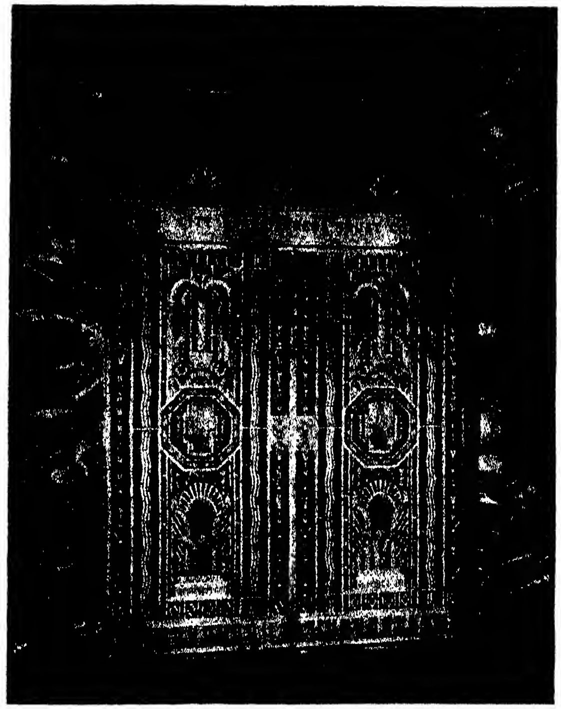
ALUMINUM is one of the white metals and is especially noted for its lightness. It is non-corrosive, and non-staining, and can be cast or forged into various shapes in order to secure the desired designs. It is used for shop fronts, doors, grilles, hardware, and exterior covering where its peculiar qualities are needed, as in Figs. 191 B–C and 197 B.

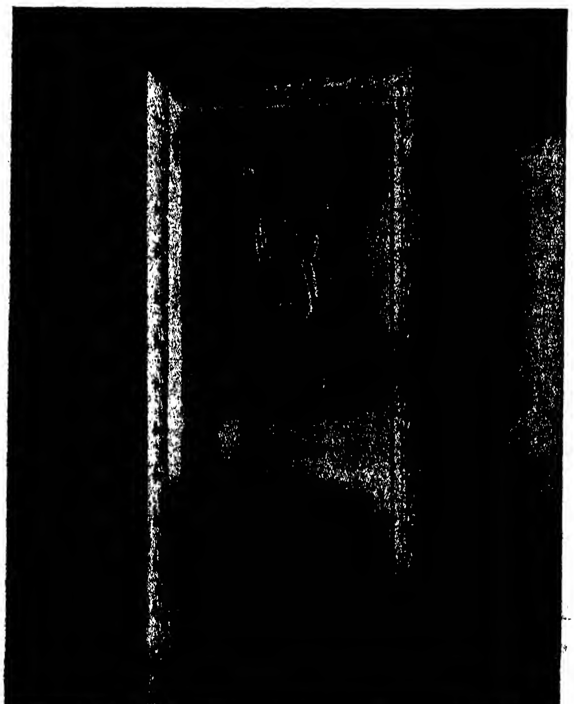
MONEL METAL is another product of the present movement which is often used by contemporary designers. It is a mixture of nickel and copper with an addition of iron, silica, and manganese, giving a surface resembling that of nickel. Again it is non-corrosive and is permanent in its physical qualities. Doors and grilles, balustrades and screens (in addition to prosaic kitchen equipment) find a satisfactory expression in this material, as in Figs. 198 A and 284 C.

THE NICKEL SILVERS are ideal for interior work. Their soft, dull textures and tones combine well with the marble and wood of contemporary designs (see Fig. 198 B), or may find use in connection with more stylistic types of architecture.

Science and architecture seem to be collaborating—science contributing new metals, wall boards, and ceramic products; architecture endowing them with usefulness and beauty.







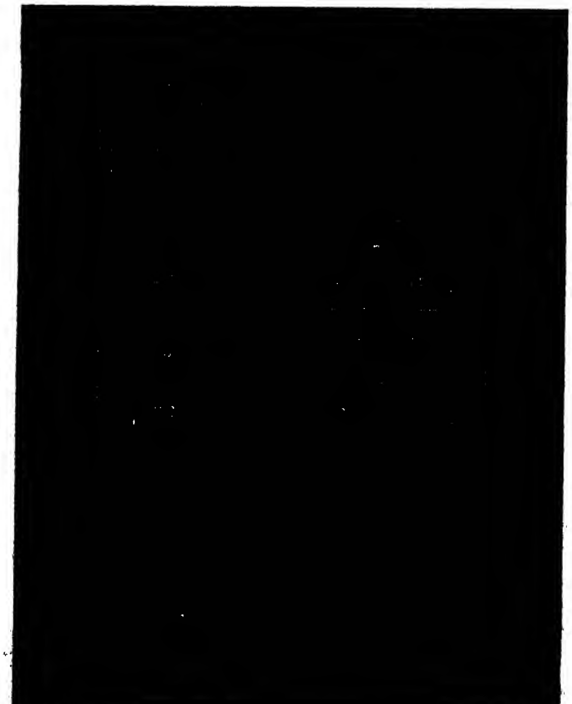


FIG. (A), above.—Graceful, curved lines executed in monel metal. Simplicity. Photos. of monel metal by International Nickel Co.

FIG. (C), below.—Bronze elevator door, with wood-veneered walls. Flat surfaces and restraint. Waldorf Astoria, N. Y.

FIG. (B), above.—Nickel silver and marble. Sophisticated richne Contemporary, conventionalized ornament.

FIG. (D), below.—Bronze doors, Cathedral, Florence. Compare Renaissance dignity with contemporary brilliancy, Fig. (C).

Plastics

During the last few years there has been a phenomenal growth in the production and consumption of plastics. As yet there is still considerable mystery about the nature of a plastic material. The layman knows that it is a synthetic product which has its origin in the test tubes of the chemist and that it is used in the manufacture of every-day things, but his knowledge usually ends there. The vast number of plastics helps prevent our complete appreciation of them and makes generalization difficult. The science of plastics is potentially so great that it may revolutionize the building industry.

The long-familiar material known as celluloid was one of the early modern plastics, although rubber and glass may be classed under this heading. To these have been added the innumerable products now available to the building industry. Plastics may be used for many parts of a building, especially for the space-enclosing surfaces—such as walls, windows, floors, and ceilings; and for equipment—such as furniture and accessories.

Some of the important groups of plastics with their origins are as follows:

1. The synthetic resins, which are the derivatives of various acids and coal-tar products.
2. The cellulose plastics, which result when cotton linters, wood pulp, etc., are treated with acid and combined with a solvent.
3. The casein plastics, which come from such sources as the protein of soybeans.

In this discussion we may leave the chemical formulae to the manufacturers and simply enumerate briefly the physical properties of their products. Plastics may be moulded, cast, extruded, and laminated, depending upon their composition and use.

The moulded plastics may be divided into three groups: the thermoplastic, or those which soften with heat and may be bent into shape; the thermosetting, or those which harden after heating; and the cold-moulding compounds. Moulding limits the sizes to small- or medium-sized objects, such as accessories for hardware and lighting fixtures, and transparent and translucent blocks for walls and windows.

The plastics that can be cast and extruded may take on various sizes and shapes. They may come to the architect, builder, and interior decorator as sheets, rods, strips, cylinders, cones—in fact, in almost any conceivable geometric form. It is possible to have great variety in the color and thickness of the objects and in the degree of transparency and opaqueness. Sheets of plastics can be used for walls, ceilings, and doors, while strips of the materials can be bent into table legs, chair backs, or light reflectors.

The laminated plastics consist of thin sheets of synthetic materials veneered to a plywood or fibre-board base. They may come in many colors and textures, either for decorative or functional purposes, and are capable of resisting water, acid, fire, or wear. As with other plastics, they may be used for interior and exterior finishes and for furniture. This group also includes resin-bonded plywoods which are strong, light, and durable.

In general, plastics open up new sources of inspiration in the field of architectural design. They remove many of the limitations of old materials and offer increased opportunities for the development of a new architecture. Plastics may be sawed, cut, bent, drilled, and treaded. They are smooth, hard, permanent, light in weight, transparent or opaque, and durable in finish and color. They challenge the imagination of the modern designer.

Fig. (A), above.—Frames of chairs and table composed of transparent plastic.

Fig. (B), above.—Tops of tables and bar made of colored plastics.

Fig. (C), below.—Ceiling and accessories of plastic. (Photos. by Du Pont de Nemours & Co. and Westinghouse Electric and Manufacturing Co.)

BOOK TWO

THE DESIGN OF ARCHITECTURE

PART FOUR

THE PRINCIPLES OF DESIGN

CHAPTER X

THE ESSENTIALS OF THE STRUCTURE

The various periods of historic development have left to this age buildings which may be identified as temples and cathedrals, cottages and palaces, work shops and factories. These have been built to house the activities of man, and to these structures has been given the name of architecture. Architecture may be a group of buildings or a profession. It may be identified with decades or even centuries. The profession of architecture has varied so much with the different ages and, even in our own generation, has undergone such changes that a brief definition is difficult to formulate. In some periods the architect is the master builder; in others he is merely the designer. In the twentieth century, our complex civilization has made him a business and professional man, an artist and a constructor. Changing conditions affect the status of the architect as well as the nature of architecture.

The term "architecture" is an inclusive one. It may refer to the process of designing a building and supervising its erection. These activities may be regarded as both an art and a science. Often, however, "architecture" means either the treatment of a building, as "the architecture of Reims Cathedral," or the buildings themselves, as "the influence of Greek architecture." It will be seen that the basic idea back of all these definitions is that of "building," used either as an action or an object. This means that architecture may be regarded as the procedure associated with the conception of an idea and its realization in terms of building materials.

Unfortunately, the problem is not so simple as that, for not all structures are worthy of the name of architecture. It is necessary, therefore, to decide where mere building leaves off and architecture begins. Architecture is represented by a building which meets in a satisfactory manner the requirements of logical function, sound construction, and beautiful composition. It is only when all these qualities are present that good architecture can be said to exist. In its broader aspects, architecture is shelter. In dealing thus with the term "shelter," we are not using it in its limited sense as serving as a dwelling for man, but rather with the idea that it represents protection for all the activities of the human race. The basic function of architecture is to provide shelter for man during the various hours of his daily existence—during work, recreation, and sleep.

Man begins to create shelter by surrounding space with the materials provided by nature and made usable by the ingenuity of civilized peoples. Space, in itself, is indefinable and intangible, and has no limits. Yet when it is enclosed with stone and steel according to accepted rules of composition, the result may be called "architecture." Here, then, is the basic conception of architecture, the one which is developed throughout this discussion. We will not be concerned so much with the styles or traditions as with the thought that a building should grow from a study of the needs of the client and from the interpretation of these needs in terms of the available materials.

In providing shelter it is to be observed that buildings have walls and roofs, doors and windows, and that these elements are assembled in a simple or complex manner. Whatever the type or character of the building, parts of it are more evident to the observer than others—the exterior is more readily seen and understood than is the arrangement of the rooms, which is called the plan. Thus there exist the invisible and the visible structures, or the plan pattern and the apparent volume.

The Invisible Structure

The plan is the beginning of a building. It is the foundation upon which the scheme of the structure rests. It relates the various units to each other. It is the most important element of volume and should receive early consideration whenever the solution of a problem is attempted. We should proceed from within to without; from a satisfactory arrangement of the plan units to the enclosing of these units by the shell which is called the exterior. However, since the plan is less obvious to the uninitiated, it may logically be called the invisible structure, while the exterior may be regarded as the visible structure.

The Visible Structure

By enclosing space, volume or mass is created. If this space has no relation to the activities of man, there exist only the simple geometric forms of the cube, the pyramid, or the sphere. If the surfaces of these volumes and the enclosed interiors are treated so that the forms are related to human needs, then they may be regarded as architecture. This is enough to indicate that our visible structure is composed of form and surface as follows:

1. Form.
   - Mass—volume, or evidence of the third dimension.
     - Direction—vertical or horizontal axis of the mass.
     - Shape—geometric qualities.
2. Surface.
   - Area—surface with two dimensions, as the façade of a building.
   - Texture—surface treatment identified with materials, rough or smooth, etc.
   - Tone—light and shade caused by openings, projections, etc.
   - Color—inherent or applied colors caused by spectrum hues.

MASS. In an architectural discussion the accepted definition of form deals with shape. If a shape is two-dimensional, the figure is called an area or surface; but if it is three-dimensional, it becomes mass. In architecture, mass is usually volume, and the surfaces which enclose space have areas. One should never lose sight of the fact that, in an architectural composition, mass is more important than surface. In the design of a building, we should proceed from the general to the particular, from mass to detail. The approach to design should not be through the details of a style but rather through a consideration of the mass of the building which grows out of the function for which it is planned.

If the designer fails to realize that mass has three dimensions, the design after execution may prove to be very disappointing. The fault of working entirely in direct elevation is that only a two-dimensional surface is seen. The architect is creating "paper architecture," which is nothing more than a pleasing façade with no depth or body. The architect must train himself to think continually in three dimensions. When the building is erected, the observer is conscious of mass and volume, and a lack of consideration for these in the preliminary studies becomes evident in the completed structure.

More and more does modern architecture depend upon mass, rather than detail, for its effect. However, the mass of a structure must follow the rules of composition—just to have a conspicuous mass or volume is not sufficient. Mass can be vigorous or weak; it can have vitality ~~and strength~~, or it may be indecisive and faltering. If it is correctly composed in an arresting manner, mass alone will arouse a definite emotional reaction. It will stimulate the observer with the sense of its completeness. Many of the tall buildings of our cities, with their properly related masses, are examples of the use of sheer weight and bulk with little detail. The decorative elements of a structure should always be subservient to mass. Ornament should simply enhance a building. It should, upon closer examination, increase the satisfaction to be derived from a piece of architecture. It may in a manner alleviate but it can never expiate the evil of unpleasant massing.

In order that mass may be decisive, it should be directional. It should be either horizontal or vertical. (See page 206.) A building which approaches one or the other without quite reaching it leaves the observer in a state of doubt. A beautiful building is always emphatic in its appeal, but this emphasis is obtained in a quiet, insistent way by the correct disposition of its parts, rather than by restless and meaningless projections and details. Thus we face the necessity of studying the composition of architectural masses.

In our later studies of design it will be seen more clearly how the function of the building dictates the plan, or the arrangement of the units in a horizontal and a vertical direction. The pattern growing out of this composition consists of geometric forms—the square, rectangle, circle, etc.—which lose their abstractness and acquire significance when applied to architectural uses. This pattern or plan is two-dimensional, but the development of the plan into an enclosed structure gives the third dimension. The square becomes the cube, the rectangle is now a mass with direction, and the circle furnishes the base for the hemisphere, cylinder, or cone. Mass thus grows logically out of plan.

The simplest kind of a directional architectural form is one which has no appendages and is either horizontal or vertical, as in Fig. 206 B. In itself it has no particularly interesting contours and must depend for effect upon satisfactory proportions and upon a pleasing disposition of doors and windows. If a smaller horizontal unit is added to either end of this larger element, there now exists a slightly more complex composition consisting of a major mass and two minor masses, as in Fig. 206 C. This arrangement places the emphasis upon the centre unit in contrast with the smaller ones at the ends, and should be an outgrowth of an attempt to express the relative importance of the elements in plan.

In Fig. 206 D there are present the same forms that were used in the previous example, but it will be seen that two vertical elements have been introduced. This breaks up the strictly horizontal quality of the composition and adds interest and accent to the group. We now have a major horizontal, two minor horizontals, and two major vertical units.

These attempts at composition of masses have all been based upon the idea of sym-

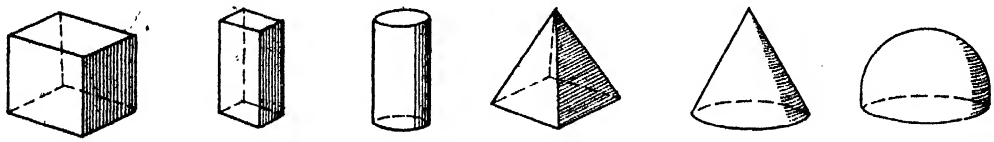


FIG. (A) GEOMETRIC SOLIDS

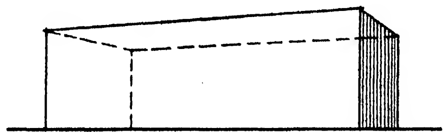


FIG. (B) SIMPLE RECTANGULAR MASS

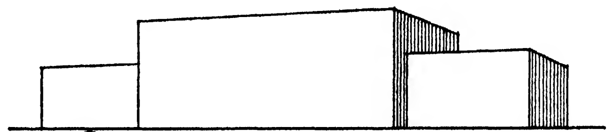


FIG. (C) MAJOR AND TWO MINOR HORIZONTALS

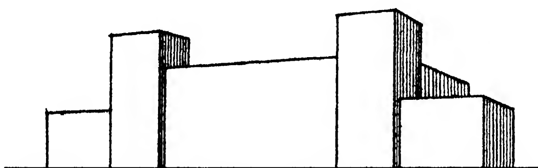


FIG. (D) SYMMETRICAL HORIZOTALS AND VERTICALS

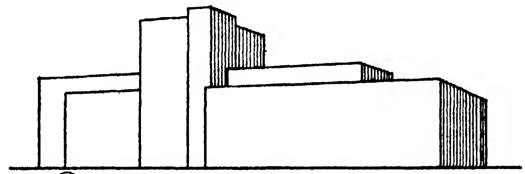


FIG. (E) UNSYMMETRICAL HORIZONTALS AND VERTICALS

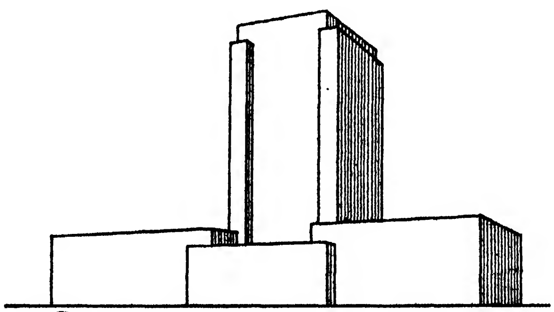


FIG. (F) DOMINANT VERTICAL WITH HORIZONTALS

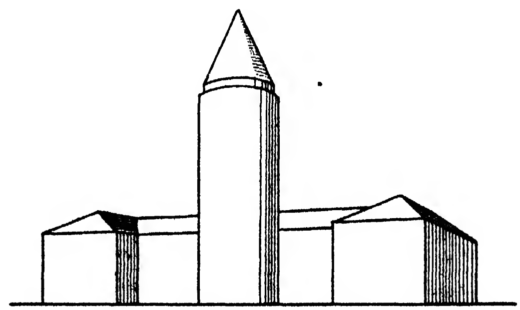


FIG. (G) VERTICAL, AND HORIZONTAL WITH APPENDAGES

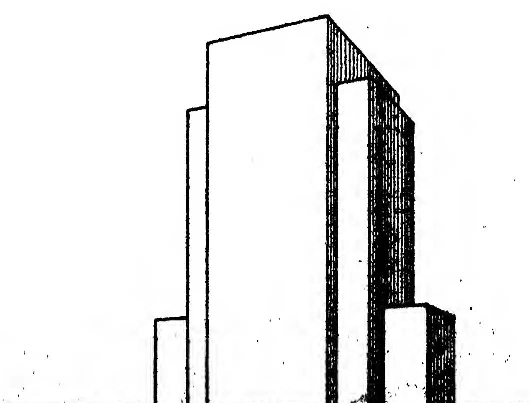


FIG. (H) MAJOR AND MINOR VERTICALS

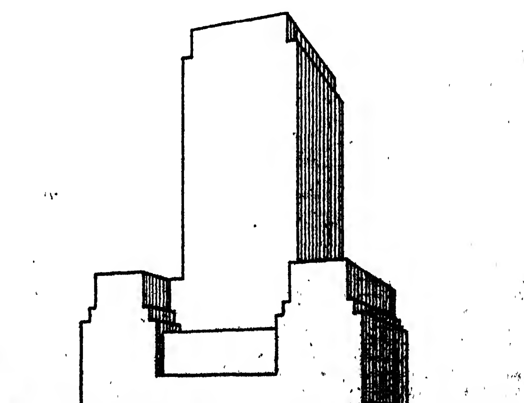
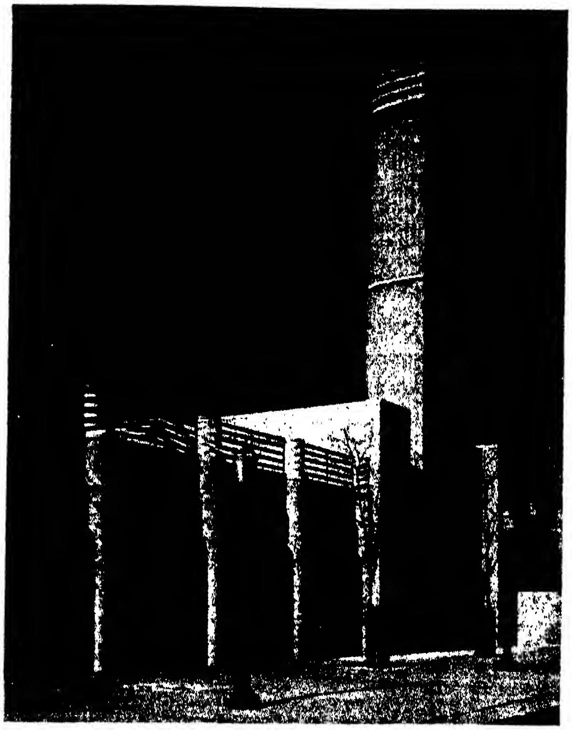


FIG. (I) MAJOR VERTICAL WITH CONNECTED MINORS



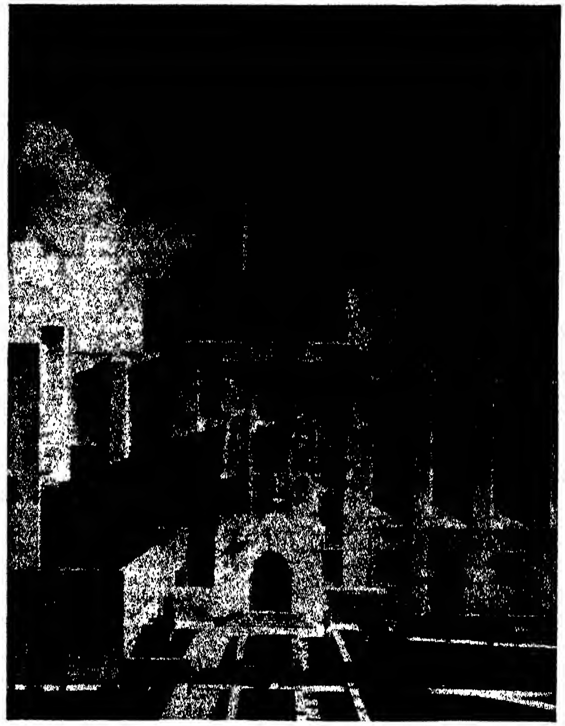


Fig. (A), above.—Contrast of vertical and horizontal masses. Brick. Bath house, Staten Island, N. Y.

Fig. (B), above.—Powerful massing rather than detail. Concrete. Los Angeles Public Library. Bertram G. Goodhue, Archt.

Fig. (c), below.—A composition in abstract design—vertical masses opposing a horizontal. Hall of Science, Chicago. Paul Cret, Archt.

metry, or an equal distribution of parts on either side of a central axis. (See Balance, page 252.) However, in Fig. 206 E, major and minor horizontals are combined with a dominant vertical in an unsymmetrical manner. Again this should be the result of logical planning rather than a studied attempt to secure a picturesque effect. If an important vertical is united with two horizontal masses, the effect secured may be similar to the one illustrated in Fig. 206 F. In this the vertical is the most conspicuous element in the group, and the horizontal units simply act as a foil to the tower. It will be noticed how a central minor horizontal helps to tie the composition together.

In Fig. 206 G there is illustrated a combination of rectangular, cylindrical, conical, and pyramidal forms—shapes which in themselves may be quite abstract but which, when assembled to meet some of the needs of man, are full of architectural meaning. In this study a strong vertical is opposed by and contrasted to a horizontal with projecting terminating units.

Figures 206 H and 206 I show masses which are familiarly like those of the tall buildings in our large cities. Naturally they are decidedly vertical in direction. This is particularly true of Fig. 206 H, which is made up of minor vertical masses building up to a major vertical. In Fig. 206 I an important vertical unit grows out of a series of minor masses arranged in the form of set-backs, which are typical of the pattern established by the zoning laws of New York City and copied in other communities.

We have already said that architectural surfaces are areas of materials which enclose a building and that they are of secondary importance to the masses which they create. This is quite true, but in order that a building may be wholly satisfactory in its appeal, the necessary attention must be given to the treatment of the exterior. The surfaces of a structure have texture, tone, and color.

TEXTURE refers to the quality of surface treatment. Texture is usually associated with materials. Stone may be polished and reflect light in a sparkling manner (Fig. 212 C), or it may be rough and coarse (Fig. 210 A) and give to the building a feeling of strength and simplicity. Stucco, with its various textures or treatments to catch the sunlight, has played an important part in the design of homes which are Mediterranean in character, as in Fig. 210 D. Surfaces covered with brick have a different character from those in which wood is employed. Thus texture depends largely upon the choice and use of materials. The selection of a definite material fixes, to some extent, the character of the final effect, but the treatment which is given to that material often produces startling results. There should be a consistency in the selection of the textures of materials—a harmonious relationship between the various surfaces. Contrast and variety must be present but the character and quality of different textures should agree. Polished marble and bright chromium are sympathetic with each other but usually do not combine well with rough field stone or brick. The character of each particular type of room or building calls for a corresponding type of texture. The ingenuity of the present age has brought out unlooked-for effects by combining stone, metal, and glass.

TONE is variety in the use of the gradations from black to white. Tone comes from the change of impressions carried to the eye as a result of the juxtaposition of dark and light areas. Tone, or the creation of light and shade, may be secured by the use of doors and windows, or by shadows cast by projecting parts of the building, or by mouldings, as in Figs. 211, A, B, C. Tone gives interest to an exterior and, if the results are to be entirely satisfactory, requires the same careful study that was devoted to the general massing. Poor arrangement of windows, pilasters, and cornices can mar, even though it cannot destroy, a beautiful and powerful composition.

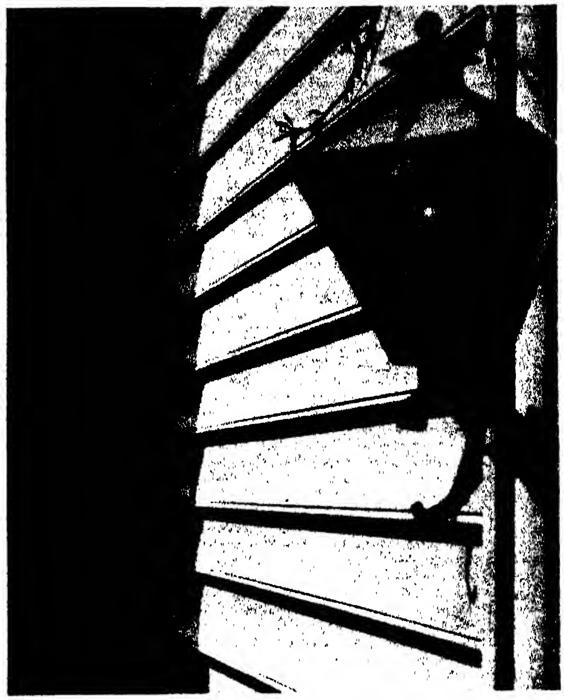
COLOR is also one of the factors to be considered in surface treatment. Its use varies with different periods and countries. The warmer climates have usually produced the most colorful architecture, as is witnessed in Spain and Italy with their walls of delicate hues, tile fountains and wainscots, and richly contrasting roofs. Color, as distinguished from tone, results from the hues of the spectrum. It may be inherent as in marble which is colored by nature (Fig. 212 B), or it may be applied, as in the case of surfaces which are painted or decorated by man (Fig. 212 D). After a rather depressing period in this country when color was used very sparingly, this method of decoration is becoming more conspicuous in contemporary architecture. Color is secured by means already suggested; by the use of marbles, metals, glass, or tile, upon the exterior, and by these same methods plus painted decorations upon the interior.

One reason why color has often fallen into a state of disrepute is that it has been used carelessly. Color requires intelligent handling and a thorough knowledge of harmonies and values. The color scheme of a building should be carefully studied, with an understanding of the character of the materials which are to produce the colors. Simple, conventionalized arrangements in subdued tones are preferable to garish and bizarre effects. There should also be a sympathetic comprehension of what is called "the emotional use of color." Those of us who are stirred by the martial strains of band music, or the beauty and depth of a symphony, have experienced an emotional response to sound as a thing of beauty. In a like manner, a beautiful painting may hold one enthralled by its use of color. Color reflects the spirit of the people who create it. It is not an accident that Spanish art, produced by a dashing, vibrant people, is gay and sparkling. Color is definitely related to the lives of individuals and to the material things with which they are associated. It influences human reactions in a psychological sense. Red tends to produce rage or passion; yellow denotes gayety; blue and green are peaceful and tranquil; purple suggests a stately or melancholy atmosphere.

This psychological use of color has been related to architecture for centuries. Theatres and circuses are gay and brilliant with banners, decorations, and pageants. Bright colors stimulate the imagination and excite the senses to produce a feeling of joy and pleasure. For a like reason the funereal chapel is sombre in its color appeal. Garish hues would be an offense to those who come in a mood of respectful worship, whereas subdued colors lend themselves to the spirit of the occasion. The color scheme of a restaurant for dining and dancing should be quite different from that of a library for reading and meditation.

This relationship between color and the character of a building (See Character, page 267) results from the combining of warm and cool colors in the proper amounts. One should remember that the warm colors, the reds and yellows, tend to advance toward the observer while the cool colors, the blues and greens, appear to recede. Also the more neutral colors should be used for the larger areas, reserving for the more brilliant accents those bright colors which overpower the composition unless sparingly used.

Thus the visible architectural structure develops from a logical plan—the invisible structure—and grows into a well-composed mass with interesting and pleasing surface treatments.



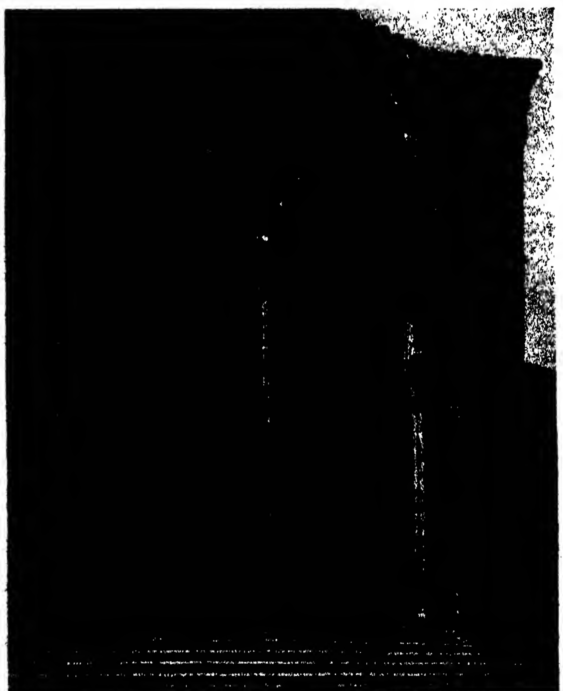
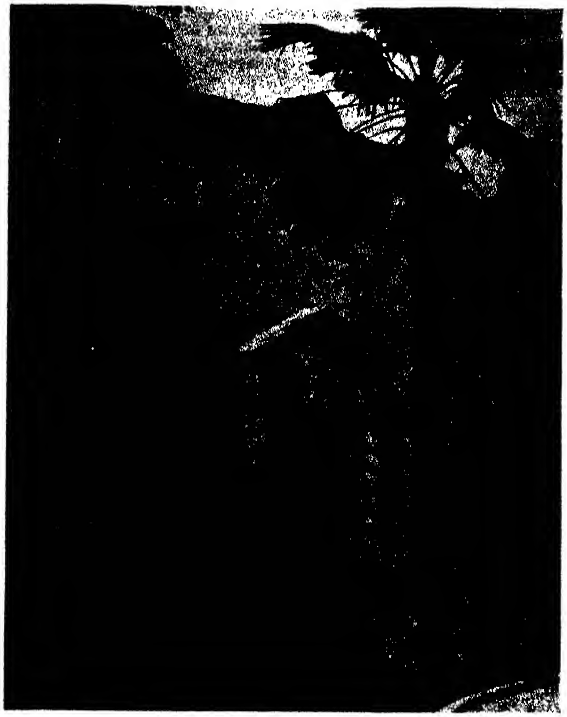


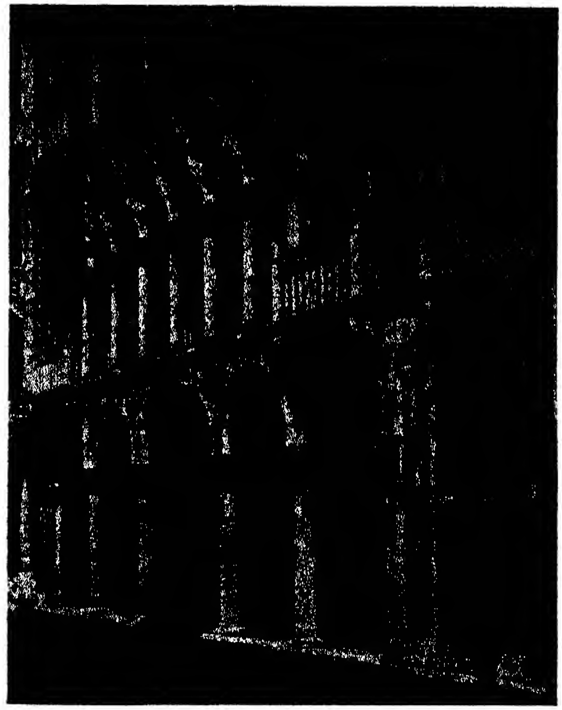
FIG. (A), above.—Comparison of textures of field stone, shingles, and lead down-spout. Informality. (Photo. Waite Bros.)

FIG. (C), below.—The texture of a brick wall; the diaper pattern, with corbeled cornice, belt course, and arches.

FIG. (B), above.—Horizontal lines created by siding. White walls with shadows. Wood, brick, metal, and glass.

FIG. (D), below.—Stucco walls, cast concrete columns, and tile floor. Robust simplicity.





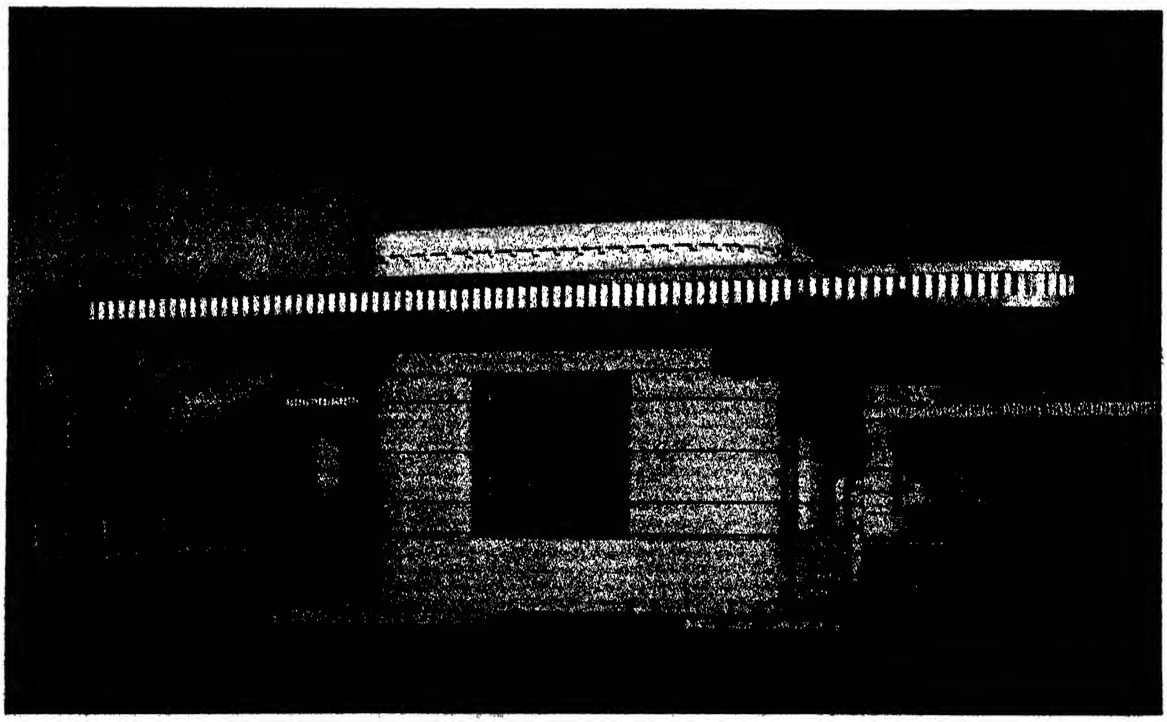
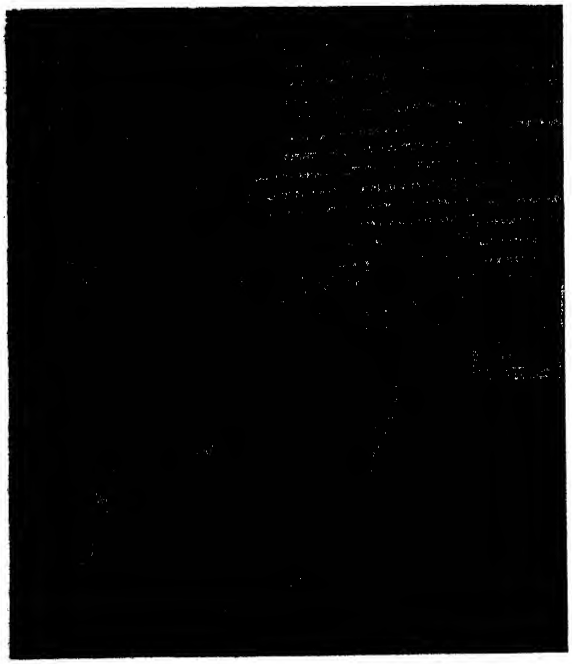
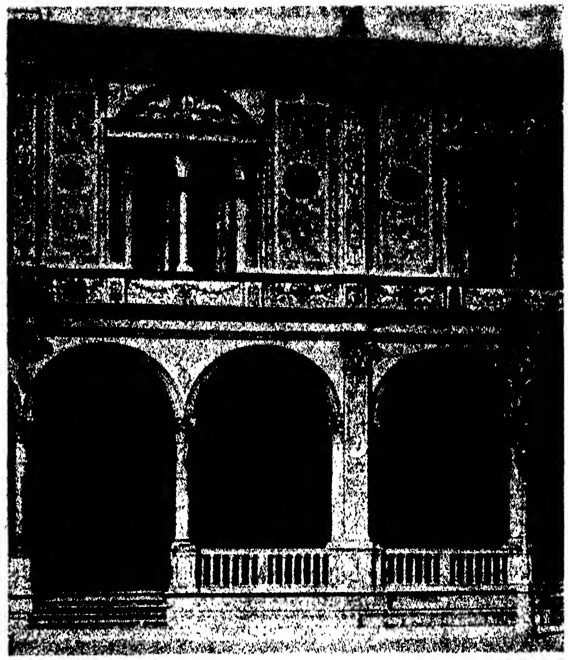


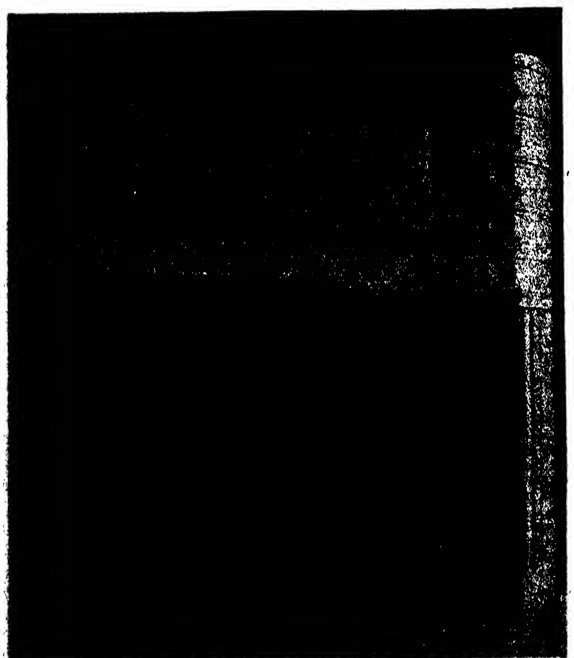
FIG. (A), above.—Tone caused by projecting surfaces and by contrasting materials of walls and roof. Residence, Pasadena.

FIG. (B), above.—Brilliancy and sparkle; light and shade; accent by use of openings. Italian Gothic. Cà d'Oro, Venice.

FIG. (C), below.—Simplicity of contemporary architecture produces less tone. Restricted to shadows of canopy, incised lines, and openings.







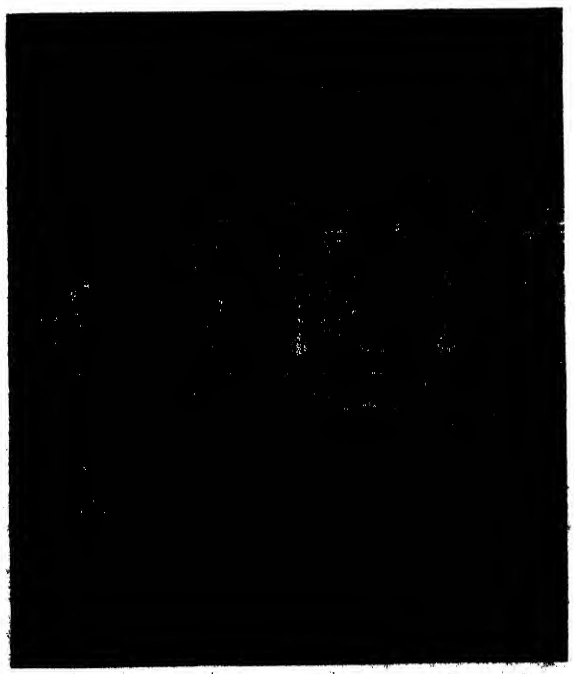


Fig. (A), above.—Contrasting materials and colors; also tone or light and shade. Mercato Vecchio, Verona.

Fig. (C), below.—Polished black granite used as contrasting color and texture with limestone wall. See Fig. 158 A.

Fig. (B), above.—The introduction of color by the use of colored marble and terra cotta. Palazzo del Consiglio, Verona.

Fig. (D), below.—Applied color. Painted walls and beams. The richness of mediaeval interiors. Palazzo Davanzati, Florence.

Chapter XI

THE PROCESS OF SPACE ORGANIZATION

The practice of architecture and the movements which it produces are always in a state of flux. Architectural education changes according to its environment. The state of flux is inevitable; the changes in education are compulsory. The difference between the architecture of today and that of yesterday is profound and significant. It is the result of a new approach made possible by changing social conditions and advances in technological contributions. Architecture no longer belongs to the past, but instead to the present and future.

Architectural design once consisted in developing a plan behind a stylistic façade. The interests and needs of people struggled for recognition, but they were held in subjugation by the overwhelming inertia of tradition. Freedom in planning was handicapped by a reverence for superficial details. The inflexibility of a Renaissance exterior exerted a definite influence on interior arrangements. The regular spacing of symmetrical windows dictated the location of walls which separated important rooms. Plans were developed in accordance with the purpose of the areas and then modified to fit Classical, Romanesque, Gothic, or Renaissance exteriors. Thus a compromise had to be reached between function and style. Style was inflexible and masterful, and function was usually bent to the will of the master.

So long as architecture is dominated by the limitations of tradition, architectural education can do little more than follow in the footsteps of the profession. Students are usually trained to enter the current version of the practice of architecture. Attitudes outside the class room—either reactionary or progressive—are reflected in the philosophy of the schools. Only the extremely courageous dare to swim against the current.

Thus architectural education once began and ended with a study of the external trappings of a style, with columns, cornices, doors, and windows. It proceeded from the particular to the general, thus reversing the process of design. It is still desirable to have a knowledge of the characteristics of these architectural elements, but experience has shown that their study should not assume a position of so great importance. The details of an architectural composition should be subordinated to the general scheme. Training in design no longer begins with exercises in drafting and rendering. The ability of self-expression is necessary, but it should be regarded only as a means to an end. Good draftsmanship may encourage, but will not produce, fine architecture. An understanding of the reasons for, and the beauties of, past periods may enable one to appreciate the significance of the contemporary movement, but it is only one of the contributions toward the success of modern shelter. Today training in design begins with a study of the fundamental principles of planning, based upon the needs of people and the resultant architectural forms.

Such training is possible because architecture is no longer bound to tradition or style.

Architecture is no longer static, heavy, inflexible, unreal.
Architecture is now dynamic, light, flexible, real.

Architecture is simple, not confused; scientific, not archaic; open, not enclosed. All this has been made possible by improvements in the science of construction, in the use of materials, and in mechanical equipment. Slender, isolated supports have released buildings from the limitations of masonry construction, thick walls, and regularly spaced piers. New products in plastics and glass have given us new conceptions of the extent of space, while the ability to heat and light our interiors more efficiently has imparted a different quality to the shelters in which we work, play, and rest. All these innovations taken together have made possible the open, flexible plan, and thus architecture has changed in character.

Architectural education is no longer interested primarily in the spacing of Classical columns, the thickness of bearing walls, or the securing of monumental effects. It confines itself to the teaching of the essentials based upon current principles of design. The old principles which produced monumental plan arrangements and stylistic façade compositions have been revised. Those principles which still apply were retained; the others discarded. Contemporary principles are concerned with planning for human needs and are not confined to the field of architecture alone. Science, sociology, and economics also contribute to the successful design of a building. The architect of today must be conscious of the character of present-day culture and its effect upon the buildings which house the activities of this civilization. He must design in terms of his physical and social environment.

In developing a set of basic principles for the production of a living architecture, the architectural designer should think of *space within space*, and not of solids in space. Formerly we regarded buildings as piles of masonry for the purpose of separating man from space. Now architecture is space, conditioned to suit human needs. It is enclosed with opaque, translucent, and transparent materials in such a manner that man may exist comfortably in it but may be spared the oppressiveness of heavy, confining walls.

The principles of space organization for architectural purposes are concerned with:

1. The use of space (utility).
   Service to occupants.
2. The collaboration of materials (strength).
   Permanence and security.
3. The contributions of aesthetics (beauty).
   Architecture as distinguished from mere building.

With these basic considerations in mind the architectural designer is ready to proceed with the organization and conditioning of space. The trained designer can think directly in terms of spatial relationships and can arrange in his mind the various three-dimensional volumes which produce architecture. Those who possess this ability may go directly from a statement of the requirements of a client to a picture of the various spaces or volumes combined in such a way that the needs of the occupants will be served. This may be called:

Design from Spatial Compositions

involving planning directly with three-dimensional volumes and the ability to comprehend cubic contents and proportions.

However, in carrying planning to its ultimate conclusion, it is difficult to avoid reducing volume to its component parts. Architectural volume is simply space surrounded by surfaces—usually six in number. These are: the horizontal base, four vertical surfaces, and the top covering—or the floor, the walls, and the ceiling or roof. The most important of these is the base or the floor, for it is upon this surface that man walks and places his furniture and equipment. The other surfaces are necessary only for protection and convenience. They separate the activities of mankind from the external forces of nature and from each other. Walls segregate sleeping and dining, work and play, noise and quiet. They form backgrounds and boundaries. Roofs protect and shelter. They complete the enclosure and repeat the floor in general shape and size.

When the designer visualizes volumes, he must do so in terms of size, proportion, and relationship. The most important aspect of a volume has to do with its horizontal dimensions. A height suitable to human habitation is taken for granted. Proportions are always based upon and related to a floor area which is adequate for the equipment and the activity belonging to it. When volumes are composed, they are placed side by side and connected by paths of horizontal travel or circulation. If volumes are placed above each other, creating a building of several floors, the process is repeated, with spaces juxtaposed horizontally. Man lives in space and is surrounded by volume, but he walks horizontally on the earth. He thinks, first of all, in terms of distance and travel parallel to the earth's surface. He buys land by the square foot for buildings which project upward from the ground.

Thus it is not possible to ignore the importance of the base of volume in the development of architectural space. Every concept of volume is related to this conspicuous element, which is called the plan. The most logical and practical method of studying volume is by analyzing it in accordance with our thinking process. We may begin with a consideration of the horizontal arrangement of two-dimensional areas and follow with their development into three-dimensional compositions. This may be called:

DESIGN FROM HORIZONTAL DISPOSITIONS

or the evolution of volume from area.

The sequential steps are:

1. HORIZONTAL DISPOSITION (two-dimensional).
    a. Arrangement of units according to function.
    b. Arrangement according to plan composition.
2. VERTICAL GROWTH (three-dimensional).
    a. Creation of volume and space relations.
    b. Development of mass and its composition.
    c. Selection of type of construction.
3. CONDITIONING PROCESS.
    a. Space organized for convenience.
        Selection of materials.
        Introduction of circulatory elements: doors, windows, stairs, corridors.
    b. Space organized for comfort.
        Introduction of mechanical equipment for light, heat, and sanitation.
    c. Space organized for appearance.
        Interior and exterior surfaces, and volumes conditioned according to principles of composition.

These steps should produce principles to guide the development of contemporary architecture. We need not be concerned with its superficial characteristics—whether it is traditional or modern. Let it be just architecture, without any attempt to qualify or describe it.

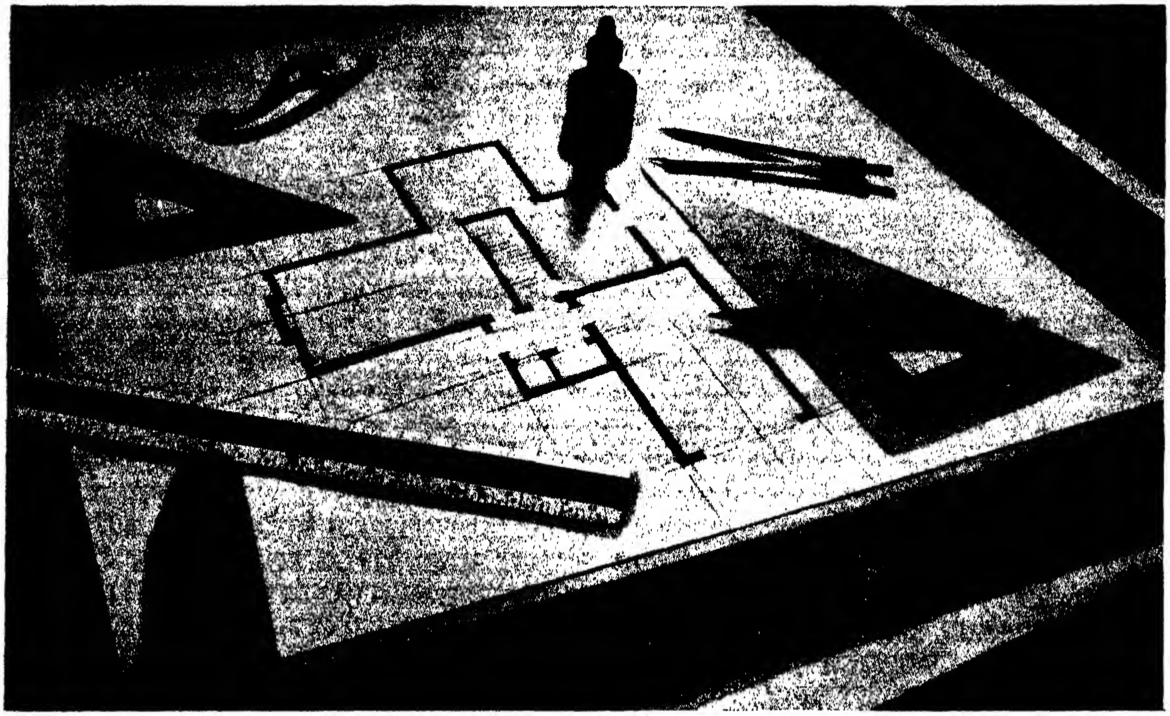
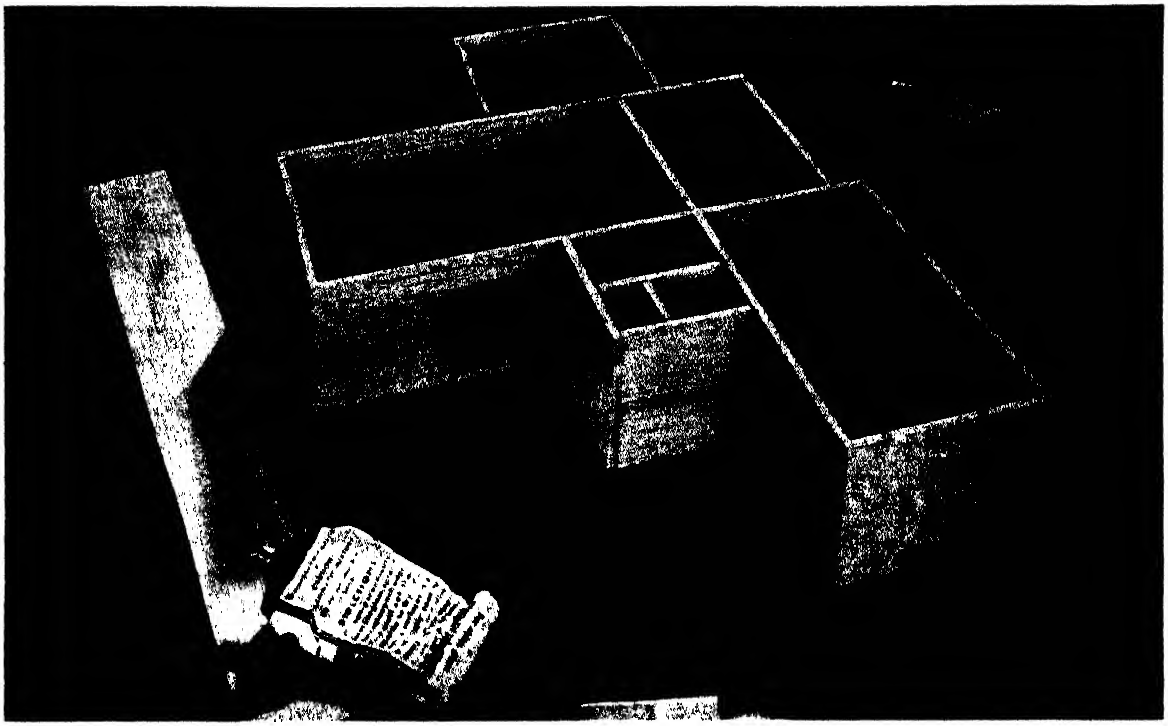


FIG. (A), above.—The horizontal disposition of plan units, related for proper function and circulation.
FIG. (B), below.—The growth of mass from plan by the use of small clay model. Opportunity to study the third dimension.



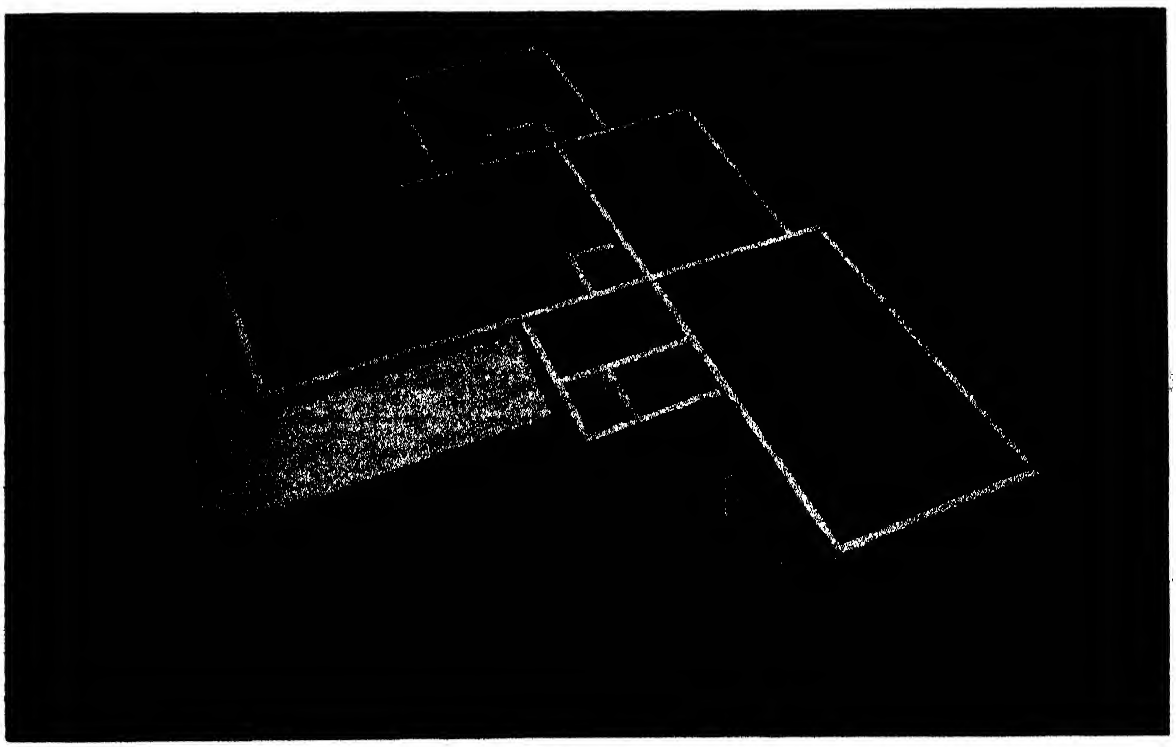


FIG. (A), above.—The vertical development of the plan into a balsa wood space model in order to study the proportions and relationships of volumes.

FIG. (B), below.—Architectural volume conditioned for use, comfort, and appearance by the introduction of doors, windows, and furnishings.

HORIZONTAL DISPOSITION. The process of solving problems in architectural design according to this approach simply places the emphasis upon an architecture composed of volume created by surfaces. It begins with the familiar study of plan elements, which develops into a consideration of interior and exterior areas and details. It is only in the importance of three-dimensional volume that it differs from the methods of the past. School design was once accused of being "paper architecture." This meant that the problems produced in the class room were not real. Their plans were hidden behind unrelated walls and they did not serve the interests of their proposed occupants adequately or efficiently. The two-dimensional drawings did not indicate the presence of spaces and volumes, nor of materials, masses, or proportions. All this has been changed by the present-day approach to architectural design. The various units of plan are first arranged in a horizontal manner in order to secure a workable relationship between the different areas. (See Fig. 216 A.) This pattern is dictated by the function of the building and the desirable size and shape of the units themselves. The rooms of a house, the galleries of a museum, or the units of a factory must be laid out to facilitate movement through the building. This is called planning for potential circulation, and probably is the most important consideration for all types of architecture. Structures are built to be used, and this purpose is defeated unless people can go easily and directly from one area to another, and unless the related areas are adjacent to each other. Architecture, thus, begins with a two-dimensional plan which is translated into foundations for vertical development.

VERTICAL GROWTH. A floor plan alone does not produce shelter. It is necessary to extend the origins of walls vertically in order to enclose space and to begin the creation of volume. Two-dimensional drawings of façades are limited in their sensory impressions, for they can tell only of the proportions of areas. For this reason it is desirable at this stage to develop three-dimensional models to represent actual buildings. This does not mean that elaborate and time-consuming models should be made; instead, small and quickly executed representations may be cut from cardboard or balsa wood for the purpose of studying the cubic contents of units. These are called "space-relation" models and are developed as follows: The small scale plan may be drawn directly on a piece of sketchboard which will form the base for the proposed model. Balsa wood, which comes in one-sixteenth or one-eighth inch thicknesses and is worked very easily, is then cut to the correct size to represent the various wall surfaces, and glued with quick-drying cement to the lines drawn to represent the plan. Another way to prepare a base is by spreading a layer of plastiline or clay over the surface of a small sketchboard to the depth of about one-quarter inch. Into this clay may be pressed these balsa-wood sections, representing walls; and thus a model is quickly constructed. This model enables the designer to study the volumes which result from the arrangement of walls to enclose spaces. The interiors may be scrutinized for correct relationships and proportions. (See Fig. 217 A.)

Another step is the development of a small, clay model which will facilitate securing interesting and satisfactory massing. This may be made before or after the space model is constructed, and each may be used as a check against the other. The plastic quality of clay permits an easy and quick trial of the general proportions of the building, and the model can be modified and changed until pleasing effects are obtained. Thus volume, which is related to interior activities, and mass, which tells of exterior qualities, may be tested by these visual methods as illustrated on page 216.

CONDITIONING PROCESS. The areas and volumes produced as the result of the foregoing methods do not necessarily represent architecture. They may be abstract geometrical forms unless they are related to man's activities and interpreted in his materials. They must be translated into brick, stone, or wood to provide a permanent shelter. The dividing areas must be pierced with openings for horizontal circulation while stairs must be added for vertical travel. The volumes are thus conditioned for convenience. These spaces, which began as abstract forms and soon became humanized, should also be conditioned for comfort. They must be provided with the proper facilities for natural and artificial lighting. Heating, air conditioning, and sanitation must be added in order that the building may be representative of this efficient age of science. The interior and exterior surfaces must then be conditioned for aesthetic enjoyment. They should have pleasing texture and color and proportions which are the result of the application of the principles of composition. Contrast, scale, balance, and unity should be correctly interpreted in order to insure beauty of line, form, and color.

The two-dimensional drawing of plan units has thus developed into a complete and fully equipped structure, visually evident in volume and mass. It began as a diagram, was developed into enclosed space (see pages 216 and 217), and later became a tangible building with physical and aesthetic properties. It grew without stylistic limitations but with a consciousness of past civilizations and traditions and their possible effects upon present cultures, into a shelter for a specific activity of a client. It represents a logical and sequential approach to the creation of a living architecture.

CHAPTER XII

THE CREATIVE PRINCIPLES

In previous chapters we have discussed the growth of mass, surface, and volume from the horizontal arrangement of architectural units. We should now study the principles by which these elements, both plan and exterior, develop and by which they are combined.

Anything which has organization must be planned, whether it is a building, a commercial venture, or a political campaign. This planning results in the arrangement of the participating elements in such a way that the combination will satisfy the requirements of that particular project. In most fields of endeavor the results are more important than the procedure which obtains the results. In architecture, the client is more interested in the finished building than he is in the method through which that building is realized. The architect, however, is concerned with the desire and its realization—the process and the results—and we must interest ourselves in the means by which a structure is produced.

The practice of architecture involves both the conception of an idea and its ultimate expression in stone, brick, metal, or wood. The process of developing this idea to a point at which a solution of the problem at hand is reached is known as architectural design. Design must concern itself with both the practical and the aesthetic. The two cannot be divorced if the resulting structure is to be satisfactory to an individual or a community.

FUNCTIONAL DESIGN deals with the development of a plan arrangement to serve in a purely mechanical way the functions of the building. It discovers the proper sizes of rooms and their relations to each other. It furnishes the elements of comfort: light, heat, and ventilation. It determines the correct size and location of the structural members which give the building strength. However, even when all these requirements are satisfied, architecture does not necessarily exist. The building may remain only an engineering structure without the spirit of architecture which is called logical beauty.

AESTHETIC DESIGN works hand in hand with practical design to the end that out of this collaboration may grow a building which not only functions in an adequate manner but in addition presents to the observer an appearance which is pleasantly related to an orderly arrangement of elements. Architecture, if it is to be distinguished from mere building, must have beauty—not beauty which is applied to the surface as an afterthought, but beauty which comes from an intelligent consideration and combination of function and structure. Good architecture has a satisfying quality which results from the correct expression of character, the proper use of proportions, and an understanding of the limitations of materials. Only those trained to understand the application of these principles can consciously and consistently produce that which is worthy of the name of architecture.

In organizing volume for use, it is found that there are three controlling factors dealing with (1) the purpose of the building, (2) the use of materials, and (3) the composition of volumes and surfaces. (See page 217.) It is from these considerations that a set of principles governing architectural design should be evolved, and it is in this direction that we may now turn our attention. In the past the emphasis was often placed upon the composition of the visible and stylistic architectural elements. Their obviousness gave them an importance beyond their place in a sound architecture, but now that exterior treatment has ceased to dominate the design of buildings, these elements and the rules by which they are composed should be assigned a less conspicuous position in the evolution of a building. In contemporary architecture, the function of the building is allowed to have a preponderant influence upon design. The appearance of the structure, while in itself important, is more closely related to utility than it was a few decades ago.

The principles by which modern architecture should be developed are concerned, therefore, with function, strength, and appearance as follows:

1. Function of the Structure.
   a. Relationship of units.
      Correct placing for proper circulation between.
   b. Physical qualities of units.
      Correct size and shape for equipment, furniture, and circulation within.
2. Strength of the Structure.
   a. Correct use of materials and construction.
      Relation to function.
      Economy of materials.
      Adequacy of structure.
      Honesty of expression.
3. Appearance of the Structure.
   a. Composition of mass, volume, areas, and details.
      Organized according to contrast, proportion, scale, balance, rhythm, unity, and character.

The Principles Related to Function

The principles related to composition are definite and definable. If the exterior of the building is well designed, it has proper contrast, scale, and unity. These qualities are easily segregated and analyzed. The principles that insure a functional and useful building are not so tangible. Securing contrast of size, shape, or color is a distinct, physical step. If contrast is desired, it is obtained by the mere process of combining elements of different characteristics. If a workable building is desired, it is secured by the more devious method of analysis and development. Functional architecture is the result of arranging volumes in such a way that they are adapted to human use.

The principles of function do not lend themselves to brief and concise illustrations. Each building has a different set of requirements, and conditions vary with each separate program. However, whether the subject is a church, factory, or home, it is necessary that there be a correct relationship of the units which comprise the structure. This is essential for proper circulation between the various parts. A building is conveniently arranged only when its component elements are so placed that man can move easily and quickly from one to another. There should thus be economy and directness of circulation.

The physical qualities of the different units should also be adjusted to the activities which are to be housed. The sizes and shapes of the various rooms should be related to the equipment and furniture which they are to contain, and these accessories should be arranged in the units according to the requirements of easy circulation within the volumes. Thus architectural space may be organized around the living-room furniture of a home, the bottling machines of a dairy, or the merchandizing fixtures of a department store.

The Principles Related to Strength

Other principles require that materials and construction be used economically and logically. There should be a simple structural scheme and one which is related to the purpose of the building and to the desired character and appearance. The plan elements should be arranged to eliminate a complicated system of construction and an uneconomical use of materials. The structure, whether it consists of simple bearing walls or a complex skeleton framework, should be adequate to provide for the necessary strength and protection. The importance of the safety of human lives is recognized in building codes. These give construction precedence over good planning or external appearance. It is, of course, unfortunate that aesthetic design cannot be so easily legislated and controlled.

Honesty of expression is another principle to be observed in connection with the use of materials. The materials of architecture have the primary function of enclosing space for the protection of man's interests and activities, an achievement which can be attained more satisfactorily by paying the proper attention to the qualities of these materials. Wood, stone, brick, and glass have their own physical characteristics and are best suited to various specific situations. Rough field stone would be inappropriate where the smooth surface of polished marble is desired. Materials should also be used in a truthful manner and not to hide or imitate. Concrete need not be painted to resemble wood, and terra cotta is interesting enough to eliminate the necessity of treating it like stone. Materials and construction should express, in addition, the function of the building. Humble materials should be used with simple structures, and the more ornate reserved for ambitious buildings. Dishonesty should be avoided at all times. False fronts, useless columns, inappropriate parapets, and spectacular roofs and domes usually detract from the functional and aesthetic qualities of architecture and should have no place in good design.

Thus the principles related to utility and structure, while not so definite as those of aesthetic composition, are of primary importance and consideration. They should precede all others because a building grows from its intended use and must be designed to satisfy the physical needs of its occupants. Its appearance appeals to the spiritual nature of the occupants, but appearance should accompany function, not lead it, just as the emotional and intellectual needs of man are the complement to his physical necessities (see page 2).

The Principles Related to Appearance

Architecture, however, does not necessarily result from the development of a functional building that is based only upon the importance of use and materials. The various units of the structure may be correctly related to each other, but the proportions of the different volumes could be so inharmonious that only ugliness and confusion would exist. It is necessary that a building be organized for appearance. The plan and the resultant masses, volumes, surfaces, and details should be developed according to the rules of composition. The principles of composition may be applied alike to the two-dimensional plans and surfaces or to the three-dimensional volumes. On the succeeding pages we shall see how architecture may be analyzed in terms of these principles of creative art.

CHAPTER XIII

PLAN COMPOSITION

Good planning is not the placing of areas together in the aimless way that a child might follow with the pieces of a picture puzzle. A logical plan must have a reason behind it—a "parti," or scheme. If an exterior which tends toward symmetry, or monumentality, is desired, the plan elements may be arranged in a balanced manner about a central axis. If a more informal massing is required, the beginning of the development—the plan—should assume this desired character.

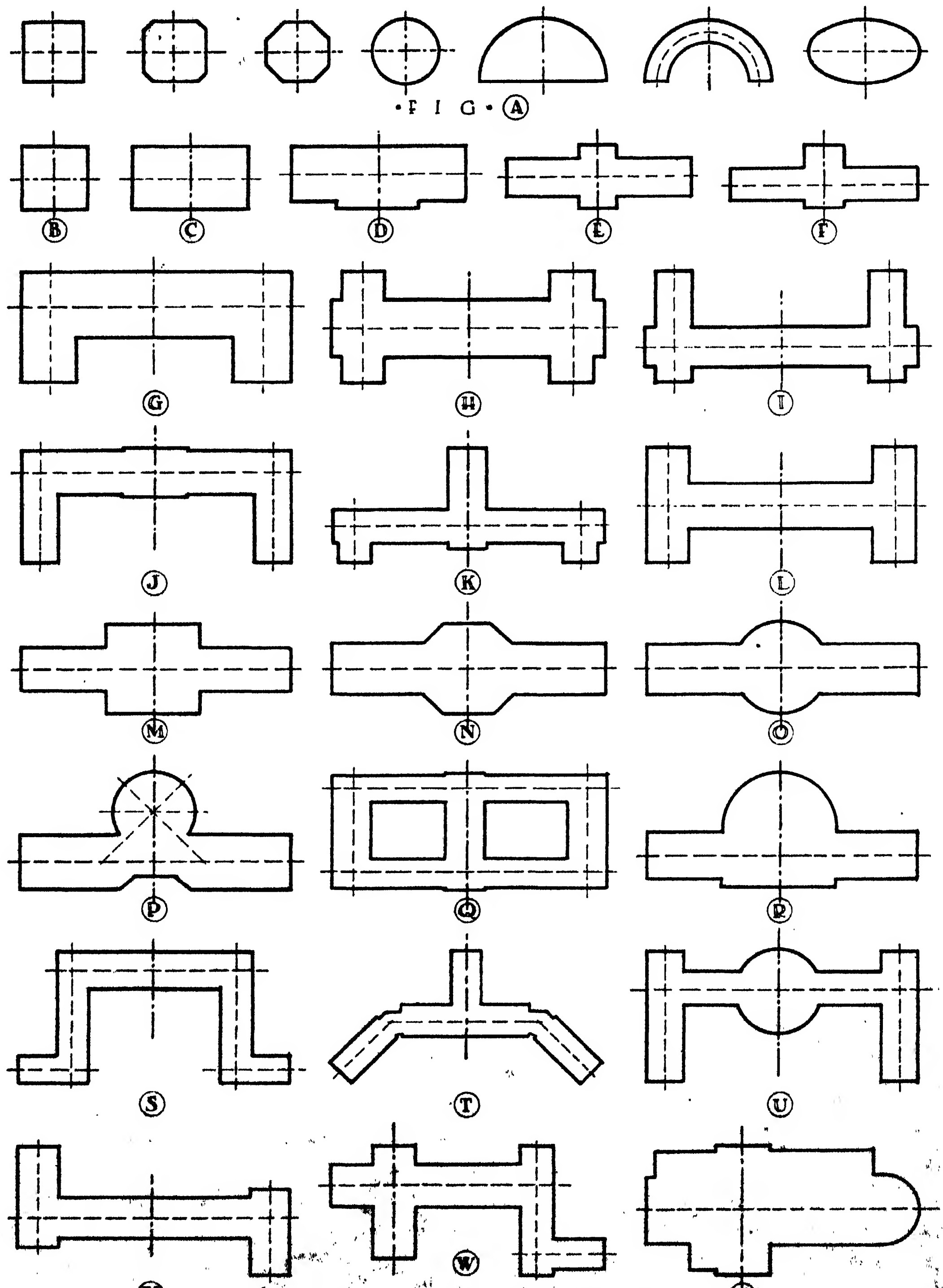
A plan may be simple or complex, depending upon the use to which the building is to be put and upon the number of units or rooms required. Regardless of the complexity which plans may assume, they may all be reduced to the simple geometrical shapes which form the basis for all architecture. As was found to be the case in the study of the elevation, plans consist of areas which are recognized as the square, circle, rectangle, etc., selected for their suitability to the function of the building.

AXIAL ARRANGEMENTS

With the exception of the most elementary forms, plans have direction. This direction is related to the shape and to the relative importance of the sides which bound the plan. This development of direction leads to the establishment of axes or lines about which the composition is organized. As one approaches a building and faces the principal façade, the major axis usually carries through the centre of the mass in a line directly away from the observer and at right angles to the main elevation. In a symmetrical composition, this is the axis about which the elements are arranged in a balanced manner, with those on the left duplicating those on the right. The principal minor axis usually extends at right angles to the major axis through the centre of the important element which tends to parallel the main elevation. In a complex plan the various parts may be grouped around other minor axes which show the direction of these units.

On page 224 are illustrated a number of typical plan shapes with their major and minor axes indicated by the broken lines. No attempt has been made in these diagrams to show the arrangement of the rooms within these areas. Simply the outlines of these representative symmetrical and unsymmetrical buildings are given. In these drawings it is hoped that particular attention will be paid to the manner in which the plans are organized about the axes and how, in turn, a plan may be analyzed in terms of these lines of direction. When a study of a plan is made, it is always desirable first to put these axes down upon the paper to serve as a guide and to help in the development of an idea. (See page 309.) This will not insure success, but it will often eliminate aimless and careless thinking and sketching.

Figure 224 A shows the development of the circle from the square and also suggests the use of the semicircle and the ellipse as architectural motifs. In the first four figures all sides are of equal importance, and no sense of direction is present. However, in the last three, there is no symmetry about a vertical, central axis, but, instead, direction is evident.



•AXIAL • ARRANGEMENTS•

The diagrams are symmetrical about the usual major axis, having a similarity between the left and right sides of the motif.

Beginning with Fig. 224 B in the second row, the development of the rectangle from the square is illustrated. The simple rectangle in Fig. 224 C has its long sides perpendicular to the line of sight of the observer (since in a represented plan the principal entrance side parallel to the street usually faces the bottom of the sheet). It will be noticed that the major axis is at right angles to the directional quality of the area, indicating that the shape of a plan is not so important in an anlaysis of this kind as the location of the entrance and the arrangement of the internal units. It will also be found that axes are sometimes called "transverse" and "longitudinal," terms which are related to the dimensions of the building. The former cuts the plan in its shortest direction, and the latter extends through the length of the composition.

In Fig. 224 D there is no doubt about one side of the plan being more important than any of the others. The projecting central bay establishes the location of the major—and in this case, the transverse—axis. Fig. 224 E shows a cross-shaped plan which is symmetrical about either the major or minor axis, whereas in the following figure the central projection toward the rear of the building is longer than the one in front and confines the symmetry to the major axis.

In Fig. 224 G the projecting elements are located at the ends of the main rectangular unit and form terminating wings. Here, in addition to the major and minor axes of the previous illustration, we must add two more minor axes which are parallel to the centre axis and which show the direction of these wings. An extension of this scheme is seen in Fig. 224 H, where the wings are extended toward the rear, forming an H-shaped plan and one which is symmetrical when viewed from either the front, rear, or ends. As was the case in Fig. 224 F, this symmetry is partially destroyed in Fig. 224 I when the wings are again pushed out toward the rear, resulting in an open court on this side of the building.

The plan shown in Fig. 224 J is similar to that in Fig. 224 G except that a central entrance motif or accent has been added, giving even more emphasis to the major axis. In the example which follows, this central unit has been extended toward the rear, and the end wings have been reduced to minor projections, but the arrangement of the axes remains the same. Figure 224 L is a variation of Fig. 224 H, again H-shaped but without the extension of the longitudinal area beyond the end wings.

The preceding examples have dealt entirely with rectangular forms, but in Figs. 224 M, 224 N, and 224 O the rectangle has been combined with the other elementary shapes, the square, octagon, and circle. In these three plans, the result has been to place considerable emphasis upon the central motif and to establish a strong accent at this point. Figs. 224 P and 224 R show the circle and semicircle combined with shapes which are not curved, all composed about major and minor axes. Figure 224 Q illustrates a more complex plan grouped around two courts, which is typical of buildings requiring considerable floor space and also ample side light, together with privacy which comes from enclosed areas. A deep, open court is formed by the elements of the plan in Fig. 224 S, while Fig. 224 T shows the longitudinal axis bent in a way which is typical of those buildings where the topography or the desire to take advantage of the view or the light makes this arrangement desirable. Figure 224 U is similar to Fig. 224 O, except for the addition of the important wings which again form a court.

The drawings in the last row on page 224 illustrate types of unsymmetrical plans, indicating that they are capable of the same organization as those which are more formal in their balance. In these informal groupings the major axis does not necessarily pass through the centre of the composition. Instead, it shows the location of the important element about which the plan and the elevation are developed. In studying an unsymmetrical plan, such as those illustrated, it is even more essential than with the simpler arrangements that the sketches be made with the aid of the directional axes, and that the relation of the axes to each other and their relative importance be kept in mind at all times.

Principles

To revert to an idea which has already been suggested, it will be seen that plans are interesting and well studied, or uninteresting and awkward in their arrangements, depending upon whether their elements are combined according to the rules of composition. Any building which makes any pretense whatever to beauty or logic must give heed to the principles of unity, balance, etc. A plan, to be worthy of the name, must be organic. All the parts must fit together in such a way that the composition will be disturbed if one element is moved. The axial arrangement of the plan should connect the various units so that one feels the complete organization of all of the component parts. The designer does not set about deliberately to create a pattern of abstract design. He develops a plan which will take care of the practical requirements of the building, but in doing this he strives for the variety and interest which come from a consideration of the fundamental rules of composition.

It is a good practice, and one which will increase the designer's vocabulary, to study plans in architectural documents and to analyze them from the standpoint of their use of principles of design. It will then be evident that the great plans of the Classic, Gothic, Renaissance, and contemporary periods are good because their composition commands the admiration of those trained to recognize the basic qualities of logical planning. However, a mere recognition of these principles does not guarantee the ability to arrive, by one's own efforts, at a satisfactory solution to a problem, although it is essential before much progress can be made. Creative ability is often quite unconscious of dogmatic rules—design ability is often intuitive, rather than the result of conscious reasoning. Nevertheless, a discussion of the application of the rules of composition to various types of plans will help to give an idea of the importance of the principles of abstract design.

CONTRAST OF SIZE. We may use the methods established in the discussion of Contrast (see page 231) and analyze plans to discover the use of contrast of size, shape, character, and direction in plan composition. In Fig. 228 A there is shown a plan which is composed of three rectangular areas, similar in shape and direction, but different in size. The centre unit is much larger than the appendages at the sides, and, on account of this, contrast of size is present. The same is true of the plan in Fig. 228 B. In this case the minor units are placed in front of the major unit, but the direction and shapes are again similar. The element of contrast is secured by the variation in size.

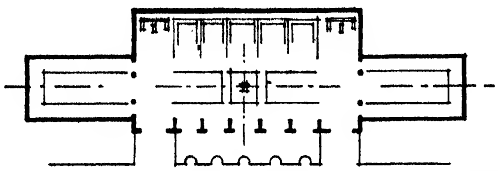
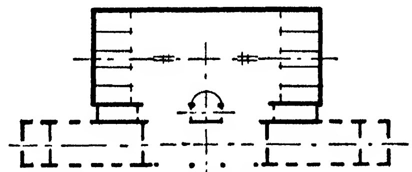
CONTRAST OF SHAPE. Figures 228 C and 228 D show plans in which considerable variety is obtained not by change in direction or size so much as by combining shapes which offer a pronounced contrast to each other. The circular and semicircular areas give a definite accent to the plan and, in their appeal, differ greatly from the rectangular forms which accompany them. Contrast of shape is perhaps one of the most conspicuous types of contrast with which we have to deal. Contrast of color may be a rival in importance, but for years (and not until the contemporary movement) color did not play so important a part in architecture as it did in painting and the decorative arts.

CONTRAST OF CHARACTER is also present in Fig. 228 C. The circular motif at the rear is open and offers more of a feeling of sparkle and gayety than the other parts of the plan. By doing this, it expresses the function of that particular unit, which is to enclose space and yet disclose the terraces and gardens which probably surround the building. Contrast of size is also evident in this example, the corridors of the side wings contrasting in an interesting manner with the rectangular areas which they bound. Another type of contrast which is a little more subtle is presented in Fig. 228 D. In the discussion of façades (see Fig. 235 A), this has been called contrast of treatment. In the rooms on either side of the entrance lobby, variety has been secured for the interior by the combination of blank walls with those which are open in character. With a simple wall treatment on the enclosed sides, there is a tendency to concentrate the interest upon the windows themselves, and contrast of treatment is thus secured.

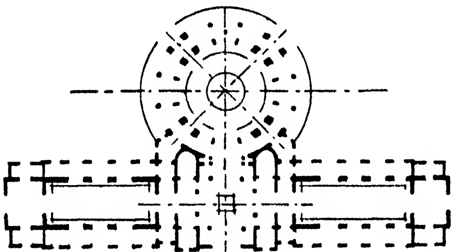
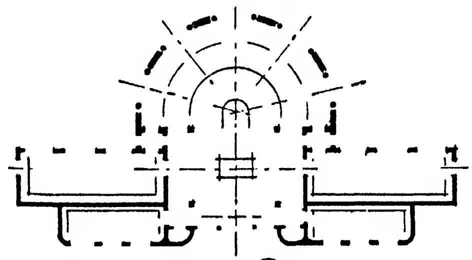
CONTRAST OF DIRECTION. The general outline of the plan in Fig. 228 E is that of a simple rectangle, but upon inspection it will be seen that it is composed of a number of smaller rectangles, similar in general shape but dissimilar in size and direction. The variety which is the result of change in direction is perhaps the most evident. The end galleries are turned at right angles to the entrance motif, to the main hall, and to the gallery at the rear. This sets up a feeling of opposition and forms a definite termination to the longitudinal direction of the other units. In Fig. 228 F, contrast of direction may be even more pronounced, because here there are only two axes, or lines of direction, and only two important areas opposing each other. In addition, contrast of size again gives interest to the plan as one travels, either with the eye or in person, from the lobby through the small corridors into the larger units or rooms. The heavy poché, or indication of wall thickness, of the large hall emphasizes its importance in the plan and offers a contrast to the smaller parts with their lighter walls.

BALANCE. This element of composition is discussed more fully on page 252, but there the emphasis is upon the elevation rather than upon the plan. Figures 228 G and 228 H show two types of plans, one arranged in a symmetrical manner about a central axis while the other is composed in an unsymmetrical way to give occult balance. In Fig. 228 G the interest depends upon contrast of size and direction. The arrangement is regular, and the general impression is one of monumentality. Contrast of direction, size, and shape, in addition to a feeling of informal balance, are all present in Fig. 228 H. Here is the plan of a building which is evidently less serious in nature than that illustrated in the preceding example. This plan has an open quality and a sense of informality which are in sympathy with the function of entertainment or recreation for which the building was obviously designed.

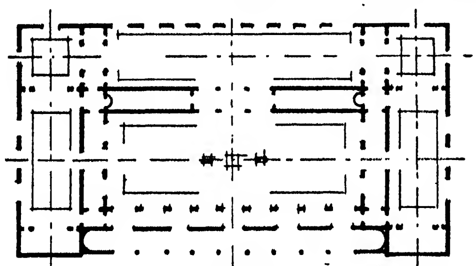
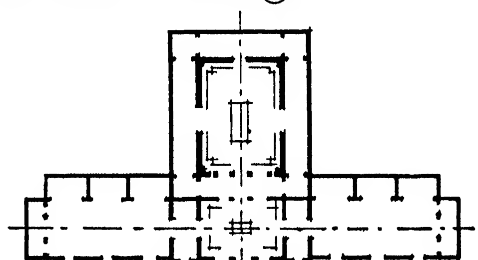
EMPHASIS. It is often desirable to erect a structure which will house a single important object or to have one unit of the plan give emphasis to one particular phase of the activity which is to be carried on within. It is necessary that the architecture frame and accent this important object or activity. This condition is secured in Fig. 228 J by the

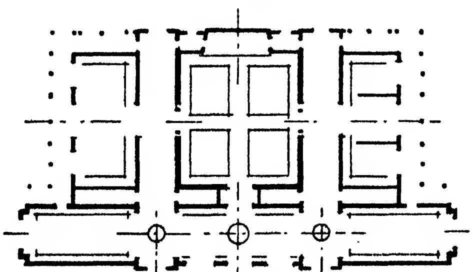
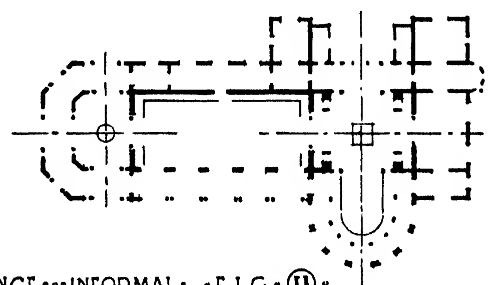
•FIG•(A)• •CONTRAST•OF•SIZE• •FIG•(B)•

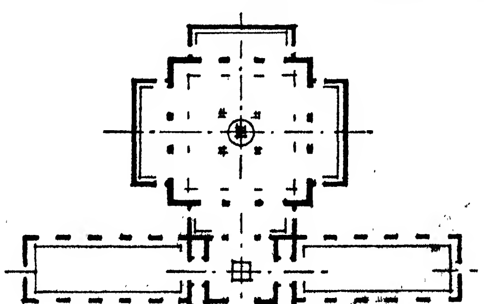
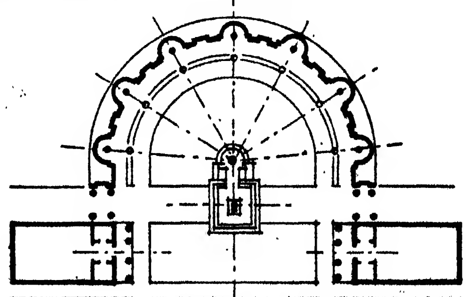
•FIG•(C)• •CONTRAST•OF•SHAPE• •FIG•(D)

•FIG•(E)• •CONTRAST•OF•DIRECTION• •FIG•(F)•

•FIG•(G)• •FORMAL•••BALANCE•••INFORMAL• •FIG•(H)•

•FIG•(I)• •EMPHASIS• •RADIATION• •FIG•(J)•

use of the semicircular element with niches which impart a decorative rhythm and point to the monument in the centre of the composition. This arrangement also illustrates the principle of radiation from a single point—the centre of interest—which contributes much to the quality of emphasis. The variety secured by the change of direction from the curved element to the straight line which forms the axis for the buildings on either side adds to the appeal of the design. In Fig. 228 I the symmetrical treatment of the large, square hall and the manner in which the surrounding units open in toward the focal point of the composition give the necessary importance to objects displayed in this hall and insure the desired direction of attention.

SECONDARY PRINCIPLES. In most of the plans on page 228 are embodied the secondary principles of repetition, alternation, transition, etc. The significance of repetition hardly needs any further comment. The word itself is self-explanatory. However, in an architectural sense, repetition may be present when a number of rooms of equal size and shape occur side by side, or when windows, columns, or arches are spaced in a regular manner to give unaccented rhythm. Alternation may be a synonym for contrast. (See page 231.) In Fig. 228 E there are alternating sizes of rectangular elements; alternation of shape is found in Fig. 228 J in the combination of the semicircular and flat niches in the large central motif. Transition is also present in a number of the plans on this page, in that there is satisfactory progression from one unit to another. Small vestibules protect and act as buffers for the lobbies which follow, and the lobbies allow the visitor to become adjusted to the situation which confronts him upon entering the building. These minor elements also give the observer some preparatory indication of the general character and use of the interior before introducing him to the more important units. In a complex plan it is often desirable not to tell the whole story at once but to allow the beauty and interest of the interior gradually to unfold itself, reserving for the climax some definitely predetermined accent. If the power of observation is trained, it will be seen that many of the principles of design may be found in a simple plan. Some principles may be less evident than others, but nevertheless they are present and contribute to the success of the composition. The most important thing to remember in plan analysis is that a good plan must have organization. The presence or absence of this organic quality can be seen at a glance, and, although it may appear rather simple of attainment, it requires much thought and study. A beautiful plan based on sound reasoning is the first prerequisite for a successful building.

Chapter XIV

THE PRINCIPLES OF COMPOSITION

There is no doubt that the so-called fine arts—painting, music, etc.—are creative; that they concern themselves with the task of adding to the sum of human happiness and enjoyment. Many individuals, however, fail to realize that architecture serves the same purpose and is achieved by the same method—that of creative endeavor. Architecture has the same basic principles which are common to painting, sculpture, music, and literature. It deals with unity, balance, rhythm, and composition. It is organized around a central plot, as is a novel. It has design, as has a sonata. It can be as rhythmic as the dance. A painting has contrast of color, and a fine piece of sculpture has beauty of form and line. Good architecture attains pleasing composition through the relation of contrasting masses and tones.

The evidence of past civilizations also shows that architecture is one of the creative arts and that the same fundamental principles of design peculiar to the other forms of artistic expression are to be found therein. The best examples of the Greek, the Gothic, the Renaissance, or the Colonial are still admired and serve as an inspiration to modern designers. Their beauty cannot be denied. They have survived during all the centuries because they were sound in their application of the basic principles of composition.

It is difficult to isolate a single quality and consider it alone. A synthesis of all of the principles is necessary in order to insure a unified and satisfactory composition, but for the sake of study it will be necessary to analyze separately these qualities and their application to architectural problems. Mere recognition of these principles does not, however, insure a successful design. An individual may be a good critic but still be unable to write a poem, paint a landscape, or design a building. Creative ability, in addition to a knowledge of the application of the elements of design, is necessary for the production of distinguished results. Ability to discern between what is fine and what is mediocre—that quality which we call taste—must be developed. Good taste is that discerning judgment which one exercises in connection with the better things of life. Good taste steers an individual through the seas of social adjustments and aesthetic decisions. It enables him to choose correctly, in accordance with cultural or artistic standards. Popular taste, however, is so often a matter concerned with group action and changes so with the times, that it is not a reliable guide. Taste must, therefore, be based upon a knowledge of the rules of proper conduct with respect to our actions and of the principles of good composition in regard to our artistic endeavors. Good taste and creative ability together should produce buildings which merit the name of architecture.

It has been seen that the principles of composition may and should be applied to the development of the plan of a building, but they are best illustrated in the treatment of volumes. Visible architecture, or the masses and surfaces of which it is composed, lends itself to critical analysis. The following discussion is concerned with the application of the basic principles of composition to space-enclosing elements.

CONTRAST

Contrast is one of the most important qualities or manifestations of natural conditions in all of man's activities. Our physical impressions are made possible through contrast. We can hear because of the contrast between silence and sound, because of the difference between the lengths of the sound waves. We can feel because of the contrast between the quality of objects. The nerves in our finger tips tell us that some things are cold and smooth whereas others are warm and rough. We can see a building because of the contrast in the shapes and textures of the surfaces which enclose space to make architecture. If the materials of nature and man were all similar in every respect and if they were placed in a perfectly diffused light, there would be no contrast. We would see nothing. It is only through contrast that we are able to live and to enjoy the experience of sight, sound, and touch.

Not only is it possible for us to see a building through the element of contrast but also the building is given beauty and interest by the difference between the types of treatment which are introduced. It is essential that certain areas, directions, and colors vary or differ from others so that by contrast the qualities of each are emphasized. It is through contrast that we secure proper scale, proportion, and unity, and consequently, a satisfactory design.

By reducing this principle to its fundamentals, we find that a few of the typical contrasts are:

1. Contrast of form.
   - Shape.
   - Mass.
2. Contrast of line.
   - Direction.
   - Type.
3. Contrast of size.
4. Contrast of tone, etc.

CONTRAST OF FORM. If form is used to mean merely surface or to imply a two-dimensional area, there exists only the element of shape. In order for a shape to be interesting there must be variety or contrast. Square and circular areas may create a diversified interest, as in Fig. 232 A; or an arch may be in pleasing contrast to the openings on either side, as in the Palladian motif in Fig. 232 B. If form is more properly conceived in three dimensions, the architectural result is mass or volume. Again, if contrasting bulks are combined, it is possible that the resulting composition may be interesting and satisfying. The mass of the lower part of the vase in Fig. 232 C contrasts with the elongated neck, while the tower of the building in Fig. 232 D gives variety in the type and arrangement of the parts.

CONTRAST OF LINE. Lines may vary with reference to direction. It is possible to have a horizontal line opposing a vertical, Fig. 232 F, or diagonal lines may form a composition as in Fig. 232 E. A line may also offer contrast on account of its change in type or character. It may be curved or straight, regular or irregular, broken or continuous (Fig. 232 G). In an architectural example, contrast of type of line gives an interesting contour or

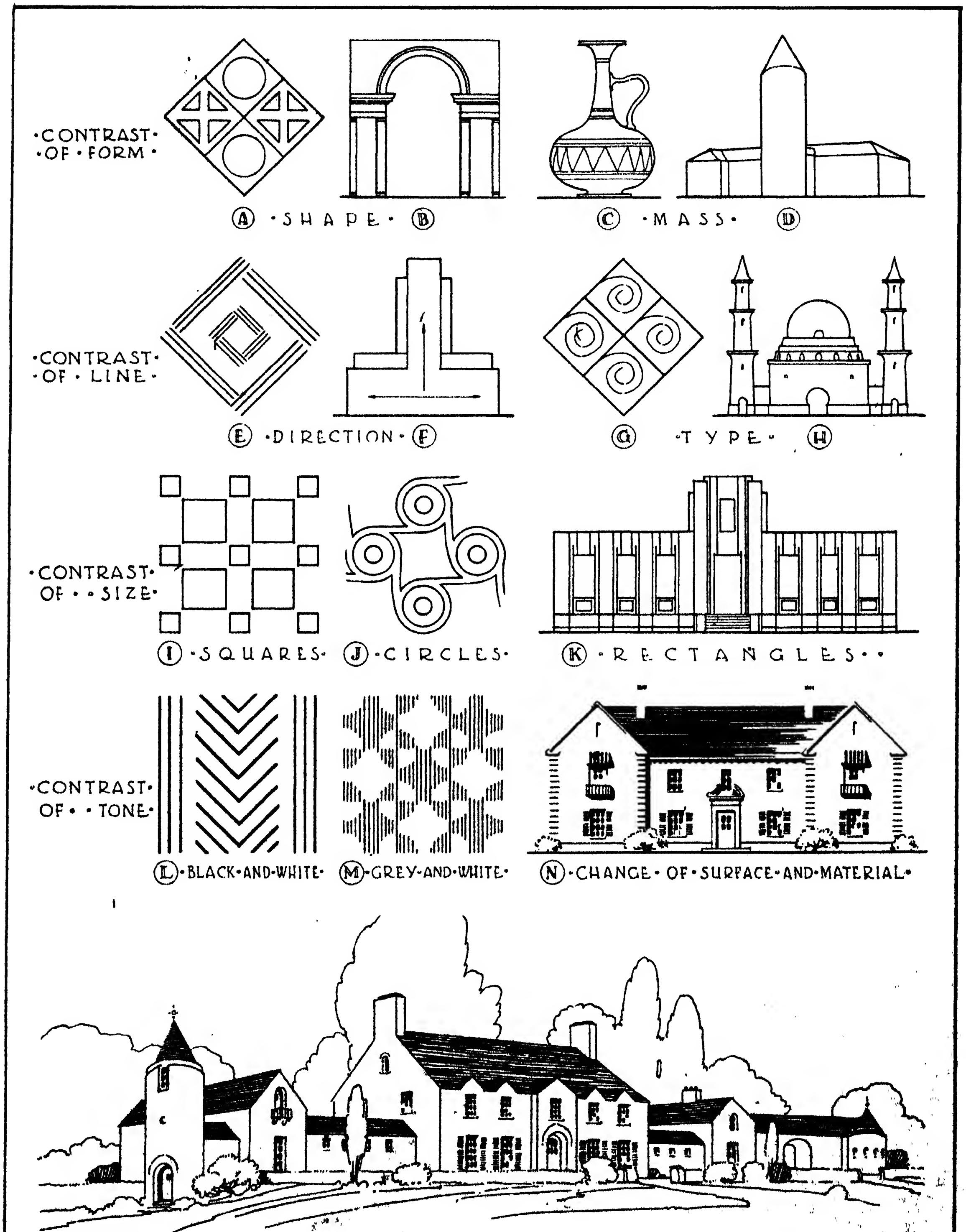
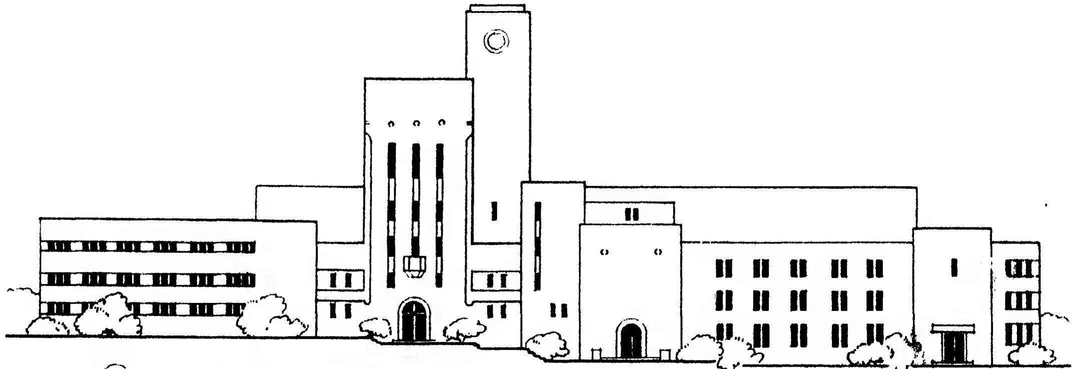
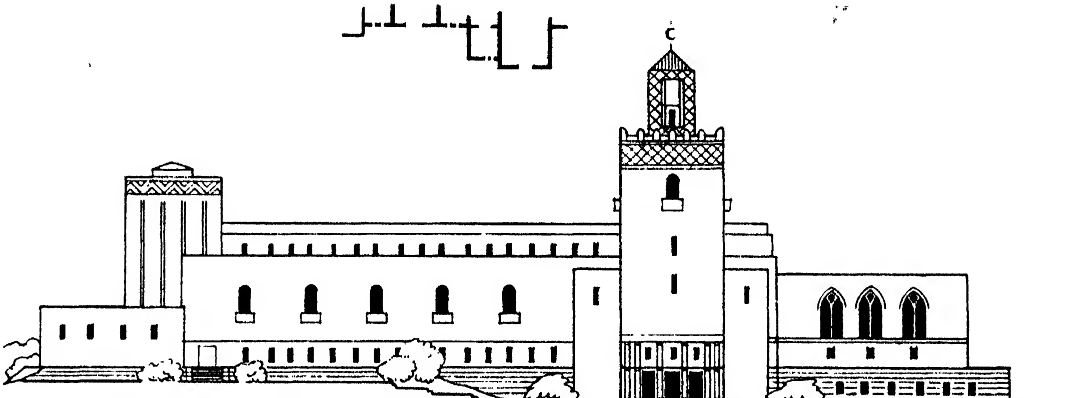


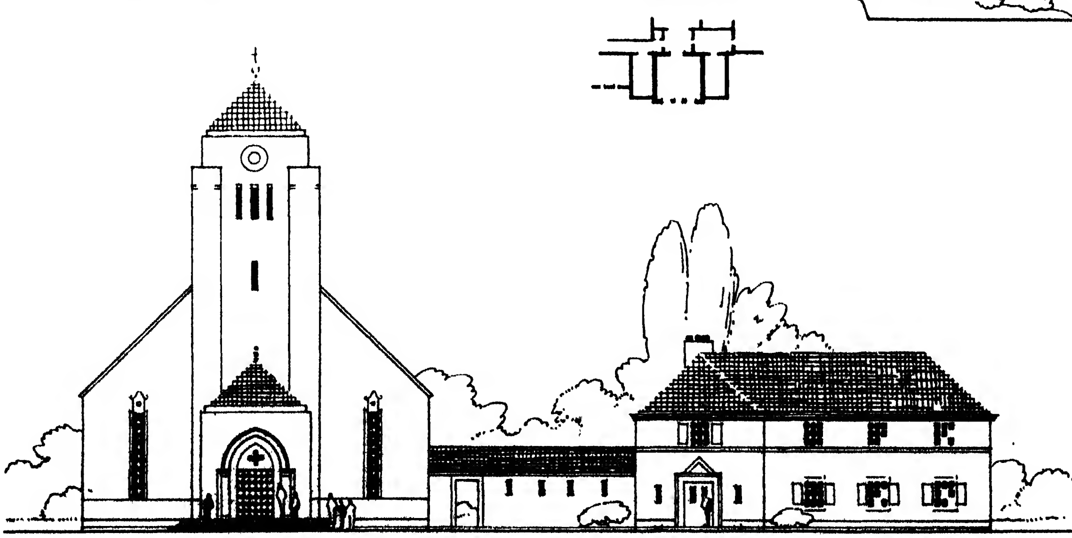
FIG. O CONTRAST OF MASS SHAPE AND TONE



•FIG•(A)• CONTRAST•OF•MASS•



•FIG•(B) •CONTRAST•OF•DIRECTION•



•ECCLESIASTICAL• ••DOMESTIC•••

•FIG•(C) •CONTRAST•OF•CHARACTER••

silhouette to a building, as in Fig. 232 H. Contrast in type or direction of line furnishes the necessary variety to the contour of a cornice. (See Mouldings, page 123). The straight vertical and horizontal mouldings accent the curved members and make possible a play of light, shade, and reflected shadow.

CONTRAST OF SIZE. Another type of contrast deals with objects which may have the same shape and direction but may vary in size. If this change in size is gradual and uniform, the result is called gradation, as in a string of beads which increases in size from the ends of the strand to the middle. Fig. 232 I shows an interesting pattern formed by the combination of squares of different sizes, while Fig. 232 J offers a pleasing area of abstract design composed of large and small circles. In the architectural example, Fig. 232 K, the rectangular windows and door contrast with each other in the matter of size.

CONTRAST OF TONE. After the general mass of the building is established and an interesting contour is obtained, the surface treatment is the next consideration. Tone may be secured through contrast—contrast of texture, openings, or planes. In Fig. 232 N the exterior of the building is given interest on account of the contrast between the dark roof and the light walls. This feeling is strengthened by the introduction of the darks of the openings and by the shadows cast by the projecting wings of the building. Contrast of tone is secured in the examples of abstract design, Figs. 232 L and 232 M, by the use of black and white, or gray and white, areas.

COMBINATIONS. In Fig. 232 O an architectural composition is presented which illustrates in a combined way some of the various types of contrast. There is, first of all, contrast of mass—not only with reference to whether it is cylindrical or rectangular, but also with reference to the direction of the mass or volume. The entire composition is decidedly horizontal; but variety is secured by the vertical direction of the tower, of the end wings, and the chimneys. Contrast of shape is also present in the rectangular and arched openings of the building, and contrast of tone is secured by the darks and lights of the roofs, walls, and windows.

Contrast is the opposite of similarity. If similarity exists to a marked degree, the effect is monotony. The façade of a building may consist of a simple, unadorned wall pierced with many uninteresting windows, and the effect may be very monotonous. On the other hand, it is possible to go to the other extreme and to have contrast which is too violent. Pilasters, belt courses, and decoration may be used too profusely. The result will be a restless and disorganized design which lacks repose. It is thus necessary that contrast be present in just the correct amount: enough to give variety but not an excess, which will cause confusion.

CONTRAST OF MASS. Turning now to the strictly architectural subjects, we find in Fig. 233 A an interesting combination of rectangular masses based upon contemporary practice. Here there is contrast of vertical and horizontal volumes giving a composition in abstract form which becomes capable of housing human interests through the introduction of windows, doors, and floor levels. It will be seen that no Classical elements are used in the treatment of the exterior; that no belt courses, cornices, or columns assist in dividing the surfaces into interesting areas. A pleasing composition is secured chiefly by the relationship which exists between the various block-like units of the buildings and by the disposition of the windows, which give interest to the surfaces of the masses. The elements of the Classical Orders have been popular partly because they supplied standard-

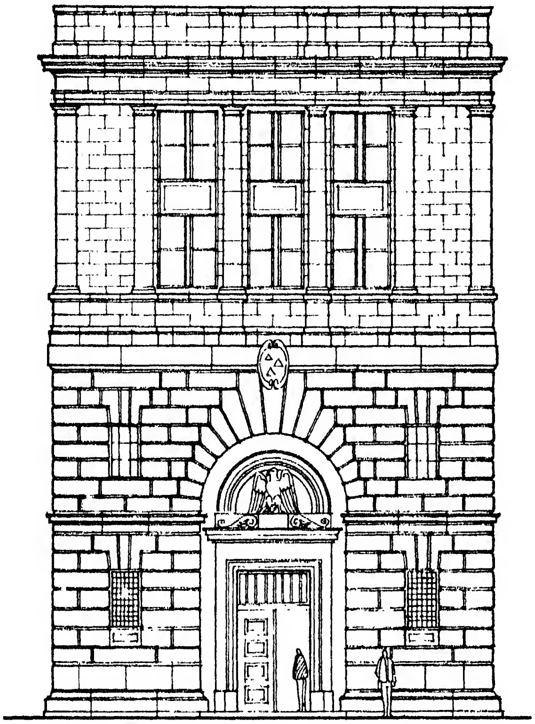


FIG. (A) CONTRAST OF TREATMENT

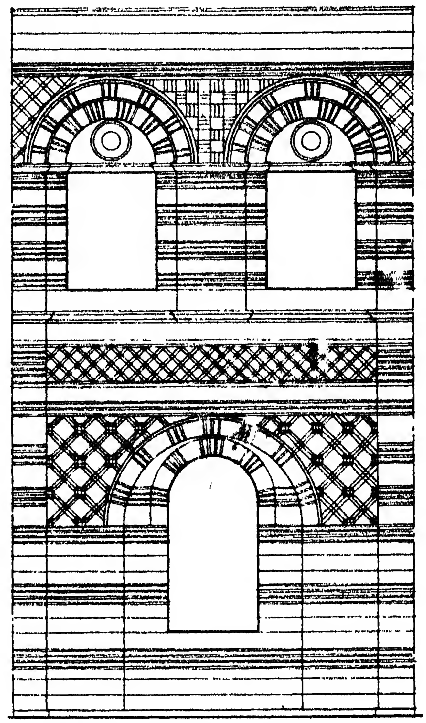


FIG. (B) CONTRAST OF PATTERN

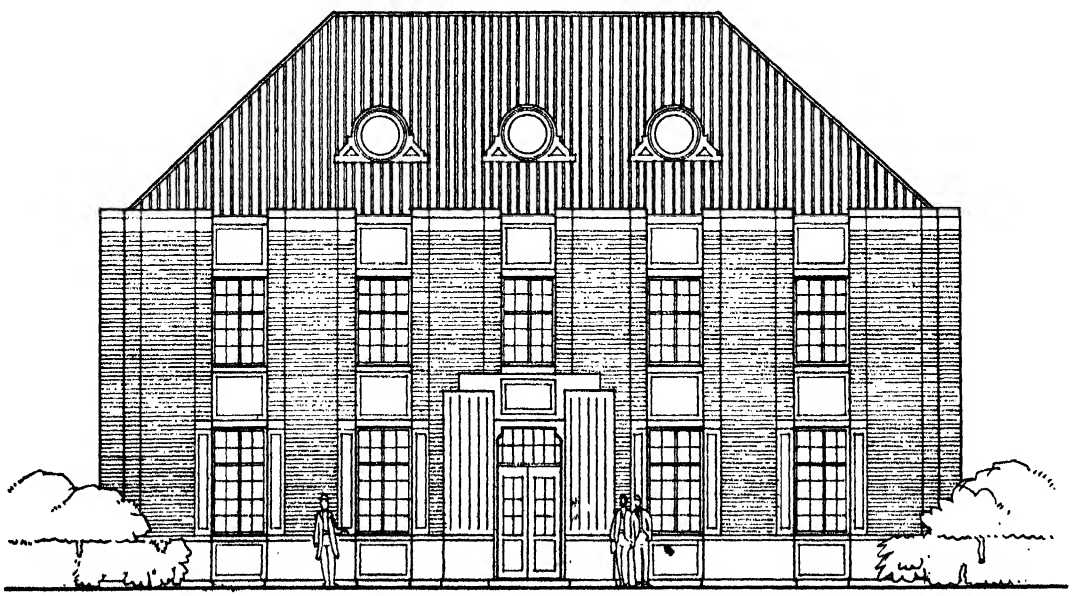


FIG. (C) CONTRAST OF AREA

ized verticals and horizontals which could be applied rather easily to the exterior of a structure. The success of this application, of course, depended upon the ability of the designer. If the Orders were used in an archaeological manner, the results might be satisfactory but uninspiring. If Classical motifs were employed only as a basis for the design and if modern conditions and materials were allowed to play their part, there was more likelihood that a spirit of freshness and originality would ensue. With the partial abandonment of traditional forms in the modern movement, it has been discovered that considerable imagination is necessary in order to design without the aid of these standbys. The creation of a piece of architecture which depends upon plain wall surfaces combined according to the principles of good composition is now more a matter of personal expression.

In Fig. 233 A, attention should be called to the manner in which the eye is carried along to the tower by means of a series of minor vertical units which prepare one for the climax of the dominant element near the centre. Consideration should also be given to the horizontal treatment of the windows on the left, which emphasizes the direction of that portion of the building and opposes the vertical feeling of the forms near the main entrances. It is well to remember that contrast is opposition. If verticals did not oppose horizontals, if openings did not differ from walls, and if accents did not successfully compete for the interest of the observer, contrast would not exist.

CONTRAST OF DIRECTION. The drawing in Fig. 233 B is based upon a design for a Scottish Rite temple. Here again is an interesting contrast between the horizontal direction of the composition and the dominant vertical accent of the tower. This latter may be called the major contrasting element, while a minor vertical is to be seen at the left represented by the space over the stage of the auditorium. The termination of the tower gives additional emphasis and contrast to that part of the structure. There is also present in this connection contrast of tone, which is seen in the decorative treatment of the upper and lower portions of the tower. Interest in other parts of the façade is secured by the contrast of the windows with the wall surfaces. In the wing at the right, the upper windows are pointed and are larger than the rectangular ones below, while at the left the arched openings with balconies are surrounded by large areas of wall space which again give variety and contrast.

The discussion thus far has been confined entirely to contrast in elevation, but this is secured largely through contrast in plan. It is necessary that the various units in plan should vary in size and projection in order that a monotonous exterior effect may be avoided. The different elements must be wide or narrow, long or short, so that some may be more important than others. In addition, there should be a variation in the projections of the various parts of the plan, in order that the proper emphasis may be secured. Few situations can be more uninteresting than the equal projection of a number of bays or wings of a building. The plans shown on page 233 illustrate the presence of contrast by reason of the difference in the sizes and relations of the rooms and towers.

CONTRAST OF CHARACTER. The problem of designing a church and a parish house is usually an interesting one, though often difficult. The two parts must be similar in general feeling, but the use of the various architectural details must express the different function of each particular structure. The church must have ecclesiastical character (see page 274), and the parish house must harmonize with the former, but not to such an extent that it might be mistaken for a place of worship. This calls for a subtle balance of contrast and similarity—the contrast of character, as in Fig. 233 C. Here the spire of the church which we associate with ecclesiastical buildings gives a suggestion of function, and the important entrance indicates the public character of the structure. The house has smaller windows than the church, their size being regulated by the interior which they are to light. The shutters and the chimneys impart a touch of domesticity and intimacy which would not be desirable in the church and which is lacking therein. Contrast of direction is also present in this example. The church, as seen in direct elevation, is vertical, whereas the parish house is horizontal. In addition, contrast of size is evident—the large church towering over the smaller dwelling.

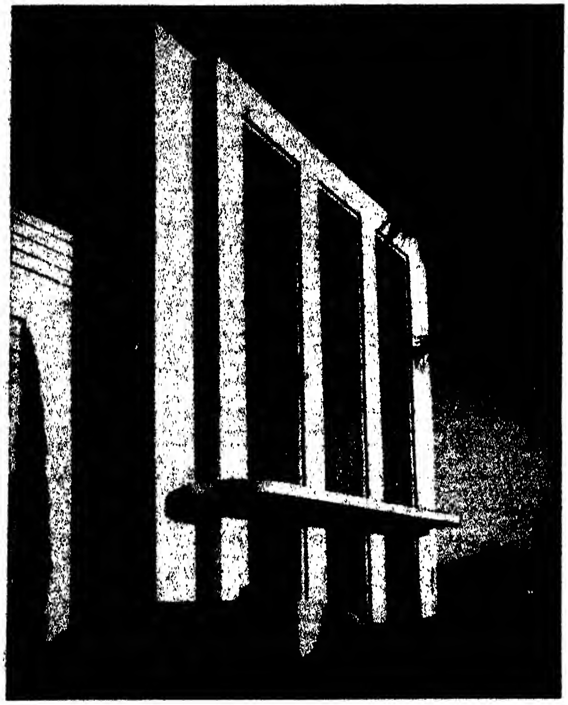
CONTRAST OF TREATMENT. The importance of contrast warrants the extention of its study to include those examples on page 235. Here in Fig. 235 A there is found contrast based, not on direction or mass, but upon the handling of the various surfaces. Interest is secured by changing the character of the treatment of the upper and lower portions of the façade. The rustication of the lower floor is heavy in character and horizontal in direction. The treatment of the upper floors is more refined in its use of detail, and a vertical feeling is secured by the use of columns and pilasters. The arched entrance also offers the quality of variety when used with the rectangular door and windows, while contrast or opposition is secured by the upward thrust of the columns against the inert weight of the entablature.

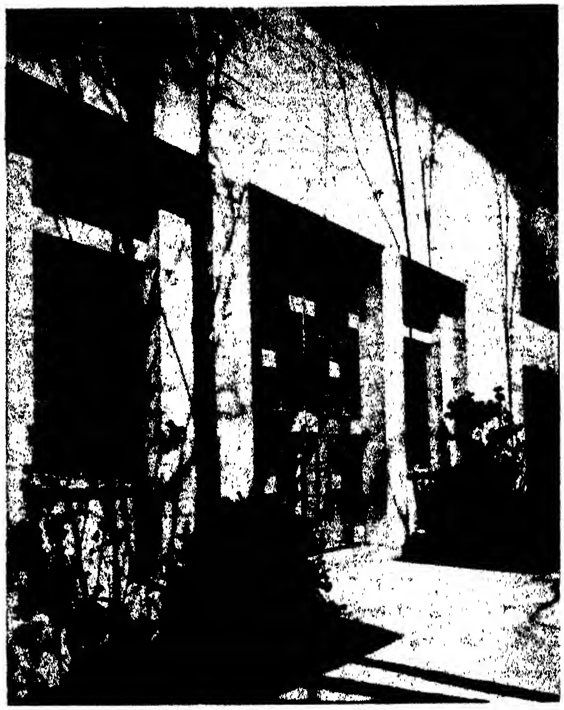
The example illustrated in Fig. 235 B is based upon old Persian brickwork and shows contrast of tone secured by the alternating patterns of brick and stone. Accents are also obtained by the change in direction of the voussoirs of the lower arches.

A slightly more subtle type of contrast is evident in Fig. 235 C. The general direction of the building is horizontal, but the treatment of the exterior is given variety by the introduction of vertical piers. In the roof, the lines of the tile oppose the horizontal direction of the roof itself. A satisfactory contrasting relation exists between the width of the windows and that of the piers. The latter are wider than the former and provide for dissimilarity of surface, or an interesting proportion of parts.

From the foregoing remarks it is evident that contrast results from dissimilarity, or the association of unlike masses, areas, or tones. Contrast, we have said, is also opposition —opposition by which one element wages a successful battle against competing elements. One shape or color clearly dominates the others. This condition may also be called emphasis, but, as has already been indicated, this emphasis must be present in just the proper amount. If a doorway, a window, or a panel seems to detach itself from the wall or appears to be unrelated to the rest of the composition, it may be too emphatic in its appeal. The element of contrast is too strong. There is not a satisfactory transition between the surrounding wall surface and the dominant architectural motif. Therefore, although contrast is essential to a unified composition, transition should always tend to alleviate the burden imposed by excessive and sudden changes in treatment. Mouldings and decorative details should frame structural or circulatory elements, and belt courses, cornices, and quoins should help one surface to member gracefully with the next and assist in tying the entire arrangement together in a pleasing and interesting manner.

There should also be transition in the relationship between masses. This situation is shown in Fig. 233 A where the adjacent volumes prepare the observer for the dominant vertical near the centre of the composition.





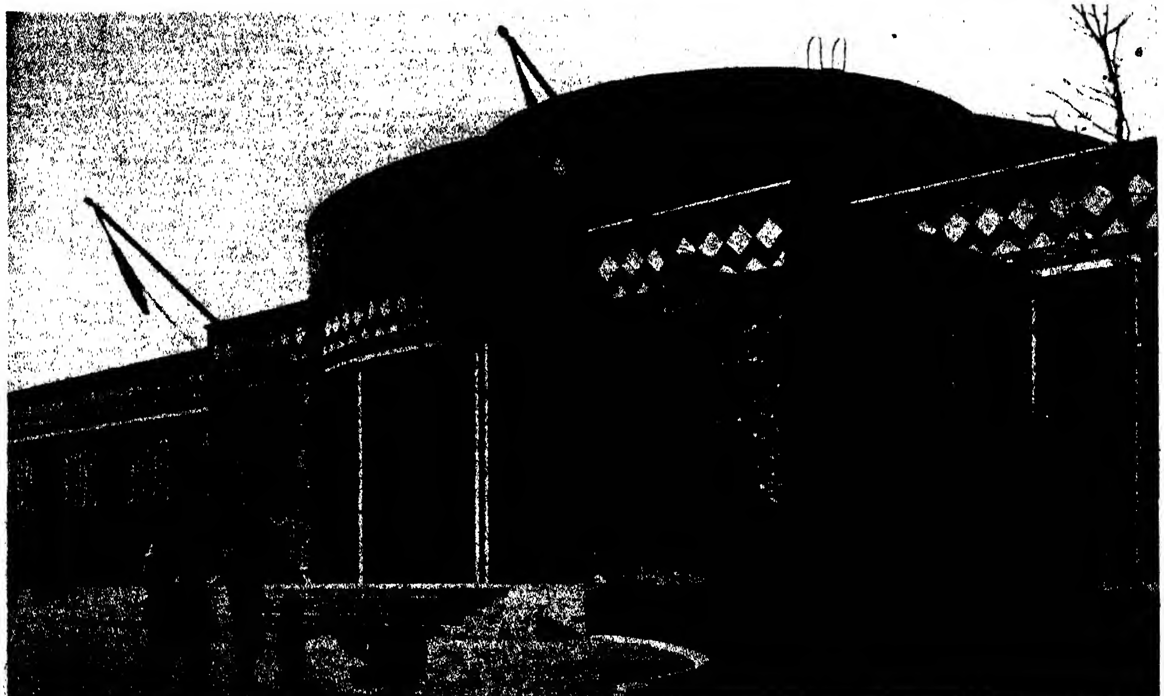
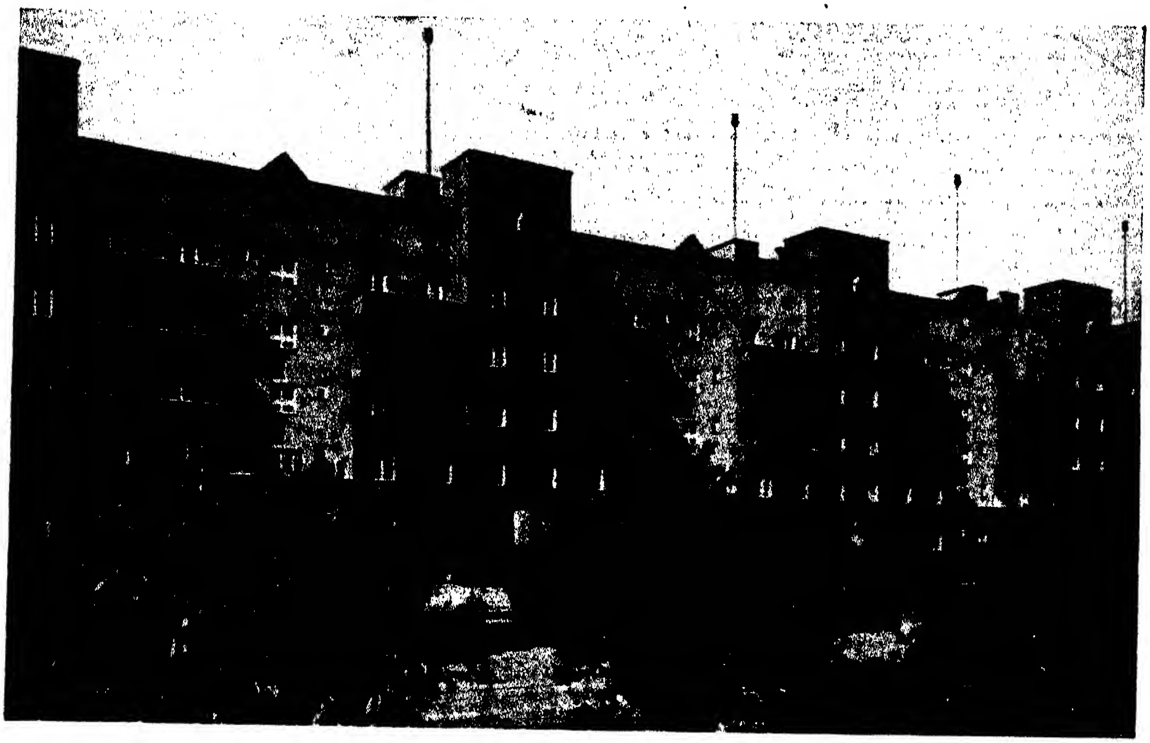


Fig. (a), above.—Contrast between verticality of piers and horizontality of canopy. Broadcasting Studio, Hollywood.

Fig. (b), above.—Contrast between concrete walls and openings. Similarity of treatment, angularity in fenestration and grill. Art Academy, Colorado Springs.

Fig. (c), below.—Contrast of shape, materials (brick and stone) and color. Open entrance contrasted with solidity of flanking bays. Bath house, Brooklyn.



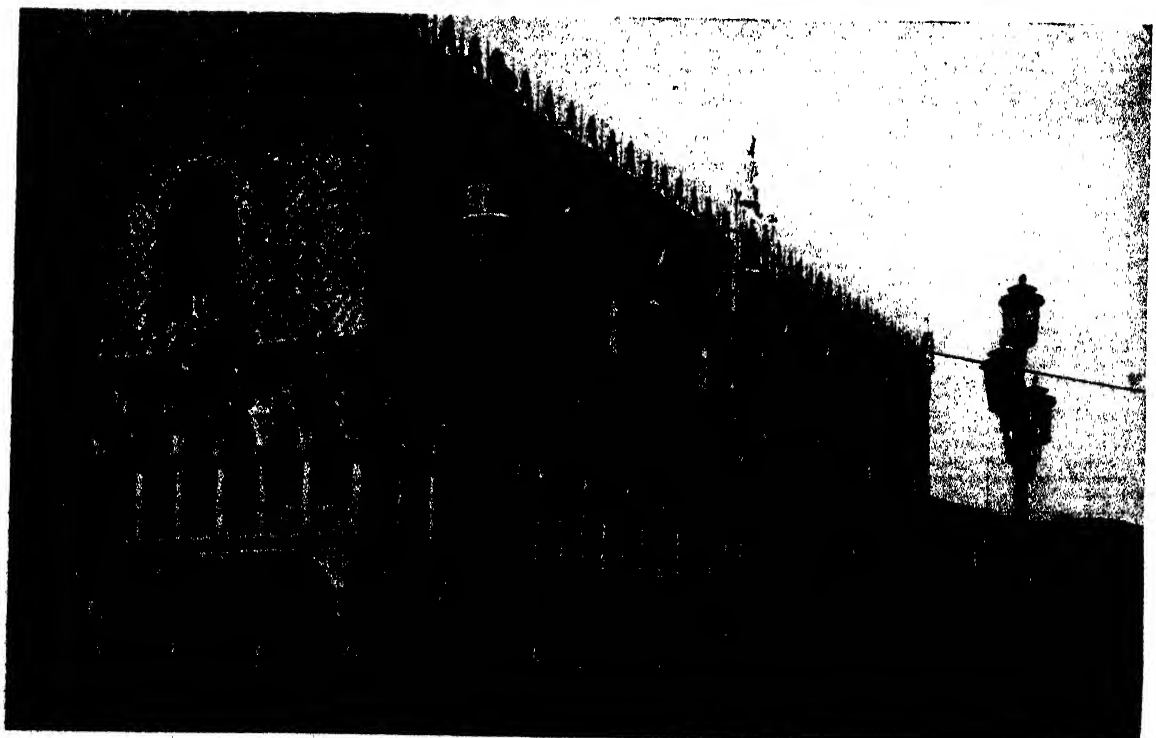


FIG. (A), above.—Contrast of direction; wall surface with balcony; vertical with horizontal. Karl Marx Hof, Vienna.
FIG. (B), below.—Contrast of treatment; simple solidity opposed to complex openness. Also contrast of pattern. Doges Palace, Venice

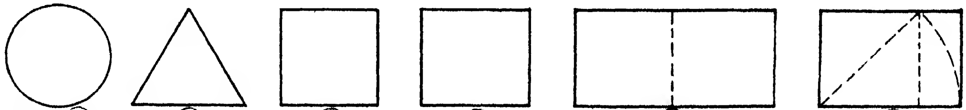
Proportion

GEOMETRY. Proportion is largely a matter of relationships. It is evident by a comparison which the eye makes between the size, shape, and tone of the various objects or parts of a composition. There are certain geometrical forms which have very definite proportions. These are the circle, triangle, and square (Fig. 241 A–C). The eye judges them quickly and classifies them with no difficulty. They are dominant shapes in a composition and for that reason should be used for accents. In a plan, a circular or square unit acts as a focal point or the centre for radiating lines. On an elevation, these same shapes will give emphasis to that particular portion in which they are incorporated.

Just as a circle is more evident and less intriguing than a freehand curve, so is a square less interesting than a rectangle. However, a rectangle should very definitely take on the proportions of that particular shape. It should not approach a square in its dimensions, because a state of doubt will exist in the mind of the observer as to its classification (Fig. 241 D). The eye will be unable to decide whether it is a square or a rectangle. On the other hand, if the rectangle becomes too long, it approaches the area of two squares, as in Fig. 241 E, and there is an unconscious tendency for the eye to divide it into two equal spaces. Thus, there is competition between the two parts. (See Unity, page 262.) The diagram in Fig. 241 F illustrates the proportions of a rectangle which have long been regarded as satisfactory. Its acceptance does not necessarily eliminate all other rectangles, but it has been found through long usage that this relation of the length to the width is pleasing. It is called the "Golden Mean," and it is constructed by making the long sides of the rectangle equal to the diagonal of a square based upon the short sides.

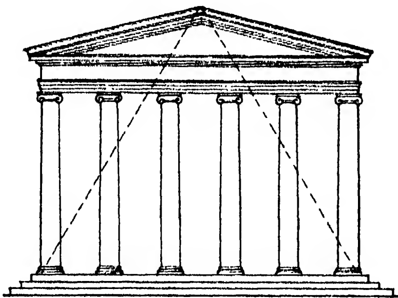
Rules of proportion are made only to be broken by those trained in the correct use of the principles of design. It is with some hesitancy that the following remarks are introduced, because of the fear that they may be seized upon as short cuts or infallible rules which will lead one through the mysteries of composition. There have been very interesting efforts upon the part of scholars of the past and present to relate the art of design to the science of geometry. No doubt their theories have considerable merit, but the fact still remains that formulas are useless unless they are used by an understanding and appreciative mind. The chief benefit to be derived from a study of the principles illustrated in Figs. 241 G to 241 L is the realization that certain geometrical forms are quite pleasant in their proportions. Their influence upon design should be an unconscious one rather than a studied effort to make the solution fit the diagram. If a design is based upon shapes which are generally recognized as having desirable qualities, it should take on the characteristics of the examples used. But success is not assured—it still depends upon the ability of the designer.

The equilateral triangle, or one with equal sides and angles, has long been accepted as a form with good proportions. It is static and stable. Its centre of gravity is low, and it tapers in a regular manner from the base to the apex, carrying the eye up to this focal point of the composition. A triangular arrangement in a painting, in a sculptural group, or in an architectural massing offers a satisfactory disposition of parts. It goes so far in insuring good results that the privilege of using it has been abused, and it is regarded as the easiest way out of a difficult situation. Figs. 241 G and 241 I show the application of the equilateral triangle to Classical and Gothic buildings, and Fig. 241 L illustrates the use of

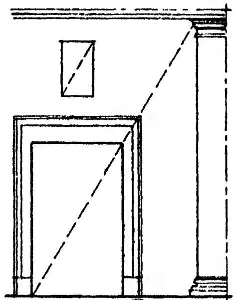


·FIG·A B C D E F

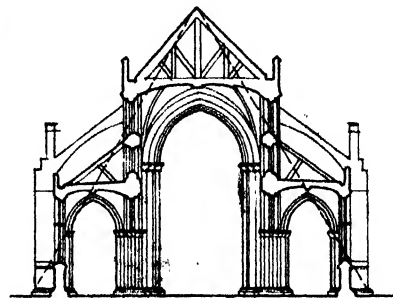
·GEOMETRIC · SHAPES·



·FIG·G·

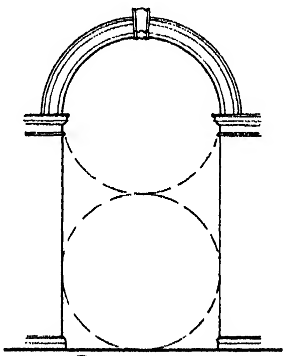


·FIG·H

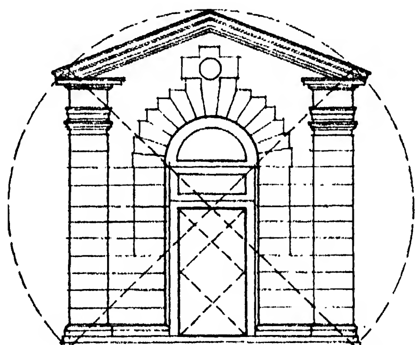


·FIG·I·

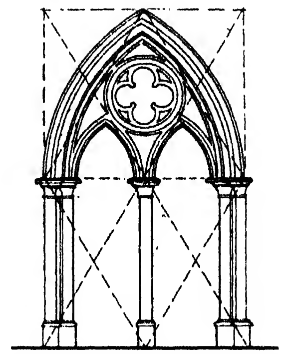
·THE · EQUILATERAL · TRIANGLE·



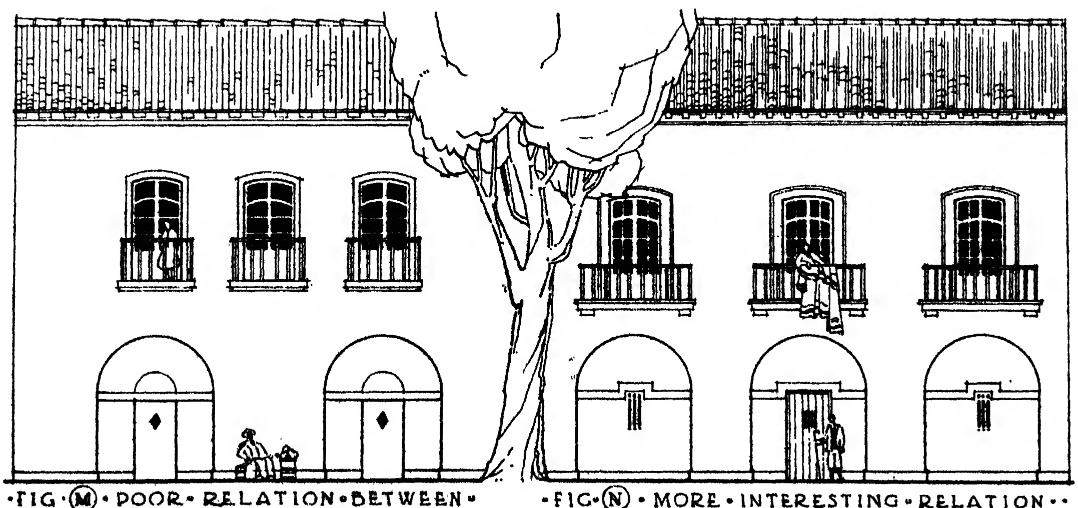
·FIG·J· THE · CIRCLE·



·FIG·K·CIRCLE·AND·SQUARE·



FIG·L·EQUILATERAL·TRIANGLE·



·FIG·M· POOR· RELATION·BETWEEN· ·SOLIDS· AND · VOIDS· · ·EQUALITY·

·FIG·N· MORE·INTERESTING·RELATION· ·BETWEEN·SOLIDS·AND·VOIDS· ·INEQUALITY·

this same geometric shape in the design of a Gothic window of the Early English period.

Questions are often asked as to the date of the discovery of this principle. Did the builders of the Parthenon or of Reims Cathedral rely consciously or unconsciously upon the characteristics of the equilateral triangle or the circle in achieving the results which are so apparent in these two masterpieces? Or did later theorists discover that many of the important buildings of these two ages could be reduced to these fundamental patterns and thus build up a system of design and reasoning? Architectural design is ever a matter of choice. Decisions must be reached in a very personal manner. And so with the foregoing questions—the architectural student must allow his own investigations to help him in reaching his conclusions.

If the façade of a building is developed in such a manner that areas of similar shape are repeated throughout the composition, it may lead to a unity of treatment. A sense of harmony will be the result if use is made of a rhythmic repetition of motifs which have a common geometric shape as a base. Fig. 241 H shows the use of such a device in an architectural grouping. Again the student is warned that monotony will result if the idea is carried too far, and that discerning judgment, rather than mathematical calculations, must be depended upon if the results are to be satisfactory.

Classical and Renaissance buildings have given us arched and rectangular openings which have stood the test of time with reference to their proportions. Upon analysis it has been found that many of these openings are two diameters high, as in Fig. 241 J. When the beginner is working with these traditional forms, it is usually desirable to retain these accepted proportions. However, in the hands of a skillful designer, the relation between the vertical and horizontal dimensions of an opening may vary from this standardized formula more often than it agrees with it. Again the eye and not the hand should rule.

The circle and the square have been found to possess certain properties which recommend them as a base upon which to begin a design. This is illustrated in Fig. 241 K, where the façade of a small structure has been developed within these areas. It will be noticed that the diagonals pass through important points in the composition.

RELATIONS. One of the most important phases of proportion and one which should be considered in the development of a façade is the relation of the solids to the voids, or of the wall surfaces to the openings. It is necessary that one clearly dominate the other in order that the element of contrast will be present. (See Fig. 246 C.) If there is a similarity between the width of the windows and the spaces between, indecision or competition will exist. In Classical, Romanesque, and Renaissance buildings, where heavy stone construction predominates, the windows and doors usually occupy a minor portion of the façade and the wall surfaces are quite dominant. When the Gothic builders learned the art and science of transmitting the thrust or weight of the vaults to isolated buttresses, the walls of the cathedrals became unimportant. Large areas of stained glass took the place of these walls, and regularly spaced piers carried the load of the roof and vaults. In contemporary architecture the cantilever of concrete and steel frees the designer from many of the restrictions of masonry construction, and there is a tendency to use openings freely. Even here one should not forget the rules of good proportion and contrast.

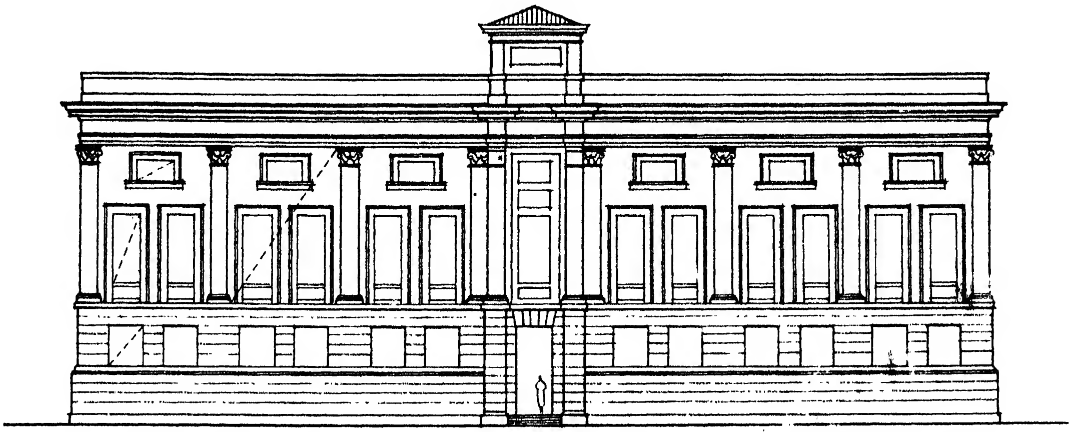
In Fig. 241 M there is an example of what may be considered to be lack of correct proportions. The width of the arched openings in the lower arcade is exactly equal to that of the piers. In addition, when seen in direct elevation, the width of the doorways equals the spaces between the jambs and the piers. On the second floor there is again similarity in spacing. The distance between the windows is the same as the width of the openings, and the space between the bottom of the windows and the top of the arcade is equal to that between the top of the windows and the cornice. The railing of the balcony is too high for the height of the window. The proportions of the divisions of the glass are not satisfactory, because their direction is horizontal instead of vertical or parallel to the axis of the window. It will also be noticed that the projecting blocks in the cornice have the same width as the spaces between the blocks, again illustrating the lack of contrast.

In Fig. 241 N the same elements that are found in Fig. 241 M have again been used, but an effort has been made to impart to the design a feeling for good proportions. The arched openings are much wider than the piers between, and there is a more satisfactory relation between the openings of the first floor and the wall surfaces. The windows of the second floor have been respaced so that the solids clearly dominate the voids, whereas the spaces above the windows are much greater than those below. The rafter ends, or projecting members of the cornice, are separated by areas which contrast in size with the width of these block-like forms. The proportion of the height of the balcony rail to that of the window has also been improved in this example. The divisions of the glass are now distinctly vertical and thus harmonize with the openings themselves.

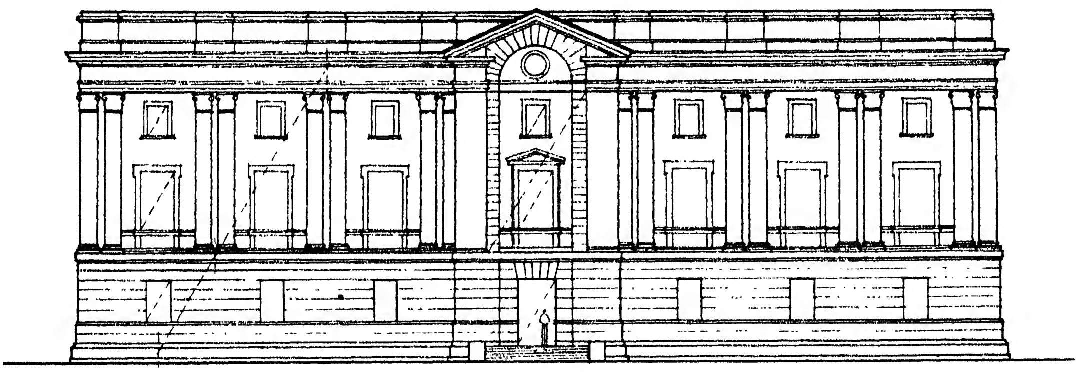
CLASSICAL. Any discussion of proportion immediately calls to our attention the Classical Orders. The Renaissance interpretation of Classical architecture, as developed by Vignola and Palladio, is based upon standardized proportions. The Greeks did not design in this manner, but it was possible for Renaissance architects, by studying a large number of Roman examples, to strike an average which would represent the outstanding characteristics of these Classical elements. As has been indicated in Chapter VI, all parts of the Orders have been worked out in terms of the diameter of the column at the base. However, this standardization of proportions has often led to stereotyped results and, when followed blindly, has hampered the inclinations and talents of contemporary designers. It has become increasingly difficult to apply unmodified Classical motifs to present-day buildings which are being erected in an age so different from that in which the Orders were developed. For this reason it has been necessary either to abandon entirely the restrictions of the Classical style or simply to use it as a source of inspiration, modifying its details to suit modern conditions. A word of caution is necessary, however, after the preceding remarks. The Greek and Roman examples are so satisfactory in their proportions that any changes made must be based upon the principles of good design and should retain the spirit of the style. Fig. 245 A illustrates what might happen to Classical or Renaissance architecture in the hands of one who does not understand the theories underlying its development. The central motif is too tall and narrow to be interpreted in the Renaissance manner and gives the effect of being crowded. The pilasters of the main façade are spaced much too far apart to produce a feeling of support. It should be remembered in this connection that the column and entablature is simply a form of the post and lintel. The spacing of columns was originally determined by the size of the stone available which was to serve as the lintel. True masonry construction recognizes the limitations of stone with reference to dimensions and use. The areas created by these widely spaced pilasters in Fig. 245 A are too wide and too awkward in shape to be filled with windows in a satisfactory manner. As a result, the openings on the second floor are too slender to retain their Classical feeling. Those on the top floor are of such a size and shape that the wall spaces around them are unpleasantly related to each other—there is too much space at the sides and not enough at the tops and bottoms. There is also a lack of harmony between the shapes of the windows of the first floor and the doorway which provides the main entrance to the building. The base course is too high and tends to divide the first floor into two equal divisions. (See Unity, page 262.) Throughout the entire façade there is a lack of similarity of proportions in all the elements, both in the openings and the spaces created between the pilasters.

In Fig. 245 B many of the faults encountered in the preceding example have been corrected. The central motif has been made wider, allowing ample room for the inclusion of the various necessary decorative elements which accompany the style. Coupled pilasters have been used on the main façade, reducing the span between and providing a better feeling of support. At the same time a wall surface which is vertical rather than horizontal is created. The windows, the proportions of which are based upon the principles previously discussed, fill the areas in a more satisfactory manner than in the other example. The lower element of the base course has been reduced in height in order that there might be more contrast with the remaining wall surface of the first floor. A sense of unity is secured in the elevation by the use of similar shapes for the doors and windows, and by causing the eye to carry from one important point to another in a direction parallel to the lines which define the openings themselves.

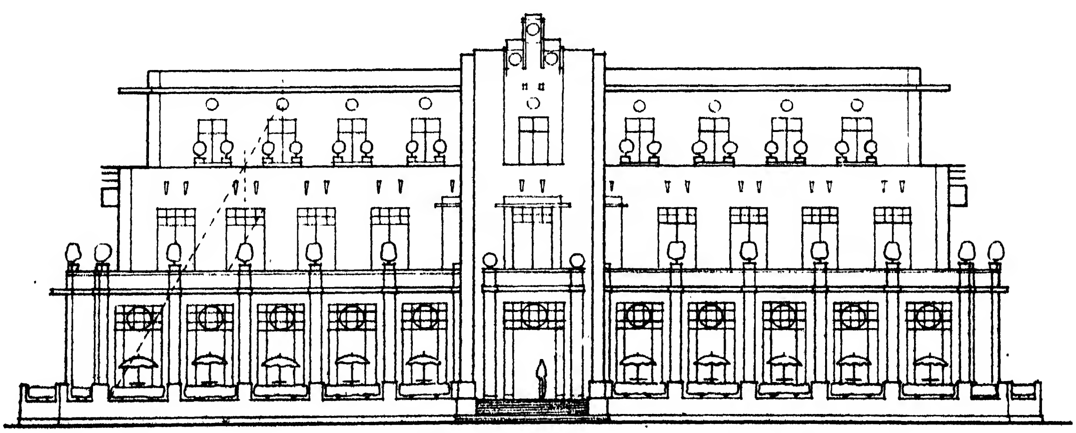
CONTEMPORARY. The building shown in Fig. 245 C illustrates an approach to design which is quite different from that employed with the other two buildings on that page. It is, of course, difficult to discuss the merits of contrasting examples of architecture when little is known of their function or use. It may be assumed that the buildings in Figs. 245 A and 245 B are public in character and that a feeling of dignity is desired. Their exteriors have been developed—unsuccessfully and successfully—by the use of forms belonging to derivations of the Classical style. The building in Fig. 245 C is less serious in nature than the preceding examples. Instead of housing some activity related to government, it shelters man in his lighter and more festive moments. In arriving at the proper character for a building of this type, the stylistic elements have been discarded and the design has been executed in what might be called the non-traditional contemporary manner. This abandonment of old forms and employment of new ones does not presume to indicate any inferiority or superiority. The design in Fig. 245 C is simply the result of new materials used and new types of construction evolved. The function of the building and the exigencies of the plan make desirable the setting back of each floor in the manner shown, and the materials of the twentieth century make possible the flexibility of construction and treatment. In this particular case, the limitations of a strictly stylistic exterior would have defeated the ambitions of the designer. In this building the composition of the façade is secured by an interesting combination of two-dimensional surfaces and three-dimensional forms. It should be noted how the floor heights diminish with each succeeding level, giving contrast and variety to the elevation. The openings of the windows are pleasantly related to the areas around them, and again a line parallel to the side of an equilateral triangle carries through strategic points in the composition. The windows are staggered in a manner which would be incompatible with the regularity of Classical architecture. The central motif does not seem too slender, as it did in Fig. 245 A. In securing good proportions without direct recourse to the past, the designer must rely solely upon beauty of form and surface treatment.



·FIG·(A)·INCORRECT·USE·OF·RENAISSANCE·PROPORTIONS·

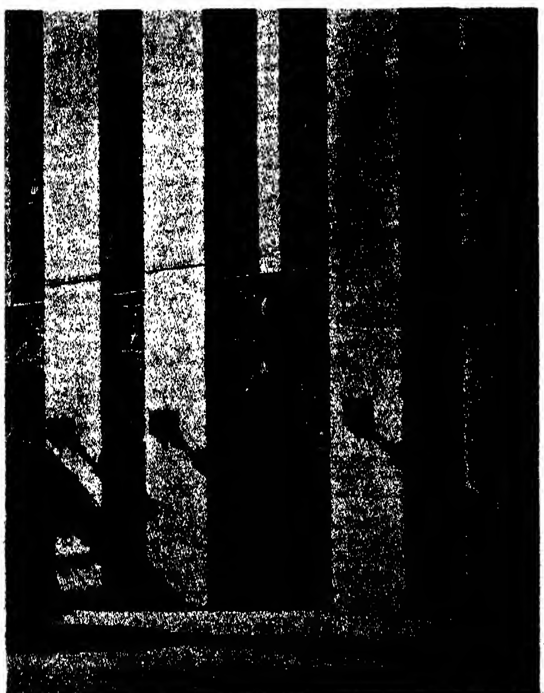


·FIG·(B)·SATISFACTORY·USE·OF·RENAISSANCE·PROPORTIONS·



·FIG·(C)·NON-STYLISTIC·USE·OF·PROPORTIONS·

··COMPARISONS··



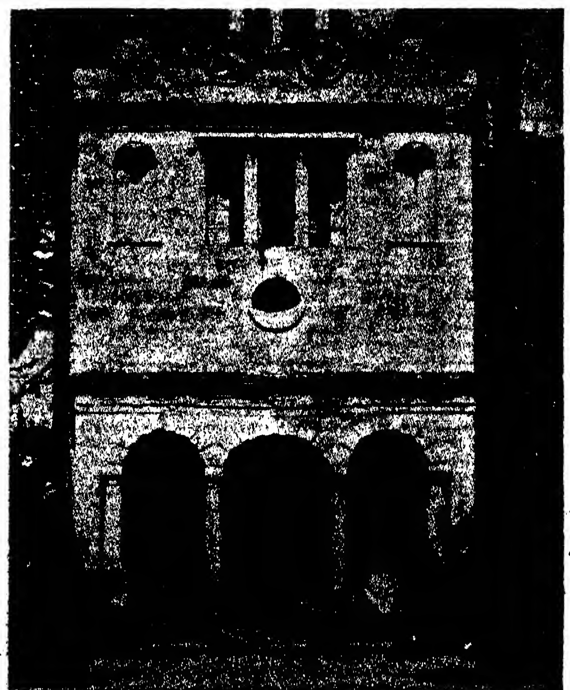
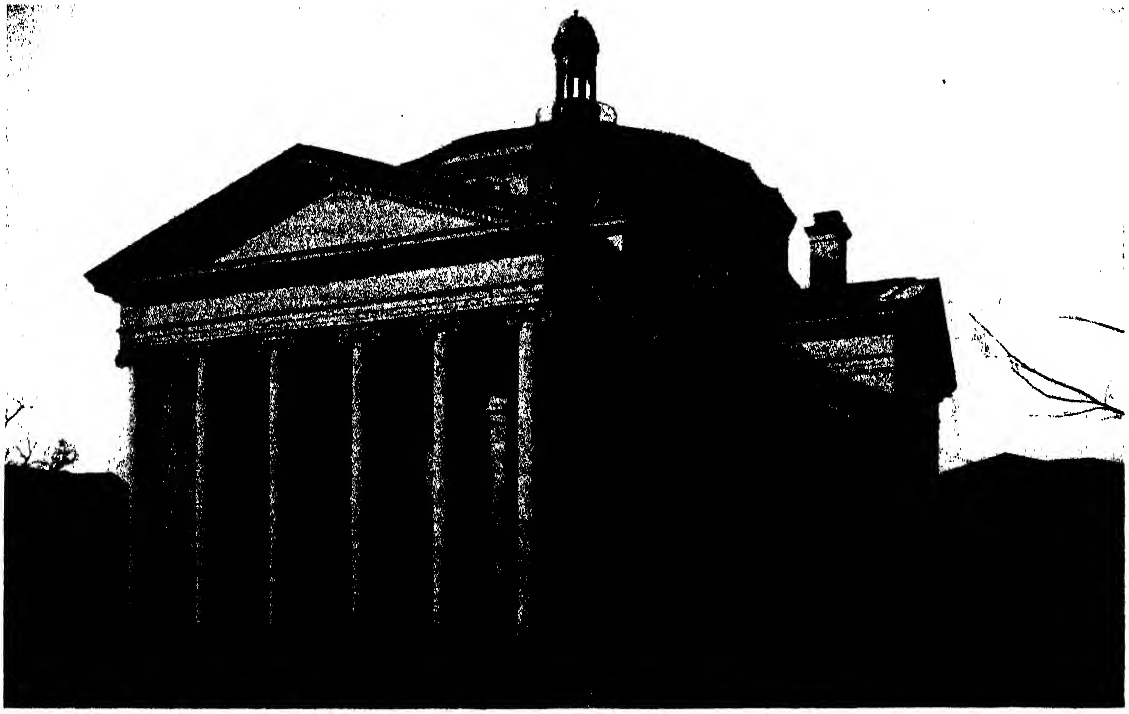


FIG. (A), above.—Lack of good proportions; too much verticality. Pedestal height excessive; windows narrow.

FIG. (C), below.—Pleasing proportions of piers and windows; contrast of plain walls surface and decoration. Concrete.

FIG. (B), above.—Poor relation of solids and voids. Arch too wide and appears unsupported. Inharmonious shapes.

FIG. (D), below.—Second story windows and details poorly placed; bad spacing. Center arch appears to be depressed.



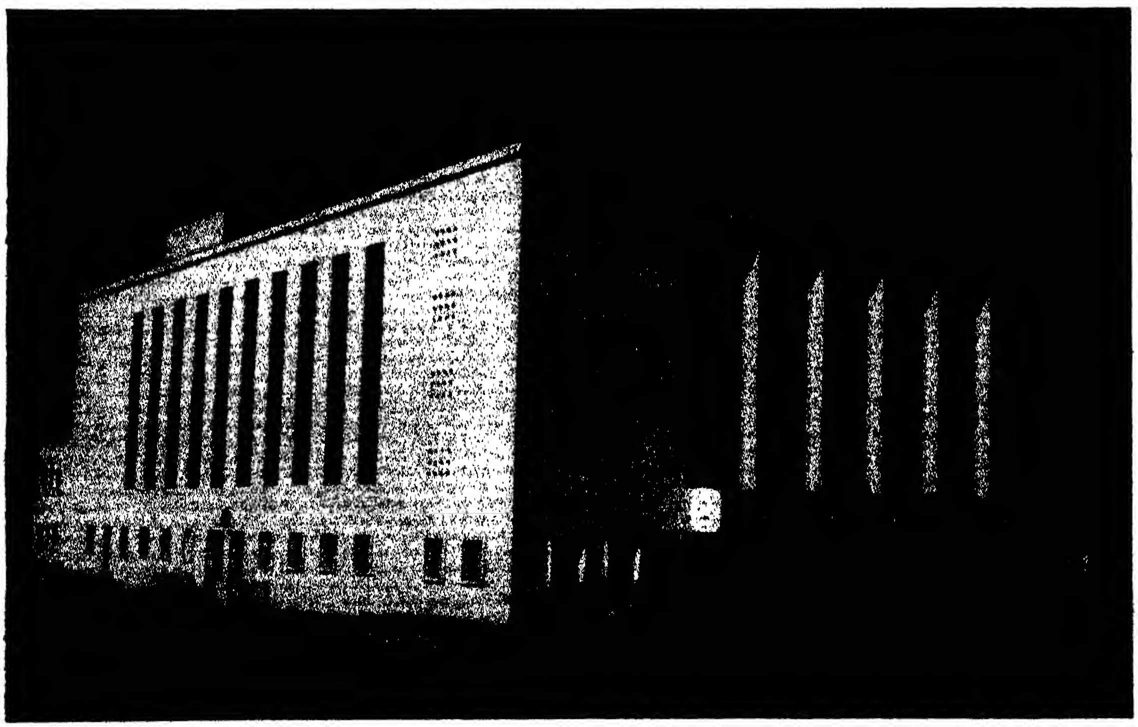


FIG. (A), above.—Pleasing use of Renaissance elements; traditional proportions. Church, Baltimore. John Russell Pope, Archt.
FIG. (B), below.—Satisfactory non-traditional proportions of solids and voids. Auditorium, Burlington, Iowa. R. B. Carswell, Archt.

Scale

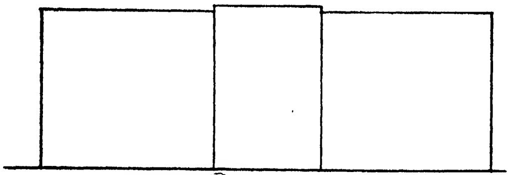
Scale has reference to proportions which are good for humans. It is one of the most subtle of the elements of design and one of the most difficult to obtain. Scale deals with the relation of architectural motifs, such as doors, windows, or mouldings, to each other and to the human figure. Architecture must be adapted to human needs. No matter how beautiful a composition may be, it is of no use as a dwelling if it is only the size of a doll's house. Doors should be large enough to walk through in comfort but not so gigantic that they require an almost impossible physical effort to close them. Steps should be of such a size as to permit easy ascent and descent. Ceiling heights must be properly proportioned to the size and function of the room. In order to prevent one from falling from one level to the next, a balustrade should be related to the human figure in such a way that safety is secured. Thus design is a matter of the adjustment of architectural elements to meet the needs of the human race, and proper scale should be present when this adaptation is made.

In Fig. 249 A there is an area which represents the façade of a building, but it has no scale. There are no details of any kind which might tell whether the building is one hundred or five hundred feet long. The structure lacks doors, windows, and steps—all of those elements which might give some hint as to its size—but, most important of all, the human element is missing, the figure of a man. In Fig. 249 B a man has been introduced, and immediately we are in a position to estimate the size of the structure. If the man is approximately six feet high, then it is an easy matter to compare his height to that of the building, and scale is thereby established.

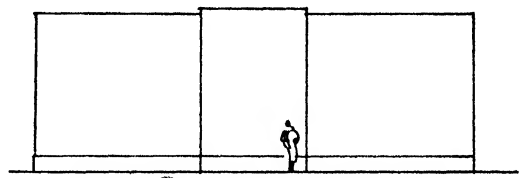
In making preliminary sketches of an elevation, one of the common faults of designers is to overlook the matter of scale. One must always remember that a small building must necessarily contain few windows, but that a large structure may have many openings. It will be seen in Figs. 249 C and 249 D how the number of doors and windows gives a definite clue to the comparative sizes of the two buildings. One is approximately twice the size of the other. If the one in Fig. 249 C is about fifty feet long, that illustrated in Fig. 249 D is perhaps one hundred feet across the façade. Again the presence of the human figures also helps in the judgment of scale. It is always wise, when making a sketch, to introduce early in the progress of the drawing the figure of a man to give scale and to help influence the size of the elements which are to be used.

Care should also be taken to use architectural motifs at the same scale that we have been accustomed to seeing them. Colonnades, which are monumental in character, should not be reduced to garden architecture. Classical and Gothic details and decoration have a reason for their existence in their particular forms and sizes, and they should be used in the same manner as they were in the period of their development. If they are increased or decreased many times in size the scale is then lost and ridiculous situations will result.

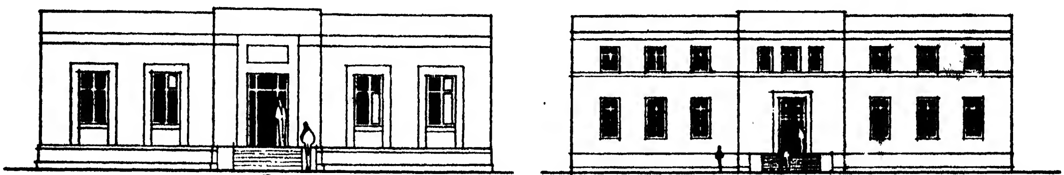
If we turn now to Fig. 249 E, we find every evidence of lack of proper scale. By comparing the human figures with the doorways on the first floor, it is found that those openings in the end wings are too small whereas the one in the central tower is too large. The windows of the first floor are too close to the ground, and the divisions of the glass are too large for the size of the opening. The potted plant on the left is too big to be easily possible and is out of scale with the building and with nature. The steps of the approach are too



·FIG·A·NO·SCALE·



·FIG·B·THE·HUMAN·FIGURE·



·FIG·C·IS·ONE-HALF·AS·LARGE·AS·FIG·D·

·DEVELOPMENT·OF·SCALE·

·FIG·E·EXAMPLE·OF·INCORRECT·SCALE·

·FIG·F·EXAMPLE·OF·CORRECT·SCALE·

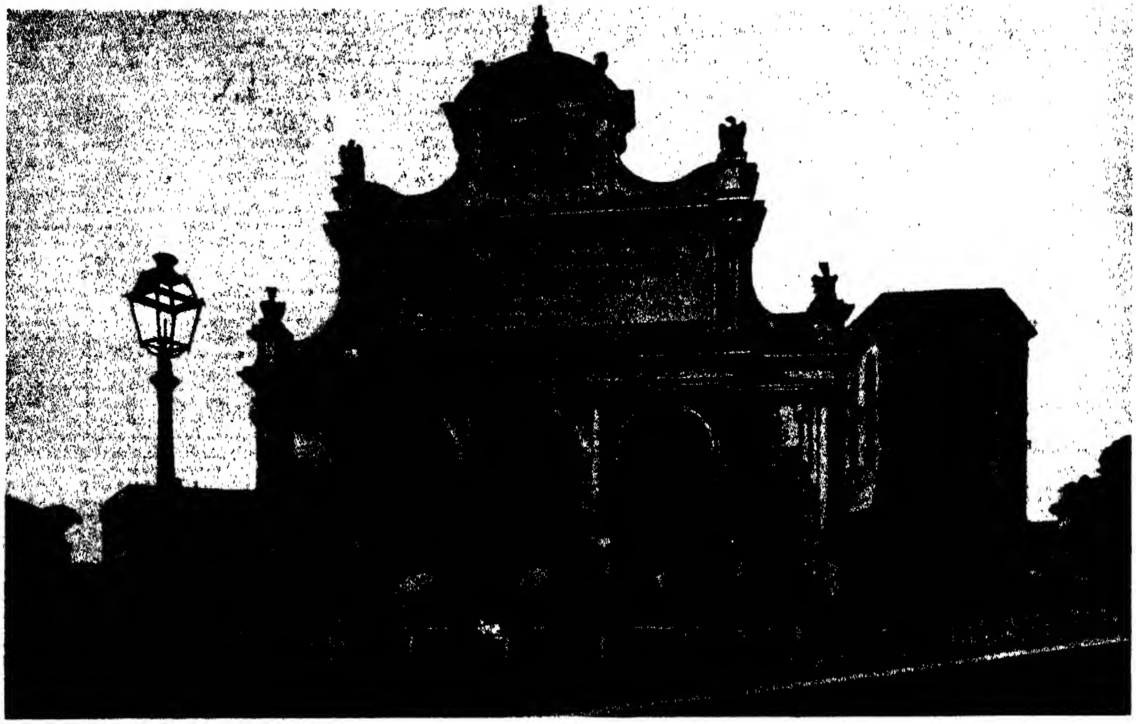


FIG. (A).—Lack of proper scale between large and small arches. Portion above main entablature too large for that below.

small, probably measuring only three inches in height whereas they should be closer to six. On the second floor, the windows are much too large in comparison with the other elements of the façade, and again the glass divisions are big and out of scale. Even the shutters appear to dwarf the human figure and seem, together with the heavy window sills, to be out of place in the composition. There is also an unfortunate change of scale between the window on the second floor of the tower and those on either side of this central motif. The lantern hanging over the main entrance is unrelated to human conveniences and is too large for its use and position. The roof tiles are much larger than any examples of tile which we have available and would be impracticable even if tile were obtainable at this size. The dormers of the roof are mere miniatures and look ridiculous when used with the large windows below. The arched openings in the tower are too small and the iron railing is too low to serve any practical purpose. The tower itself is too narrow and slender and seems out of proportion with the rest of the building.

In Fig. 249 F an attempt has been made to bring all parts of the building and landscape into proper relation with each other. The various elements have been correctly related to human uses, and good scale and proportions exist where confusion and lack of proper scale persisted in the preceding example. The doors are of such a size that they may be entered without fear of discomfort while the windows have a better relationship to the floor levels, wall areas, and functions of the interior. There is also better scale between the different parts of the façade; there is present that subtle adjustment of sizes and shapes which causes the elements to appear to belong to the same building.

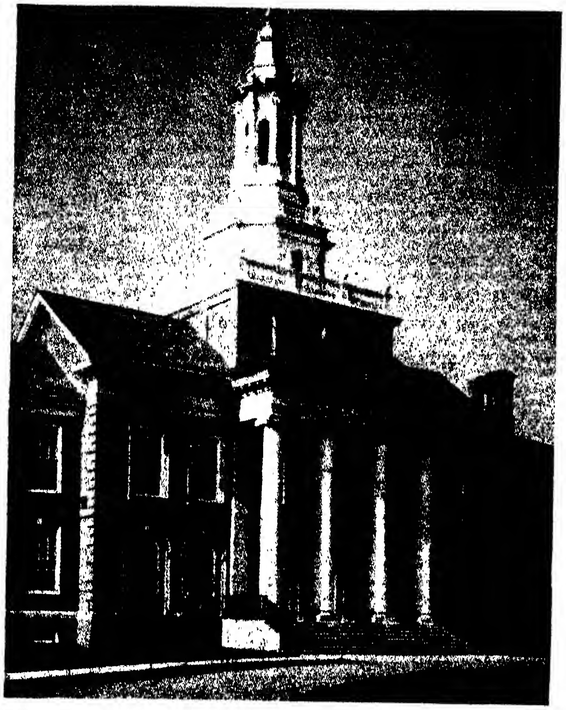


FIG. (A), above.—Satisfactory scale between openings, columns, balustrade, and cupola. Limestone and brick. School, Great Neck, N. Y.

FIG. (B), above.—This indicates the gigantic scale of S. Peter, Rome. Barrel vault is 150 feet above pavement.

FIG. (C), below.—Corinthian Order, openings, balustrade, and statues are large in scale. Compare with figure of man. S. G. Laterno, Rome.

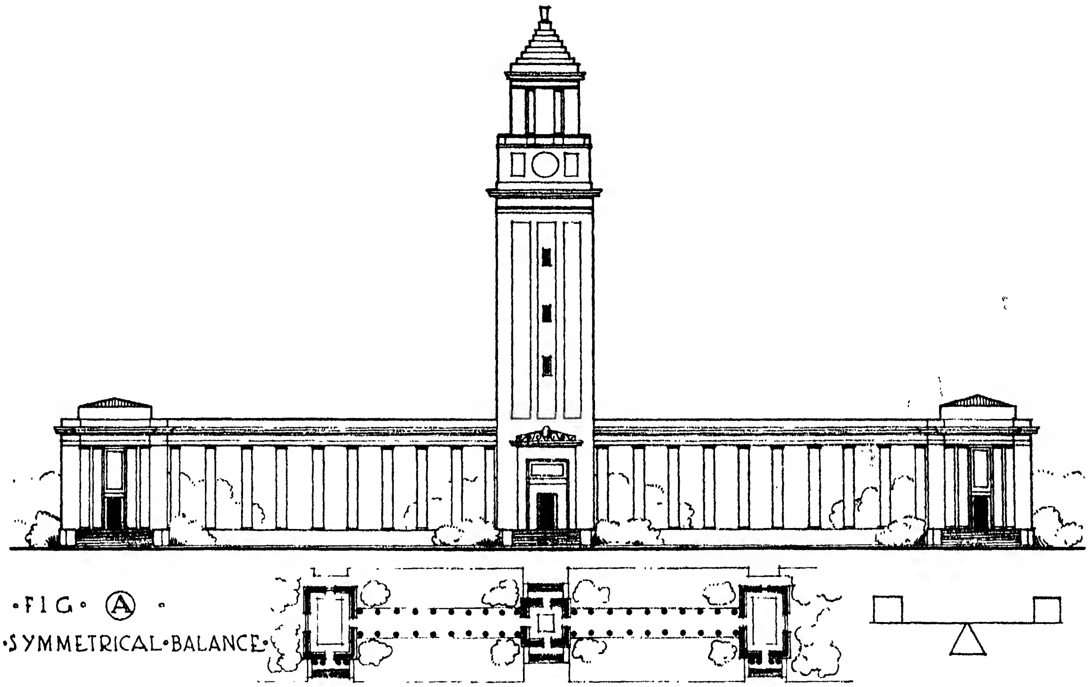
Balance

In nature there seems to be an attempt at balance or equalization. In the temperate zone the climatic changes tend to balance each other. However, nature is variable. If there is marked lack of rain, a drought results. If there are too many people for the food supply, there is a famine. The proper balance between supply and demand has not been maintained.

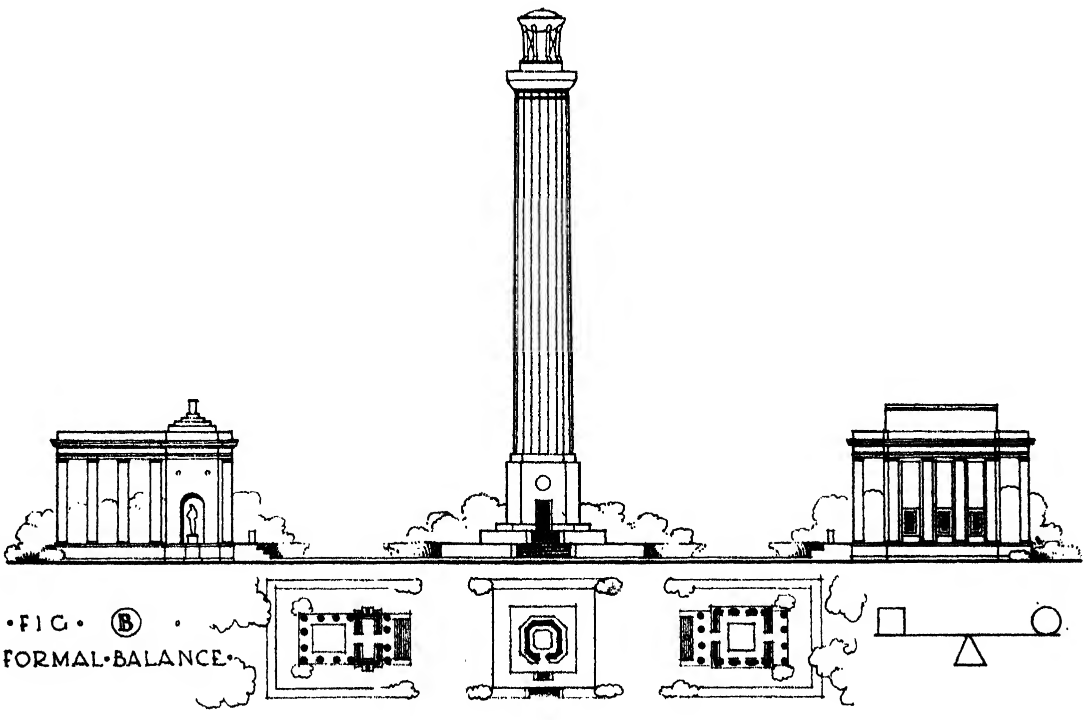
SYMMETRICAL. If balance does not exist, there must necessarily be lack of balance or inequality. Balance is equality. It is composition. It is the foundation upon which arrangement, harmony, and adjustment of weights, tones, values, etc., are developed. Proper balance satisfies the eye with reference to the relative importance of the various parts of the design. The easiest and simplest kind of balance is the purely symmetrical type in which the elements are arranged in precisely the same manner on either side of a central axis or line. Not only is the arrangement similar but each object is exactly like the one occupying the corresponding position on the opposite side. In this kind of balance the eye catches at a glance the equality of attraction on each side of the centre of the composition. All elements are duplicated—shape for shape, size for size, and tone for tone. The left half of the composition is identical with the right half, as in Fig. 253 A, and the result is called symmetrical balance. Here are shown two Classical buildings, alike in all their details. They are located at equal distances from the central tower and are connected with a colonnade of regularly spaced columns. This type of balance gives a feeling of repose and order (see Fig. 256 A); it is straightforward and direct. The effect of monumentality is more readily secured by the use of a symmetrical composition than by an informal grouping of units. Symmetry is typical of the Classical and Renaissance; the Gothic and Romanesque tend toward a lack of formality in arrangement.

There is another type of balance which approaches absolute symmetry but which lacks some of the essentials of this kind of composition. At first glance the elements on one side of the central axis appear to be identical with those on the opposite side, but upon closer examination it is found that such is not the case. The general mass and grouping of parts may be similar, but there are dissimilarities in plan, elevation, or details. The volumes of the balancing units may correspond, but there may exist a difference in their shapes and surface treatments. This type of composition, which may be called Formal Balance, is illustrated in Fig. 253 B. Here the two units are located at equal distances from the central shaft and are similar in mass or bulk. However, they are unlike in plan and consequently in elevation, though the general effect is still one of simple balance.

UNSYMMETRICAL. The preceding examples are ones which are quite easily understood. If a five-pound weight is placed on each end of a plank which is supported in exactly the middle, a state of equilibrium will exist. But when we come to a consideration of what is called unsymmetrical or occult balance, the conditions are not quickly or mathematically interpreted. Occult balance is more subtle and elusive, and is more difficult to attain. It attempts to satisfy the eye without any effort to place equal masses at similar distances from the centre of the composition. It is the grouping, in an informal manner, of elements of varying sizes and shapes. One senses, rather than sees, a state of equilibrium. Unsymmetrical compositions are typical of the arrangements of nature, in which



•FIG• (A) •
•SYMMETRICAL•BALANCE•



•FIG• (B) •
•FORMAL•BALANCE•

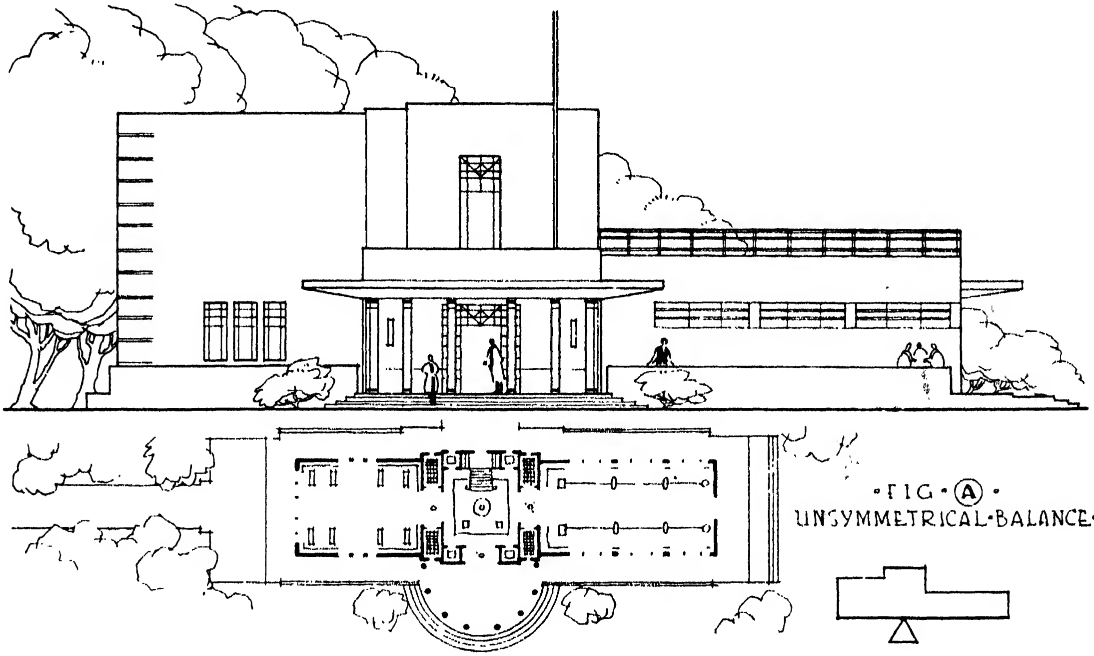
balance may not always exist. A landscape with its meadows and hills is informal in its disposition of parts. Its arrangement is accidental, and it may be good in its composition or it may be lacking in this quality. Nature works in an unconscious manner with no attempt to meet man-made rules. The artist puts upon canvas his interpretation of the scene before him, modifying it to suit his own particular fancy. He moves trees, houses, and even mountains about so that they will conform to a pattern which embodies the principles of good design. He secures informal balance in a number of ways. He may use small areas of bright colors on one side of the painting to balance a large area of neutral tone on the other, or he may create a feeling of movement in order to equalize a static quality in another part of the composition.

The eye must be satisfied when one is working for unsymmetrical balance. But the eye must be trained to perceive the accomplishment of this result. A fundamental law of physics comes to the rescue of him who lacks confidence in his own judgment, and makes it possible for him to again use the balanced plank. This time, if he places the support under some point other than the centre, he will discover that one division thus created is longer than the other. Now in order to obtain balance it will be necessary to place a lighter weight at the end of the longer arm and a heavier weight on the shorter. This suggests the principle and use of the old steelyard. In the early days the weight of the commodities produced by man was arrived at by suspending them from the shorter arm of the steelyard and by balancing the counterpoise upon the graduated long arm.

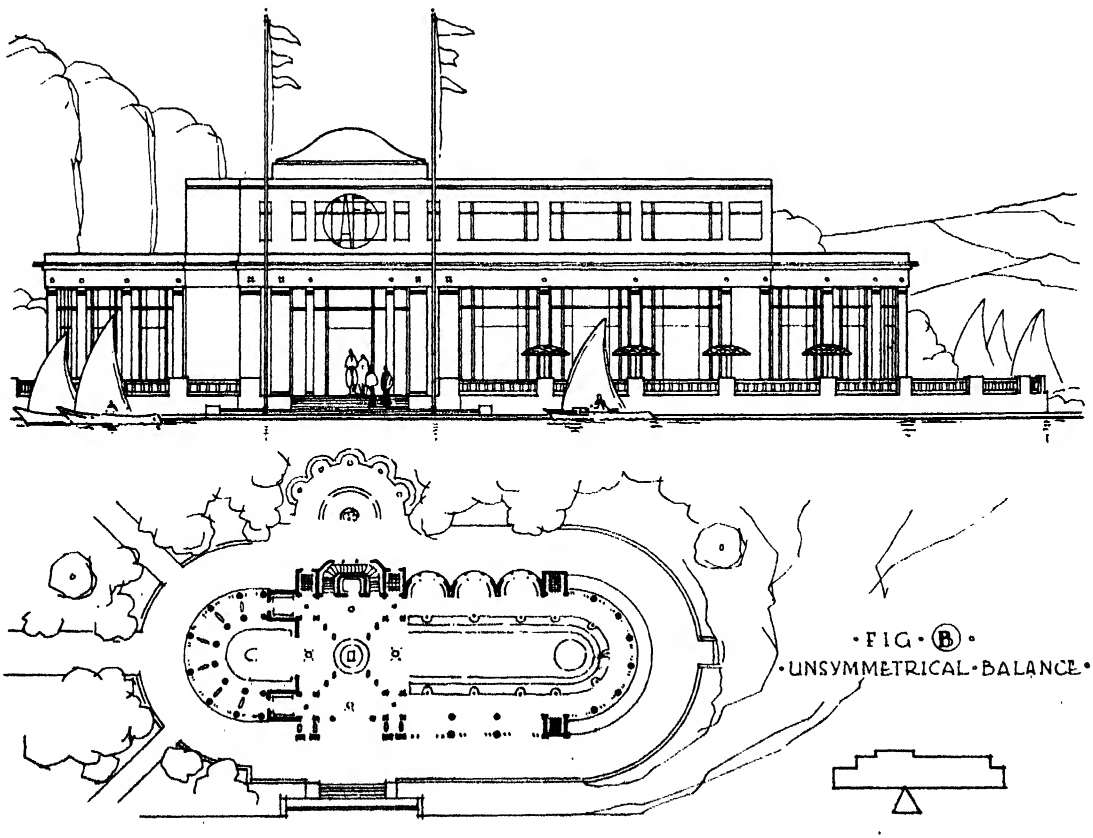
In an architectural composition the results may not be obtained in such a mechanical way, but the principle will still apply. In an informal arrangement the larger and heavier masses should be nearer the centre of the group, while the lighter, lower, and more horizontal elements may constitute the long arm of the steelyard. Vertical units may be introduced near the centre of interest, or the fulcrum, in order to create the desired accents. There are always numerous ways of arranging the component parts of a composition in order that occult balance will result. In symmetrical balance, there are only a limited number of solutions; in unsymmetrical balance an unlimited number of schemes may present themselves. The designer must be so thoroughly trained in the principles of design that the result of his efforts will come as the product of intuition rather than mathematical reasoning—the inspiration of the spirit rather than calculations of the intellect.

The building illustrated in Fig. 255 A has a plan which approaches symmetry. It is composed of a square entrance lobby with rectangular units on either side. However, the room on the right is longer than the one on the left, and an unsymmetrical arrangement results. The elevation of this building is even more unsymmetrical than the plan. The room on the left carries up higher and thus forms a more important exterior mass. The centre of gravity of the composition is near the main entrance, as it should be, and one feels that the long, low mass to right is balanced about this fulcrum by the heavier, more compact portion at the left. The little diagram in the lower right-hand corner of the drawing shows what might be the graphic interpretation of this design, but the building should simply be regarded as an informal grouping of elements to form an interesting arrangement.

The café which is shown in Fig. 255 B is based upon contemporary practice. It is decidedly more unsymmetrical in both plan and elevation. This is quite desirable in a building of this type where a feeling of informality assists in expressing the proper char-



·FIG·A·
UNSYMMETRICAL·BALANCE·



·FIG·B·
·UNSYMMETRICAL·BALANCE·

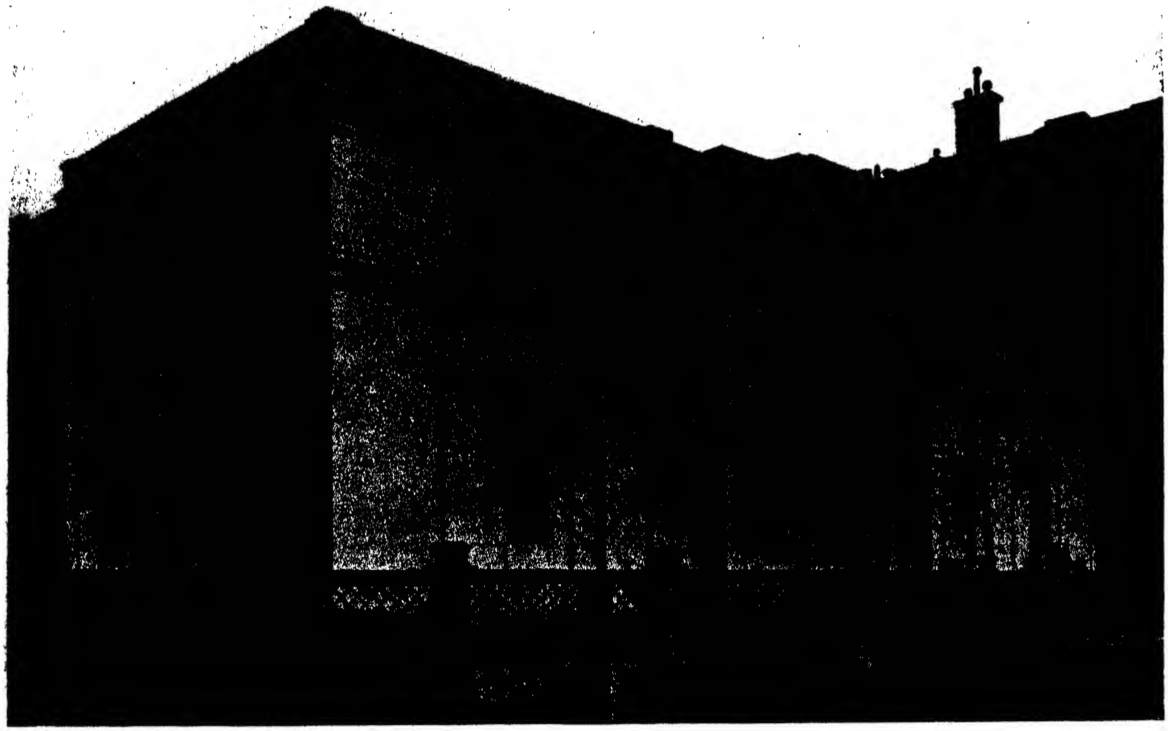


FIG. (A).—Restrained use of Italian Renaissance. Symmetrical balance. Morgan Library, N. Y., McKim, Mead & White, Archts.

acter. The building is designed for relaxation, and the sparkle of the water, the color of the banners and umbrellas, and the lightness of the architecture contribute to the creation of an atmosphere of festivity and gayety. Formality and sedateness find little use in planning a structure of this kind. The three major elements of the plan are allowed to fall into place in the simplest possible manner while the minor units unite to complete the composition. The result is an open plan which attempts no obvious balance but which is organic and well composed. The focal point of the elevation is at the entrance, and this is further accented by the use of the flagpoles. However, the mass of the exterior cannot be said to be balanced about this centre of interest. In spite of the inability of the observer to reduce the composition to a formula, there still seems to exist a pleasing informal arrangement of parts which answers the requirements of good design. Apparently the ambition of the designer is thus attained, and balance or good composition is secured.

Thus far we have been interested only in defining balance and in indicating how the various types may be obtained. Little has been said about its significance and use. Balance —formal or informal—should be the result of the influence of those controlling factors of topography, function, materials, etc. A symmetrical or unsymmetrical composition should not be deliberately foisted on the solution; rather the arrangement of the various units should be dictated by those forces which create satisfactory architecture. This question is often asked: Why are so many buildings symmetrical? Perhaps man's nature answers for us. Our bodies are symmetrical and we tend to create balanced objects. The automobile, the chair, or this book has symmetry. However, contemporary art appears to encourage unsymmetrical compositions. Classical symmetry battles against informal rationalism.

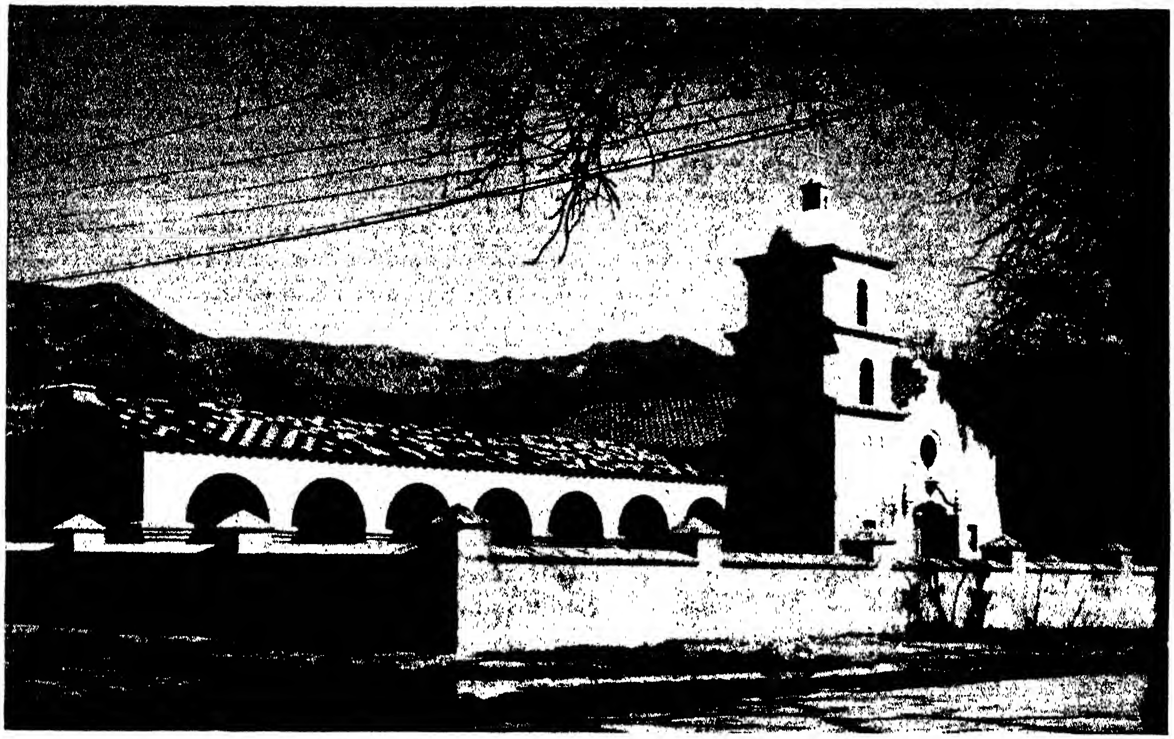


Fig. (A), above.—Unsymmetrical balance or composition with tower as focal point. Church, Ojai, Calif., Requa & Jackson, Archts.
Fig. (B), below.—Informal composition of rectangular masses. Town Hall, Hilversum, Holland. W. M. Dudok, Archt.

Rhythm

The various fine and applied arts which contribute to the enjoyment and pleasure of our daily existence have been given to this age by the accumulative, creative efforts of artists and artisans of centuries of historic development. Architecture in the present century is a profession and a business, but it is also one of the arts and serves as a stimulus to the development of the allied arts. The mere process of building a brick wall, of carving a stone, or of applying paint to a flat surface does not constitute an artistic endeavor. It may be only labor without inspiration. It is when the element of beauty is added, resulting in a pleasant reaction upon the part of the observer, that the product becomes an object of art instead of one of pure utility.

It is becoming increasingly difficult to distinguish between the so-called fine and applied arts. Painting, sculpture, and music are usually thought of as the fine arts, while any other expression which has a practical use, such as architecture, or the decorative arts, is often called applied art. However, many of the objects which we now find in museums, displayed as examples of the fine arts, served very practical purposes at the time of their creation. Today, art is entering so many of our activities that old standards of judging the differences between the fine and the applied arts are being swept away. Various phases of the fine arts are finding practical applications to modern problems, and applied art is becoming quite conspicuous in the products of business, building, and industry.

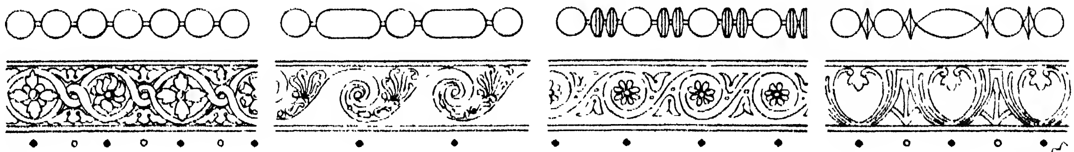
The different types of art with which we are familiar may be divided into two groups according to the way in which the impressions are conveyed to our senses or according to the manifestation of their qualities. Some may be permanent in their characteristics, as those executed in stone. Others may be transitory, as is sound. So the arts, whether fine or applied, may be listed as follows:

Static Arts.
- Architecture.
- Sculpture.
- Painting.
- Literature.
- Decorative arts.

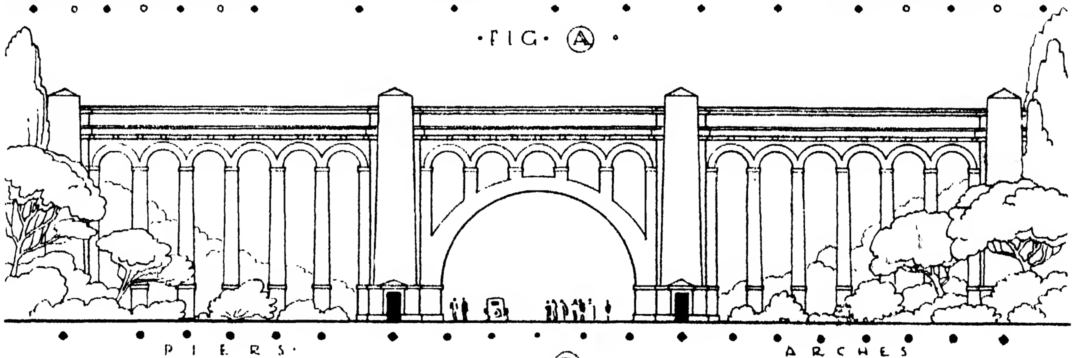
Evanescent Arts.
- Music.
- Dance.
- Dramatics.

In spite of this division, the arts have certain characteristics in common—they have organization, unity, and character. Often analogies are drawn between the processes of creating compositions in architecture, in sculpture, and in painting. However, the purpose of this immediate study is to discuss the relation between music and architecture and to make the quality of rhythm the basis of this analysis.

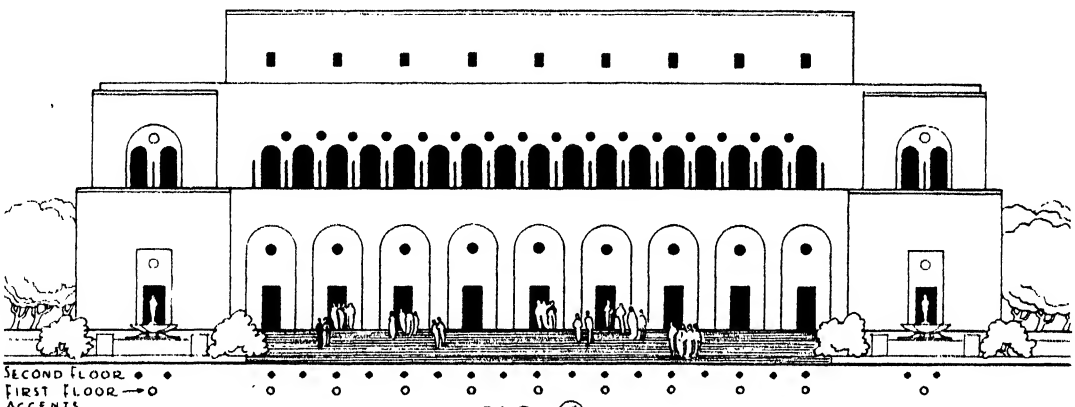
Music is an art that is heard. It is a combination of sounds arranged in such a manner as to arouse various reactions of pleasure, interest, or excitement. Architecture is an art which is seen. It is a composition of elements so arranged as to serve a utilitarian purpose and, in addition, to have an emotional appeal. The music of the western world is based upon rhythm, melody, and harmony. Rhythm is the foundation of music. Although



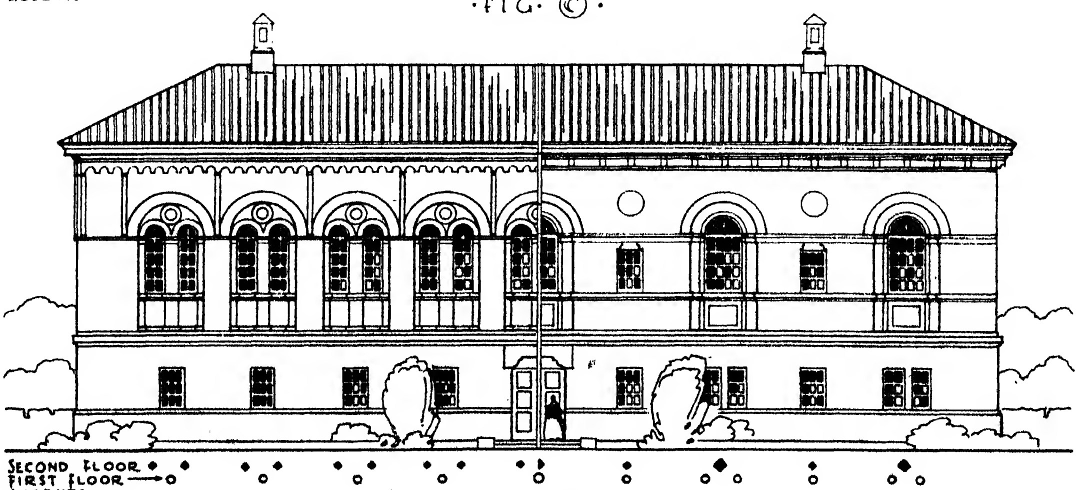
·FIG· A ·



·FIG· B ·



·FIG· C ·

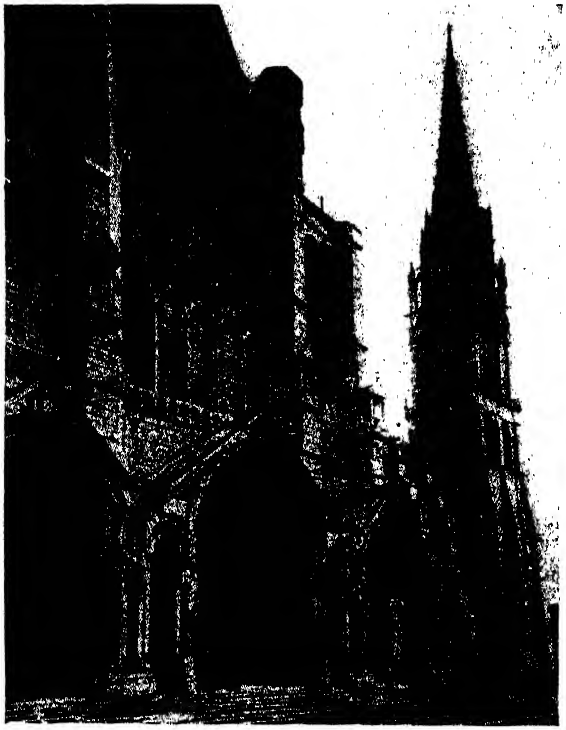


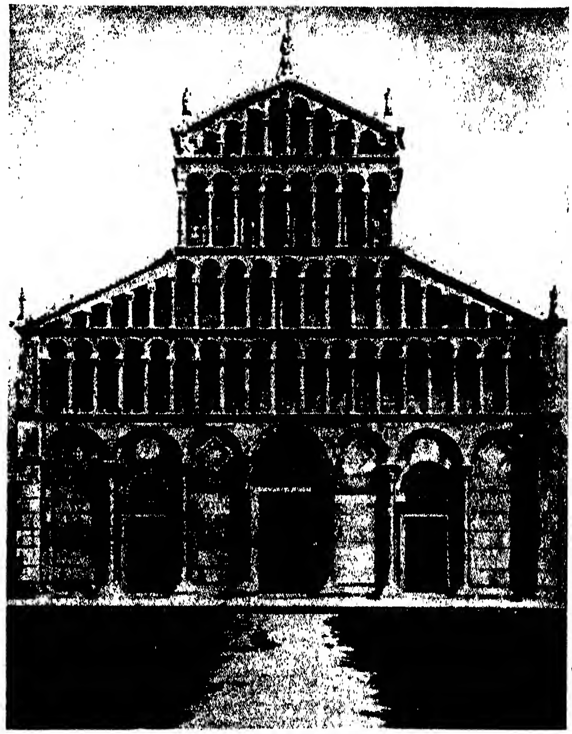
·FIG· D ·

it is necessary that there be tones of pleasing quality, still these tones must first be organized into some kind of time or spacing. Unorganized sounds result in discord or dissonance; unorganized architectural forms cause confusion. Movement is the basis of rhythm. The movement in music may consist of the time, which may be fast or slow, or it may be the tempo or repetition of the theme through the composition, regular or irregular. There is the same feeling of movement in architecture. A building is, of course, static. It remains indefinitely upon its foundations. But there is a movement of the theme as it travels across the façade of the building—the eye pausing here to look at this detail and then going on to the next. An unbroken wall has no rhythm. There is nothing except texture to arrest the attention; nothing to be seen beyond the shape and contour of the surface. However, if equally spaced windows are introduced, then regular repetition is present and we have unaccented rhythm. If the openings or details are arranged in such a manner that some are more important than others, then the eye grasps the significance of this relationship and pauses longer in contemplating the larger elements. This brings about an accented movement, a skipping along quickly over the minor divisions and a rest upon the major motifs.

This movement which we call rhythm must be directed and controlled. If unrelated noises occur, such as the din of a factory, there is no organization and hence no rhythm. If windows and doors are thrown into the façade of a building in a haphazard manner, there is no scheme or sense to the arrangement and again no rhythm. RHYTHM, then, IS ORGANIZED MOVEMENT. It may be the movement of the eye across a painting from spot to spot of similar color—~~the rhythmic use of color~~. It may be the repetition of a similar type of line in a piece of sculpture—the rhythmic use of line. It may be the movements of dancers—the rhythm of motion. It may be found in the continuity of a series of arches forming an arcade—the rhythm of direction. (See Fig. 261 C.) It may be simple as in architecture, or complex as in a symphony. However, both forms of expression have this in common: the pleasure derived from music depends more on the manner in which the tones are combined than upon the tones themselves; in architecture, the arrangement of masses and details contributes more to the success of the composition than do the motifs themselves. Rhythm, or spacing, is of primary importance.

The examples on page 259 range from decorative forms to complex compositions. The carved mouldings, Fig. 259 A, show simple and accented repetition in the bead and reel, the egg and dart, etc., and also the rhythmic flow of line in the two central vine patterns of the second row. In the design of the viaduct, Fig. 259 B, the eye may be assumed to catch the emphasis of the piers rather than the openings between the piers, as indicated by the black accents under the left half of the drawing. If the tone of the background is darker than that of the piers, the openings may be more important and will carry the eye along the composition in accordance with the accents on the right side. The grouping in Fig. 259 C illustrates simple repetition with varying intervals between the "notes" or openings. On the second floor, there is a rapid or staccato-like repetition, while on the first and third floors a legato or slower movement prevails. In Fig. 259 D the windows on the left side are arranged as follows: first floor, regularly spaced; second floor, grouped in pairs with wider spaces between the pairs. The right side of the composition shows: first floor, alternating one-two arrangement; second floor, size and shape alternating to give a definite accent. Thus it can be seen that rhythm also depends upon arrangement.





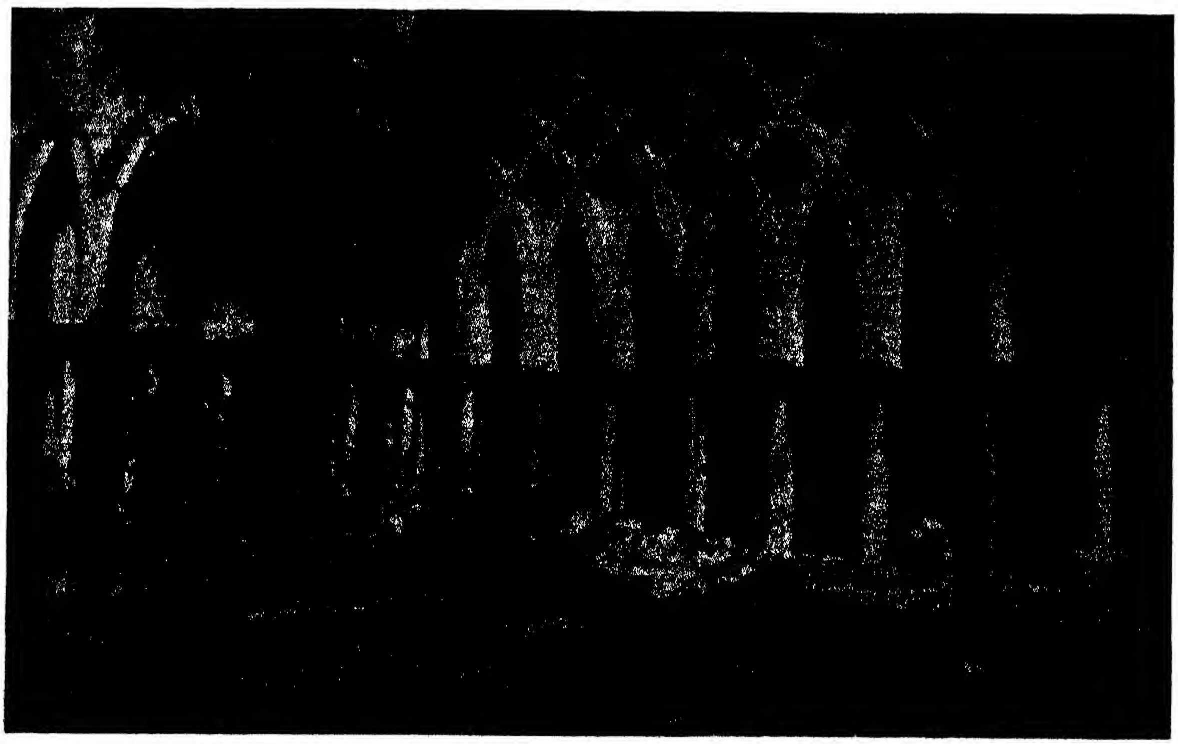


FIG. (A), above.—Rhythmic repetition of line and direction—flowing line and verticality. Chartres Cathedral.

FIG. (B), above.—Simple repetition in first, second, and fourth arcades; gradation in third and fifth. Pisa Cathedral.

FIG. (C), below.—Regularly accented motifs; pointed, interlaced arches. Gradation in size of created panels. Cloister, Amalfi Cathedral.

Unity

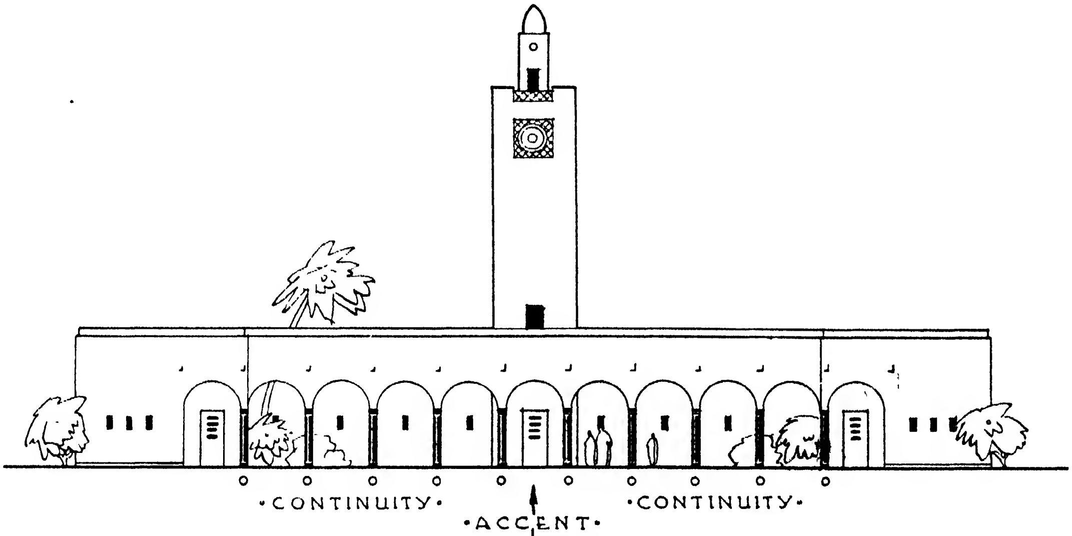
Unity is the culmination of all the previously mentioned elements of design. If a structure has unity, it must have contrast, rhythm, and scale. Unity suggests harmony. It means that all the unrelated parts of an architectural arrangement are brought into proper relation to each other so that a satisfactory composition is obtained. If unity prevails, all the unimportant parts must be kept in their places and be made simply to assist the major units in the rôles which they are to play in the development of the structure. This is similar to a well-organized business group or a disciplined army. There must be the leaders and those who assist the leaders, each with his own particular function to perform.

It is easy to understand the unity of simple geometric forms, such as the square, circle, and triangle. They are elementary in their shapes, and no portion of the whole tends to detach itself and to create new forms, or centres of interest, as is characteristic of the amoeba in the lower types of animal life. Elementary geometric forms are compact and direct; they tell a single story in the briefest possible manner.

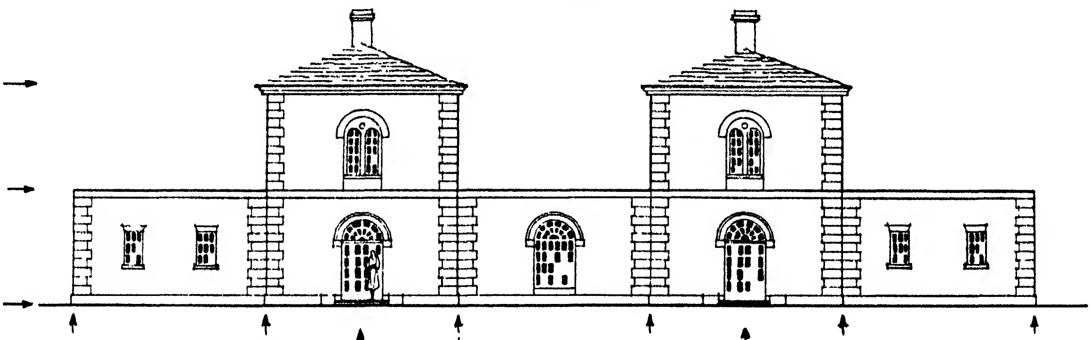
The simplest kind of unity dealing with motifs of more than one member is to be found in ordinary repetition. A sound repeated again and again, and beads of the same size and spacing on a string, offer examples of continuity and unity, even though they are monotonous in their arrangement. If this unity would be more emphatic and interesting, an accent may be introduced into the composition, so that a dominant note is added to the regularity of the repetition. In other words, the highest type of unity is secured if there exists no doubt as to the presence of a central motif. This applies equally well to all forms of creative endeavor. In a dramatic production there must be a plot which dominates all the minor situations of the story. In a symphony there is often a theme about which the music is built and to which the orchestra returns at frequent intervals—first, perhaps, with the wood winds, and then with the strings. In a successful painting the different parts must be arranged in such a way that one figure or object forms the centre of interest. The attention of the observer must be drawn to this focal point.

In an architectural composition the elements must be arranged in such a way as to insure the domination of the less important parts by the major masses of the building. All the units should together form a compact and coherent ensemble. In order that this may be possible, there must be a leader—there must be no lack of discipline. Fig. 263 A shows the use of a simple arcade which gives regular repetition. The dominant note is added by the introduction of the tower which provides an interesting accent. This recalls the desirability of having the element of emphasis in architectural compositions. It may be secured by the size, position, or treatment of the motif which is to give the desired importance to that particular part of the building. The size of the tower in Fig. 263 A makes it conspicuous, and its central position calls one's attention to it even more insistently. If it is not desirable to insure emphasis by increasing the size of an object, the treatment of wall surfaces or details may be varied in order to obtain the proper accent.

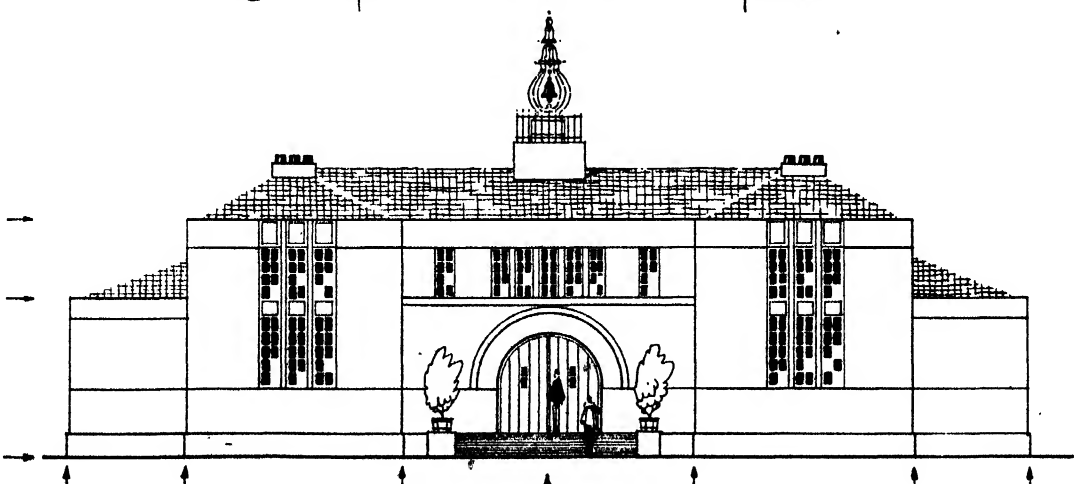
COMPETITION may be a stimulation to business, but it is one of the worst foes of unity. In studying an architectural problem, the plan receives first consideration, and here it is too easily possible, but not desirable, to have the elements competing with each other for the place of importance. However, the elements of an elevation are more quickly seen and understood than those of the plan, so let us first consider a façade in which unity



·FIG·A·



·FIG·B· LACK·OF·UNITY·THROUGH·COMPETITION·



·FIG·C· UNITY·THROUGH·CONTRAST·

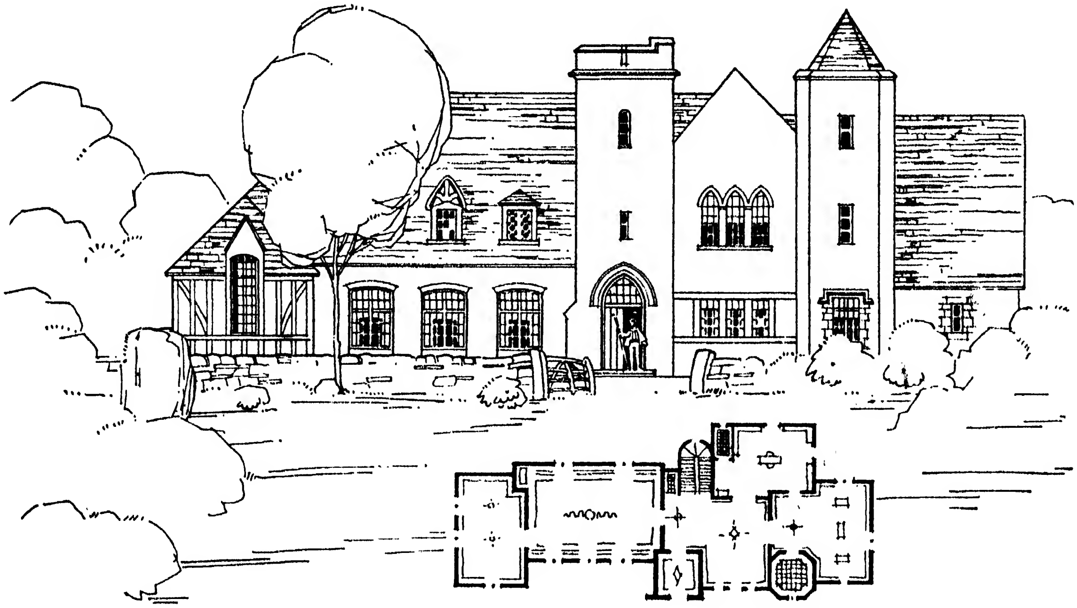
does not exist. In Fig. 263 B there is competition of the most flagrant kind, because each part of the elevation is trying to be just as important as the others. This is especially true of the two-story units standing at equal distances from the centre of the group, each attempting to catch and retain the interest of the observer. This causes DUALITY, or the presence of two strong, conflicting personalities. The façade is also divided into five equal parts horizontally and into two similar divisions vertically. This is an unfortunate condition, because contrast is lacking and no element is able to secure the proper domination.

In Fig. 263 C it will be seen that the proportions have been changed. The five horizontal divisions of the façade remain, but they have been respaced to create two major masses, with a connecting link, terminated by two minor masses. The two vertical units have now been connected by the continuation of the second story, and the entire composition has been crowned by a small cupola. The latter gives the accent necessary to furnish a centre of interest after the competition between the two vertical wings has been eliminated. The belt course which divided the elevation into two equal parts in a vertical manner has now been shifted, and the first story becomes the more important instead of struggling to hold its own with the second floor. In other words, the façade has unity.

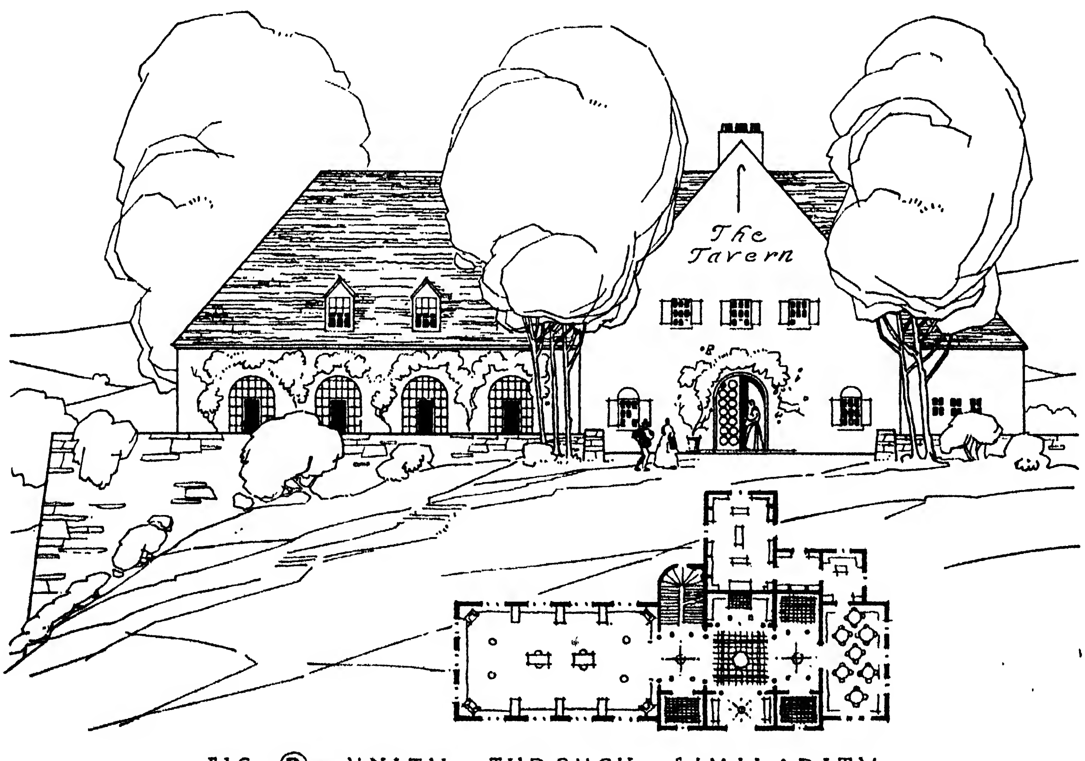
CONFUSION. Another type of competition may also be responsible for the lack of unity. In the example in Fig. 263 B there is evidence of well-organized competition where the opposing forces are of equal importance. In this other kind of competition, we find confusion. There are too many events taking place at the same time. In the example of the arcade, Fig. 263 A, simple repetition was employed to secure unity. Only one thing was being done, the repeating of the same motif over and over again.

In Fig. 265 A confusion exists because of the lack of similarity between the various elements employed to create the building illustrated. It is a case of unorganized competition and contrast. Dissimilarity is too pronounced. In the elevation, the two towers are of equal importance, each calling for attention, and furthermore they are disturbing in their lack of harmonious treatment. The tree in the foreground is unfortunately placed so that it creates a third dominant which adds to the confusion already caused by the towers. The most annoying fault of the façade is the use of so many dissimilar architectural elements. The doors, windows, dormers, and wall treatments might be quite satisfactory if considered singly, but when they are combined the result is very disturbing. The pointed arches and the half-timber—the semi-ecclesiastical and the domestic qualities—are not in sympathy with each other, and confusion prevails. No central theme or mode of architecture is repeated throughout the composition. It is like an orchestra whose members are playing different scores, each beautiful in itself but creating a discord when all are produced at once. The plan of this building shows the same lack of organization and unity. There are no distinct axes which carry through from one part to another, and walls are pushed about in a careless manner, destroying any effect of orderly arrangement.

In Fig. 265 B an attempt has been made to correct the faults which are apparent in the preceding illustration. Confusion gives way to simplicity. The two towers have been reduced to a single, important unit, and emphasis has been increased by the placing of the two trees so that the eye is more easily led to this dominant part of the composition. The plan has undergone the same changes as the elevation. Instead of a number of unrelated areas, we now have harmony and similarity. Logic and order prevail instead of confusion and disorder.



•FIG• Ⓐ • CONFUSION • THROUGH • DISSIMILARITY •



•FIG• Ⓑ • UNITY • THROUGH • SIMILARITY •

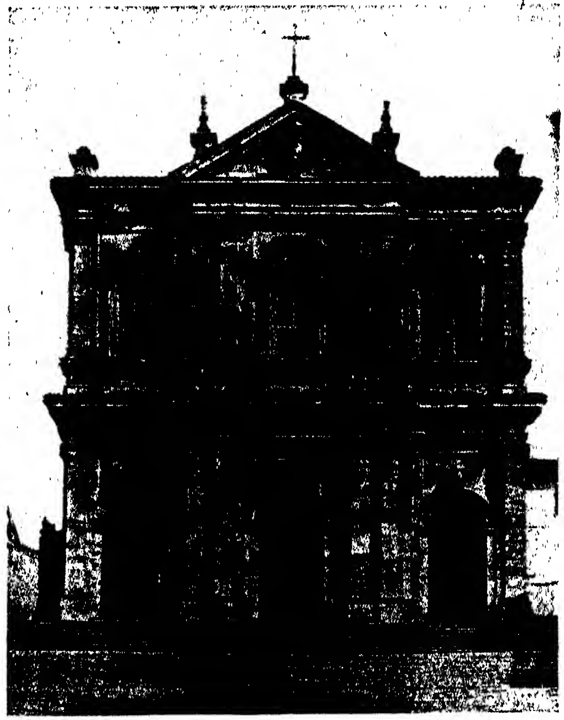


Fig. (A), above.—Duality created by presence of two equally dominant towers. Lack of unity. S. Sulpice, Paris.

Fig. (B), above.—Competition between first and second stories; neither more important. Lack of unity. S. G. Magno, Rome.

Fig. (C), below.—Less pronounced duality than in (A). Towers connected. Accented entrance. Villa Medici, Rome.

Character

The element of character has been reserved for last, not because it is the most important but on account of the fact that it grows out of the function of the building and the consideration of all of the creative principles of composition. It is something which should be kept in mind during the entire process of design. Throughout the development of a project the designer must ever strive to express the purpose of the building, both in general composition and in the use of details. Whether it is a bank, a church, or a library, it should look the part; it should possess the proper character.

INDIVIDUALS—the citizens of the community in which we live—have points of similarity. They have heads, arms, and legs. But they are often quite dissimilar in their likes and dislikes, in their reactions to the problems of life. Buildings have points of similarity. They all have, in some form or other, walls, doors, and roofs. But again they are unlike in the purpose which they serve and the appearance which they present to these previously mentioned human beings.

In individuals there is normally a difference, either little or great, in their outward appearance. This is due to something more intangible than merely the size, shape, and color of their features. This subtle quality may be called personality. Individuals are imbued with characteristics which influence their external appearance. They may be mean and stingy, or cheerful and generous. They may be taciturn or voluble. These qualities unconsciously but insistently affect their countenances, and are reflected in their manners of living. MANIFESTED CHARACTER IS THE EXTERNAL EXPRESSION OF INTERNAL QUALITIES. In any architecture which is worthy of the name, the exterior of a building expresses the internal function.

Character in architecture may be divided into three types, depending upon the source of its inception and upon whether this source deals with the abstract or the concrete. The classes are:

Character from:

1. FUNCTION, or use of the building.
2. ASSOCIATION, or influence of traditional types.
3. PERSONALITY, or the human quality or emotional appeal.

FUNCTIONAL CHARACTER. The most important kind of character in architecture is that which results from the purpose of the building or the reason for its erection. The use of a structure naturally calls for a certain disposition of parts, and this arrangement affects the appearance of the exterior, by which we largely judge character. A museum must have galleries with ample wall space and top light, which eliminates windows and necessitates the use of skylights. (See Fig. 280 A.) On the other hand, a school building must contain many windows to admit the necessary side light and to offer an interesting contrast with the possible monotony of the class-room walls. A structure with large show windows is usually a shop for the display and sale of merchandise. A factory expresses the efficient operation of the manufacturing within, while a house reflects the informal intimacy of home life. The external expression of these various internal functions gives the building the character which it is intended to possess.

ASSOCIATED CHARACTER comes from the influence of ideas and impressions related to or growing out of past experiences. The man with the lowering brow and grim features represented, especially in our childhood, a person to be avoided. We learned to recognize him as a stern and often unpleasant individual who was not in sympathy with some of our childish ideas. We know by association and experience that the various races have different physical characteristics, and we are thus able to distinguish between an Oriental, a Negro, a Caucasian, and an Indian.

In a similar manner, we have come to recognize buildings by features which have long been associated with that particular structure. A spire atop a building with stained-glass windows has always told us that the edifice was a church. Certain traditional forms have long been associated with specific types of buildings. The use of the Classical Orders often indicates the presence of a bank, and Collegiate Gothic frequently discloses the identity of an educational institution. Even though this clinging to accepted forms has often hampered progress in architecture, any attempt at casting off ideas which have proved successful in past periods must be made with caution. When a mode of construction or a type of design is found to be antiquated, it may be discarded, provided that a worthy successor has been developed to take its place. The ultra-modernists would eliminate all association with the past. They would allow the function of the building to control the exterior regardless of the effect. If this idea prevailed to the extreme, architecture would cease and only engineering would exist. Good design and proper character must always be in evidence.

The contemporary movement in architecture has, however, caused many revisions in our association of ideas. It has been necessary to adjust our points of view to the many influences which are now changing the character of our modern buildings. New methods of construction have grown out of new materials, and it is now possible to use openings in ways which were not practicable according to our former conceptions of the limitations of brick and stone. Our attitude toward physical comfort has been revolutionized. The home must be more efficient in operation and more pleasant in its interior treatment. The museum is no longer a place in which to contract museum fatigue by climbing monumental stairways, and factories are now airy and cheerful. For instance, the Los Angeles Public Library (Fig. 207 B) is quite different in appearance from the one in Philadelphia (Fig. 280 C). The monolithic concrete walls of the Los Angeles building, with their plain surfaces and informal arrangement, are unlike the rusticated stonework and regularly spaced columns of the example on the opposite side of the continent. But does not the one built of concrete have as much library character as the one of stone?

If a building functions properly and is composed according to the rules of good design, it then follows that the character should be satisfactory. A bank, for example, need no longer be heavy and semi-fortified. Our bank architecture was borrowed from the temples of Greece or the palaces of Florence. The massive walls inspired the depositors with confidence. Changing conditions have brought about a realization that there is little relation between thick stones, barred windows, and the security of investments and savings. Only the conspicuous vault doors remain to advertise the safety of the deposits. Our banks have now become efficient places in which to work, and they present cheerful and dignified interiors in which to transact business.

PERSONAL CHARACTER in architecture bears a certain relation to the same attribute in the life of an individual. Mention has already been made of the fact that distinguishing physical characteristics mark a man as an Oriental, a Negro, a Caucasian, or an Indian. In a like manner the appearance of a railway station is different from that of a beach club (Page 307). If the comparison is carried still further, it is found that the element of personality plays an important part in the revealing of character, both with man and with architecture. Members of the various races have different traits—some common to several groups, some peculiar to a particular group. The plantation Negro is often happy and care-free. The Oriental is a mystery to the Caucasian; the Indian is stoical and taciturn. Individuals are gay or gloomy, sparkling or stupid, graceful or gawky.

Buildings have qualities which are directly related to their functions, but, in addition, they ~~may possess characteristics which have to do rather with the emotional~~ reaction set up in the mind of the observer. Like members of the human race, buildings may be stern and forbidding, light and playful, or sedate and dignified, with reference to the impressions which they are capable of giving. It is to these qualities of vitality, repose, grace, restraint, festivity, dignity, etc., that we give the name of personal character. If the building is designed in the proper spirit, this type of character will grow naturally from the structure itself. It is quite essential that this intangible quality agrees with the function of the building. Nothing could be more disastrous than to have a power plant look like an entertainment pavilion—a substitution of festivity for efficiency.

EXAMPLES. Turning now to specific examples, we find in the drawings on page 271 an attempt to illustrate functional character—an effort to show that the appearance of a structure is an outgrowth of the plan, which, in turn, is established by the use of the building. The nature of man inevitably rebels against the restrictions set up by the customs of society. He recognizes that in his business dealings he must adhere to certain fundamental principles of social adjustments. He must react in a prescribed manner during his working hours, moving along the lines established by the traditions of organized business. He suffers certain inhibitions on account of these limitations upon his activities and thoughts. It is quite logical then, that, when man escapes to the seclusion of his home, he should wish for informality and freedom. The office or the factory is impersonal—the home should be personal. The atmosphere of the home should be conducive to rest and quiet—a place for relaxation. For these reasons, any effort to create a machine-like house must be tempered with some regard for the traditions of home life, even though they may be slightly romantic in their appeal.

In Fig. 271 A is shown a plan of an informal type of house based upon English precedent. The rooms are conveniently arranged, but there is no attempt to secure balance of a regular type or effects which are grand in scale. All this is reflected in the elevation, which is rambling and picturesque. Native stone and half-timber, slate roofs and chimney pots, architecture and nature, are all combined in an interesting and pleasing manner to offer a retreat from the activities of the working hours.

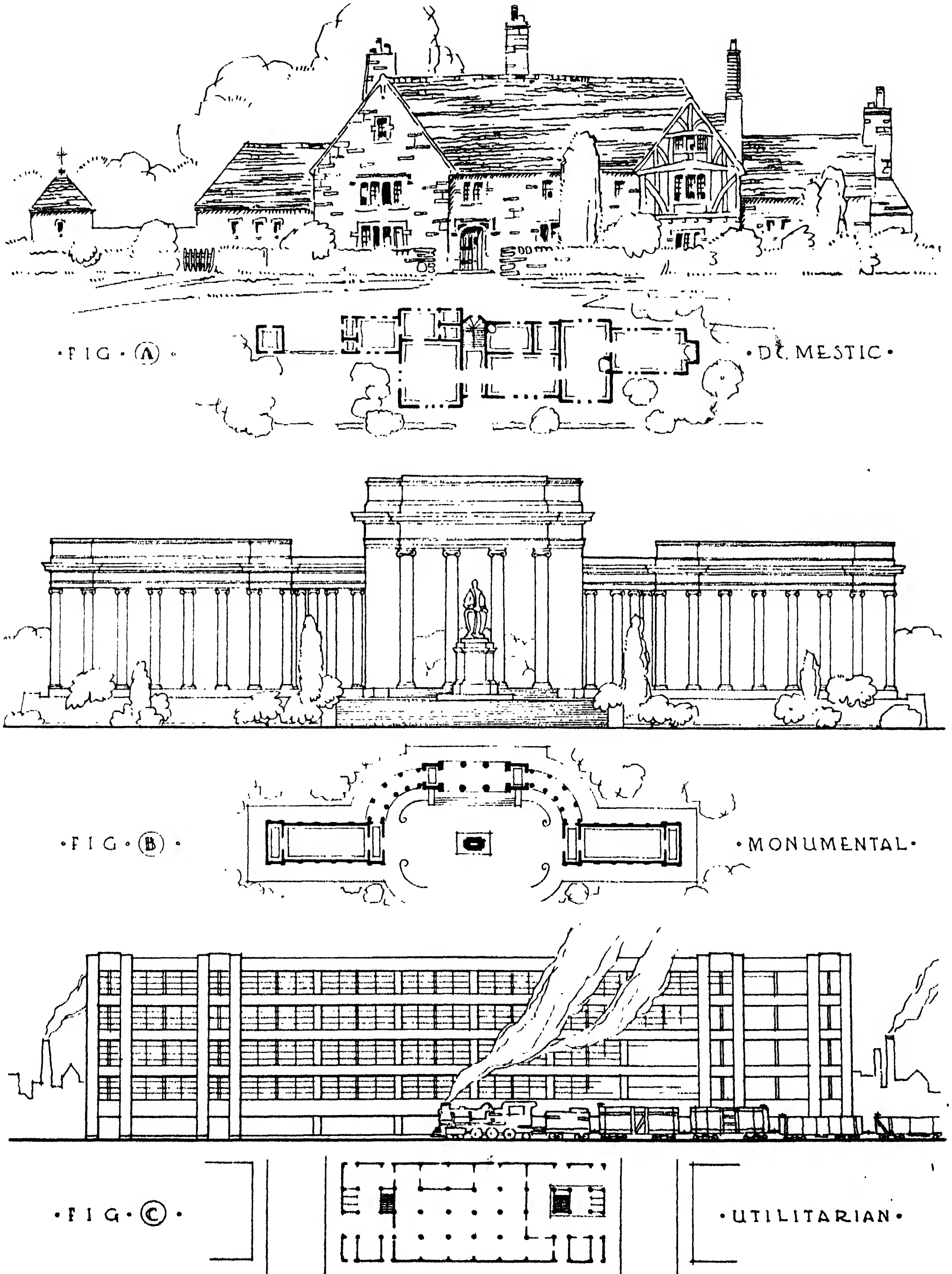
How different is the situation in Fig. 271 C. Here is a modern factory—an agreeable place in which to work. It is clean and airy, efficient and logical in its arrangement. The exterior shows only the structural members—which are stripped of all unnecessary decoration—together with the enclosing expanses of glass which assist in lighting the interior. In this building all the non-essentials have been eliminated, and only a straightforward solution to the problems of modern industry is presented. No one would mistake such a building for a residence or a church; its character is quite pronounced. This is the result of a plan which makes no pretense. A business must produce revenue; it must be housed in a structure where its operations may be carried on according to a certain schedule. The structural members of the plan must make little architectural show—they must adjust themselves to the process of manufacture rather than attempt to be ornate.

When a community wishes to erect a monument to a national hero, its motive is quite unlike that of a board of directors who build a factory. The monument serves no purpose other than to perpetuate a memory. It need not produce any revenue, and often its cost is of secondary importance. It must be impressive. It must have dignity and command respect. Its function, then, is to be monumental. This quality is most easily secured by the use of a treatment based upon the Classical or Renaissance styles, which lend themselves to a symmetrical arrangement—a stone architecture which has the feeling of permanency, of enduring for all time. The plan and elevation in Fig. 271 B show two monumental buildings with heavy walls, connected by an accented, colonnaded treatment. This latter forms the background for the seated figure of heroic proportions which dominates the composition. The use of the Ionic Order completes this picture of simplicity and dignity.

It is hoped that the foregoing illustrations indicate the meaning of functional character and, in addition, point out the difference in appearance between these three types of buildings. Domestic, monumental, and utilitarian structures have uses quite dissimilar, and their external characteristics should show the purposes for which they were erected. Character should grow from function.

COMMERCIAL. When tall buildings were first erected in this country, their designers were still thinking in terms of masonry construction. The column was taken as a model, and the early skyscrapers were laid out with a base, a shaft, and a capital, or at least with parts resembling these divisions with reference to their position. The formula was usually a stereotyped one. The base was indicated by the use of an Order—columns or pilasters—which included the main floor and often one or two floors above. (See Fig. 273 A.) The window-pierced shaft then carried the eye upward to the termination, which consisted of another Order with its columns and entablature. Here the imagination of the designers ceased, but their problems increased. No matter how they tried, it was extremely difficult to design a crowning cornice which had the proper proportions. If the entablature was in scale with the columns directly underneath, then it was much too small for the rest of the building. If the entire height of the structure was taken as the column and the entablature was related to this shaft, then the entablature became enormous and the overhang so great that it was impracticable to construct or to place in position. Usually some kind of a compromise was reached (as in the 1910 example on page 273), but the results were never quite satisfactory. It was always an attempt to make decorative forms of the past fit structural elements of the present.

Early in the history of skyscrapers some of the intrepid individuals in Chicago, notably Louis Sullivan, attempted to approach the design of tall buildings unhampered by Classical forms, but their efforts were frowned upon and their enthusiasm was discouraged. The Woolworth Building in New York, after the earlier efforts in Chicago, finally broke away from the dominance of the column and the cornice. It reared its then great height toward the sky in a way which revealed to some extent the structural system



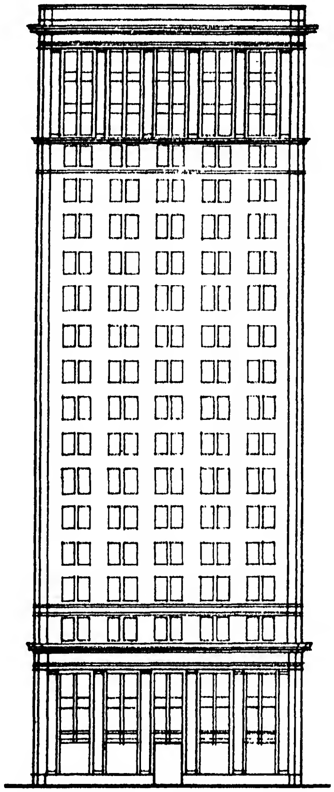
·FUNCTIONAL·CHARACTER·

underneath, but it was still clothed in a style developed from masonry construction, this time the Gothic. The competition for a new building for the Chicago Tribune, held in the beginning of the third decade of this century, brought out some novel designs—many of them too advanced even for that progressive period following the first World War. However, the publicity given to some of the outstanding designs (see Fig. 281 A), had its effect both upon the architects and upon the building public of this country. This, together with the New York zoning law requiring the setting back of successive stories of a tall building, exerted a definite influence upon American architecture. The type of structure illustrated in Figs. 281 B and 156 A is the result of this change in treatment. We thus enter the second phase in this development of character in commercial buildings. Skyscrapers of the third decade of the twentieth century are vertical. The thin lines of masonry, freed from traditional forms, conceal but accent the steel skeleton underneath, while curtain walls enclose the remaining spaces. No one can deny that they are fitting monuments to the business world of the twentieth century or that their soaring, vertical lines are inspiring. They have been a significant addition to contemporary architecture.

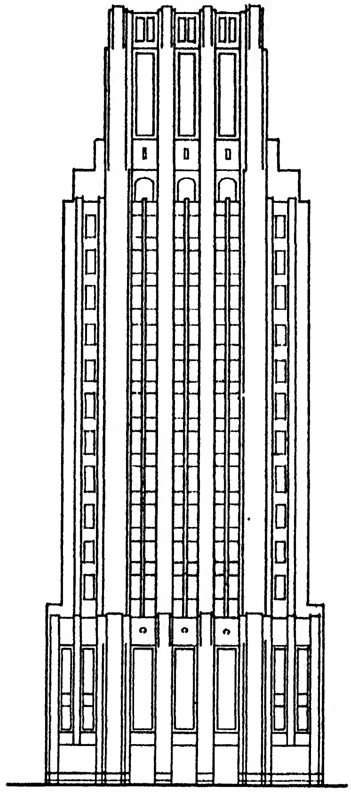
The early years of the fourth decade of this century witnessed the beginning of some dissatisfaction with the vertical character of these buildings of the 1920's. There are those who say that a tall building is simply a series of horizontal floors, and that these floor levels are more important than the members which separate and support them. The emphasis should be upon the horizontal instead of the vertical; as a result, buildings similar to that in Fig. 273 C are seen in urban centres. There is no doubt that the buildings of 1930 and 1940 are more expressive of their structural systems than were those of 1910, and that they are more beautiful. The question confronting contemporary designers is: What does the future hold for those who will build our cities of tomorrow? All we know is that the character of our architecture will change to fit the conditions imposed by new methods of living and building. We will not consciously and deliberately create a new style—it will be done for and in spite of us by changes in social and economic influences.

Another comparison of two kinds of functional character is made in Fig. 273 D and 273 E. Here two rectangular areas of similar size and shape have been developed to resemble the façades of two small buildings. They are alike in occupied space but unlike in function. One represents business; the other entertainment. The first is a small bank building, and its chief characteristic is dignity. It is a building designed to house an activity which is very near to the heart and mind of the average citizen—that of caring for his money. He will brook no levity in connection with so serious a matter. His bank must be one in which he can take pride—it should also inspire confidence in its integrity. Associated character also enters. After recalling our impressions growing out of past experiences, few of us would fail to recognize this as a building typical of those housing the business of banking.

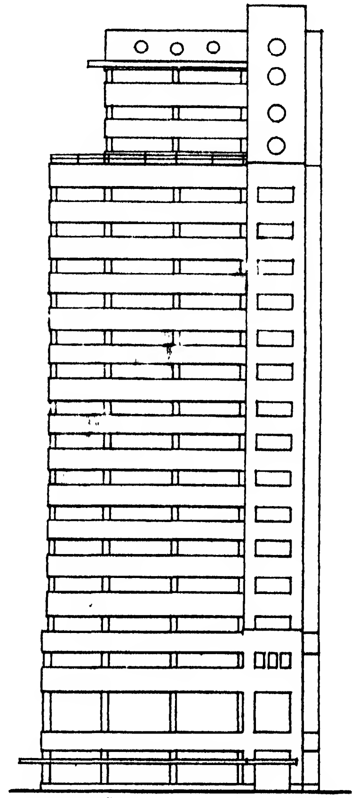
If one is planning a moving-picture house, the problem is quite different. After the average citizen has discharged his more serious obligations of the day, he is ready for a period of relaxation or recreation. He is ready to react to the stimulating impulses of pleasure. He is willing to have the spark of blithesomeness fanned into a flame. Those who successfully design places of entertainment simply draw upon their knowledge of the psychological use of color and decoration. Sombre colors and ordinary architectural



•FIG•Ⓐ• •1910•

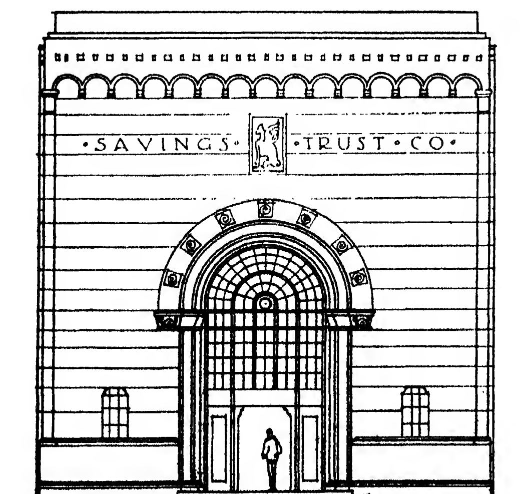


•FIG•Ⓑ• •1920•



•FIG•Ⓒ• •1930•

•COMMERCIAL•



•FIG•Ⓓ• A•BANK•

•FIG•Ⓔ• •A•THEATRE•

••FUNCTIONAL•CHARACTER••

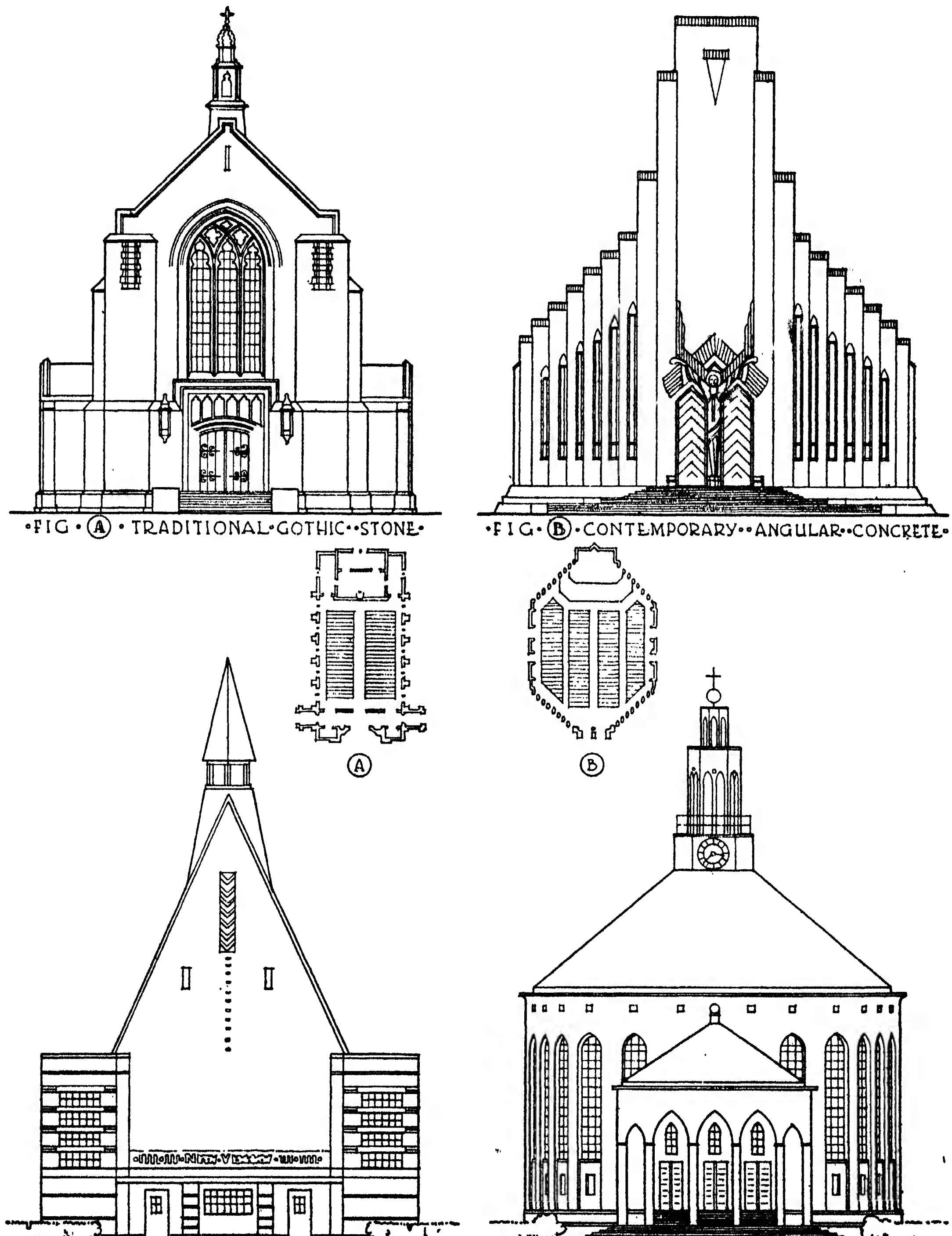
and decorative forms are monotonous and depressing. Bright colors and unusual architectural effects quicken the imagination and cater to the holiday spirit. For this reason, theatres attempt to catch and hold the eye, as in Fig. 192 B. They strive for the fanciful; and if the results are often garish, it is not solely the fault of the theory. The theatre houses an activity of man—relaxation—which is quite different from that of the bank—work—so that their characters, or external appearances, should be unlike.

Ecclesiastical. During the centuries before the age of Christianity, the Egyptians and Assyrians, the Greeks and Romans worshiped their many gods in temples which were heavy and monumental in character. In the Early Christian period the Roman basilicas were converted into places of worship, and when new structures were erected their design was influenced by these earlier examples. From these buildings was developed the church with its nave and side aisles, its narthex, transepts, and choir. Church history and church rituals have affected this development, but the form of the mediaeval church has persisted down to the present age in some more or less modified manner. The Romanesque, the Gothic, and the Renaissance have all displayed their own particular variations of this general theme, but the final results have been very much the same. A church consists of a large enclosed space for the purpose of worship: a place for the congregation, the nave or auditorium; another place for the glorification of the Deity, the altar. We know by the external manifestations of these features that it is a church. The fact that it is English Gothic or Spanish Renaissance does not detract from our ability to recognize the character and purpose of the building. By our association of ideas, by the use of traditional forms, we know that the structure is a church. It has character which comes from association.

But what is to be done about the concrete and brick structures which are appearing in this country and abroad, and which are called churches? What is ecclesiastical character? It is granted that churches executed in the mediaeval or the Colonial manner have been and still are satisfactory as places of worship. But can we not arrive at effects just as pleasing and logical by the use of new materials and new types of construction, allowing them to influence the form and design of contemporary buildings? The function of a church is to house the congregation and to create a spirit of reverence. (See page 282.) If this is accomplished, it does not matter whether it is done with the aid of concrete or stone, round arches or parabolic, decoration or simplicity. (See page 188.) It is becoming increasingly necessary that we adjust our point of view to the possibilities of these newer ideas of construction and design. We should not allow traditional forms to hamper the development of a twentieth-century church architecture.

The traditional type of Gothic church, modified to suit present methods of construction and to meet the desire for simplification of detail, is seen in Fig. 275 A. The plan is in sympathy with the tendency in some congregations toward the elimination of much of the elaborate ritual of former periods. It confines itself to the placing of the worshipers so that they may see and hear. The elevation, by reason of its use of familiar forms, is recognizable by all as that of a church and appears satisfactory in its general design.

In Fig. 275 B there is shown a drawing based upon a design for a church in Cork, Ireland. Its execution in concrete is typical of the spirit of this age, while the simplicity and regularity of the rectangular forms are expressive of the material itself. It has the vertical, inspiring direction of the Gothic, and the figure between the two doors, although



•FIG• Ⓐ • TRADITIONAL•GOTHIC••STONE•

•FIG• Ⓑ •CONTEMPORARY••ANGULAR••CONCRETE•

•FIG• Ⓒ •CONTEMPORARY••ANGULAR••BRICK•

•FIG• Ⓓ •CONTEMPORARY••CIRCULAR••BRICK•

•ECCLESIASTICAL•CHARACTER•

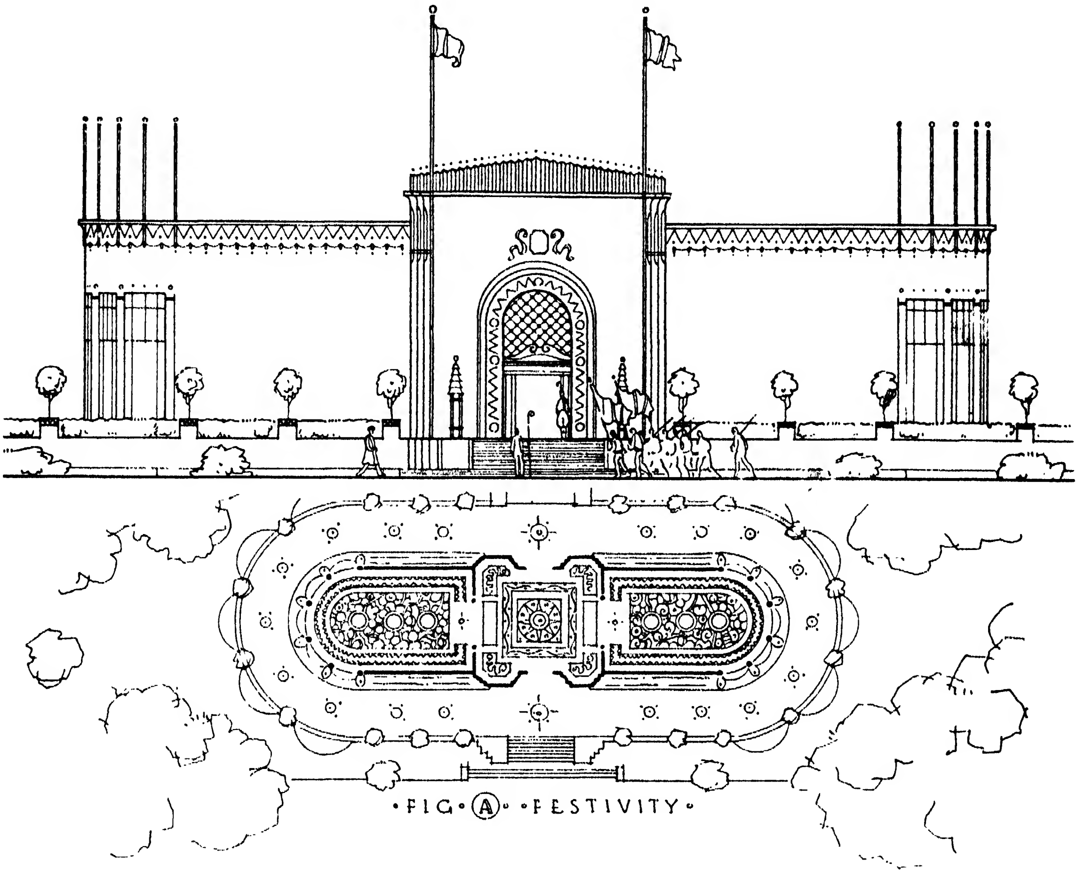
geometrical in its outline, might be comparable to those conventionalized, elongated figures of the doorways of early cathedrals. The plan of this church tends even more toward the auditorium type than that of the preceding example. The problem was that of seating a number of people so that they would have an uninterrupted view of the altar, and this has been done in a very simple and interesting manner.

Germany and Holland have contributed much to the cause of modern brick architecture, and the results have been, in many cases, unique but satisfactory. Ecclesiastical buildings have come under the influence of this movement, and Figs. 275 c and 275 d illustrate two examples which are non-traditional in their use of forms and decorative elements. The little chapel at Haarlem (Fig. 275 c) is simple and unpretentious; the church in Berlin (Fig. 275 d) is more unusual in its shape and construction. It is circular in plan, and in the interior the ceiling consists of concrete vaults supported by slender piers. (See also Fig. 83 a.) It is perhaps just as satisfactory in design as many of the more traditional examples and serves as another illustration of the change which is taking place in church architecture and ecclesiastical character.

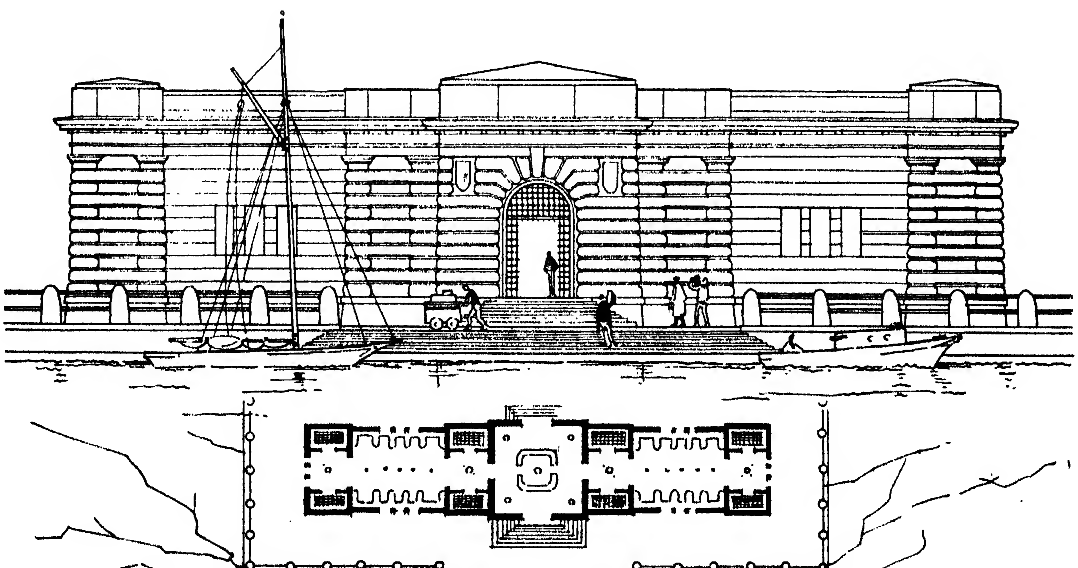
Personality. Thus far in the illustrated examples we have shown only that type of character which is either the direct result of function or which is portrayed by the use of familiar details. There is that other kind of character which is usually thought of as having more relation to human qualities than to architecture. Nevertheless, a building may tell the spectator that it has a feeling of pride, of festivity, or of humility—the personality of the structure. All this may eventually be traced back to the function of the building, but it is different from that character which is the sole product of use. A dilapidated warehouse on the water front certainly has nothing but a feeling of humility; a magnificent city hall can take pride in its size and position. So, after all, these non-functional characteristics do depend upon function and treatment but not so directly as those which are listed as educational, commercial, etc. They have more to do with the spirit of the building than its purpose—they are abstract rather than concrete. A building may display the quality of strength or that of indecision. It may be simple or ornate, picturesque or formal, unobtrusive or blatant. It has personality. Also, it may in itself be of good design but out of place when transplanted to a setting for which it was not intended. A Long Island summer home would appear incongruous on Fifth Avenue, and St. Patrick's Cathedral would look ridiculous on an Indiana highway. Character is thus also a matter of location.

Figure 277 a shows a small exposition building designed in the manner of the contemporary movement. It is intended to convey the spirit of gayety, for an exposition is built for entertainment as well as education. What gives to the exterior the necessary character? It is the lightness and spontaneity of the decoration and the use of vertical accents, banners, etc. The building has none of the dignity, sobriety, and sternness of structures given over to business and commerce. Even the plan is light in wall thickness, indicating, perhaps, a temporary material. It also has a feeling of openness which relates the interior to the surrounding landscape treatment.

An opposite effect is desired and secured in Fig. 277 b. This is the design for a customs house executed in the "Rusticated Renaissance" manner which was so popular with the students of the École des Beaux-Arts early in this century. Here a sense of strength and solidity is required. Strong walls are deemed necessary, and heavy masonry with few



•FIG•Ⓐ• •FESTIVITY•



•FIG•Ⓑ• •STRENGTH•
•PERSONAL•CHARACTER•

openings is used to give the desired character. Here all is business, all is seriousness There is none of the dash and gayety of the former building. The plan with its simple areas, thick walls, and lack of pretense makes possible the slightly forbidding exterior. The elevation expresses the plan.

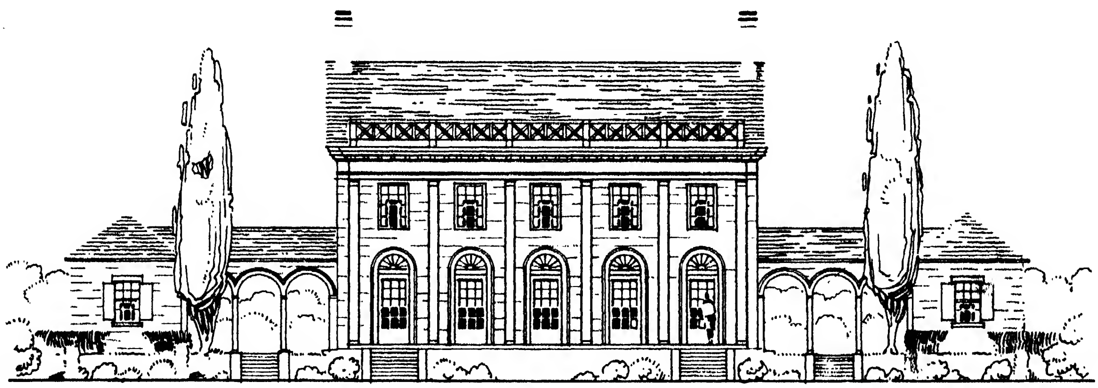
The drawings on page 279 show three examples of domestic architecture which illustrate personality or character in man's individual shelter, the home. The business executive of this century may erect an office building which is impersonal, but when he builds a home he wants it to meet the personal needs of his family in an intimate manner. Often it reflects his own particular characteristics. If he lives to display evidence of his wealth, his home will be pretentious. If he is quiet and unassuming, his home takes on these qualities.

Fig. 279 A is a house executed somewhat in the manner of the southern Colonial style. It is symmetrical in its arrangement, but the elements which give the feeling of grace are the tall, slender columns of the porch and the graceful arches of the arcades. The vertical treatment of the windows and the character of the planting also add to the effect of height.

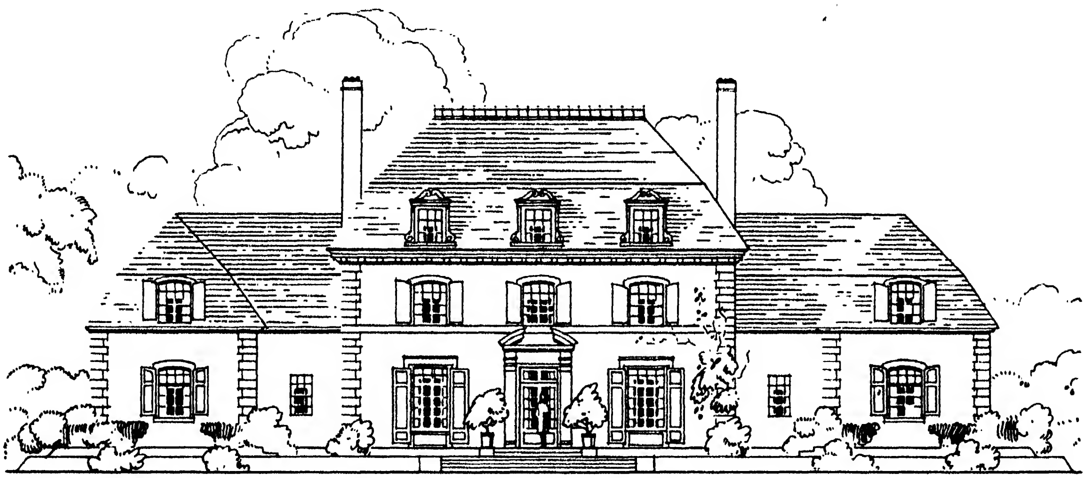
During the reign of Louis XIV, French court life was artificial, and pretense rather than simplicity prevailed. The luxurious palaces with their multiplicity of rooms and details were a reflection of the social structure of the period. The high roofs, tall chimneys, and rococo ornament were chiefly for show. It seems logical that, when a man now wishes to impress his neighbors with his worldly goods, he should borrow forms from an age whose citizens had similar ambitions. The house in Fig. 279 B is designed in the French manner and has some of the qualities of that civilization. It has ample room in which to enact all the subtle graces of a proud existence. Its proportions and use of details give an impression of lavish expenditure of money rather than of economy.

The unpretentious stone house in Fig. 279 C is informal and shows a desire to fit into the landscape in an unobtrusive way. It has breadth and restraint—breadth of direction and restraint expressed in the design and the use of one or two simple materials. Its inhabitants probably wish to lead a quiet existence with books indoors and with nature out-of-doors, at the same time to extend a cordial hospitality to their friends to share the cheer of their fireside. There can thus be much varied character in domestic architecture, depending upon the personality of the owner and the ability of the designer.

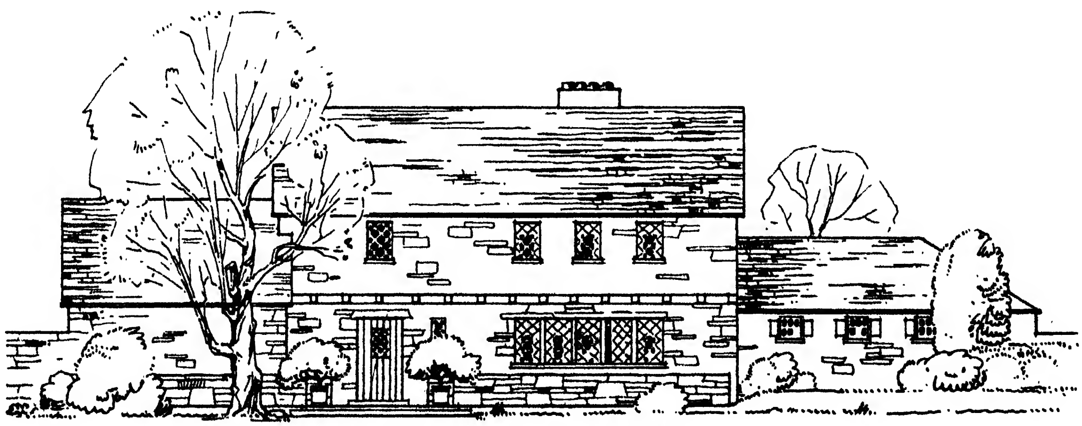
Although character has been discussed along with the principles of composition, it is not to be classed as one of those fundamentals which deal with contrast, scale, or unity. But character should develop along with the satisfaction of these cardinal principles, just as an individual—while acquiring his physical growth—is endowed with a personality. Proper character does not necessarily accompany the securing of good composition. A Caucasian may have beautiful physical proportions, but, owing to some peculiar reversion, may resemble an Indian in coloring, disposition, and social inclinations. A factory may display all the correct proportions of Classical architecture but may look like a public library. On the other hand, a church may be recognized as a church on account of associated elements—the spire and stained-glass windows—but be entirely lacking in the essentials of good design. Proper character and principles of composition are not synonymous; they appear together only by a conscious effort on the part of the designer. They must both be present in a successful piece of architecture.



·FIG·Ⓐ·GRACE·

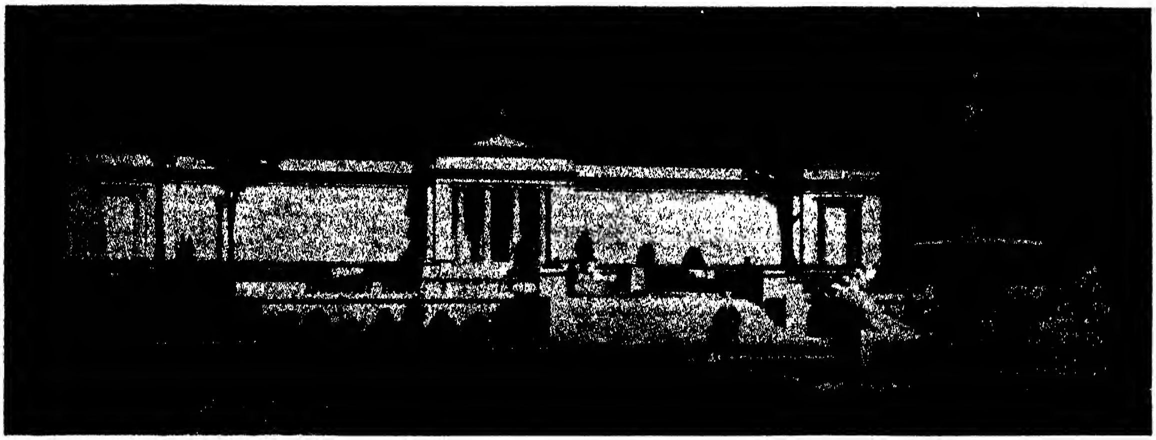


·FIG·Ⓑ·PRIDE·



·FIG·Ⓒ·RESTRAINT·

·PERSONAL·CHARACTER·



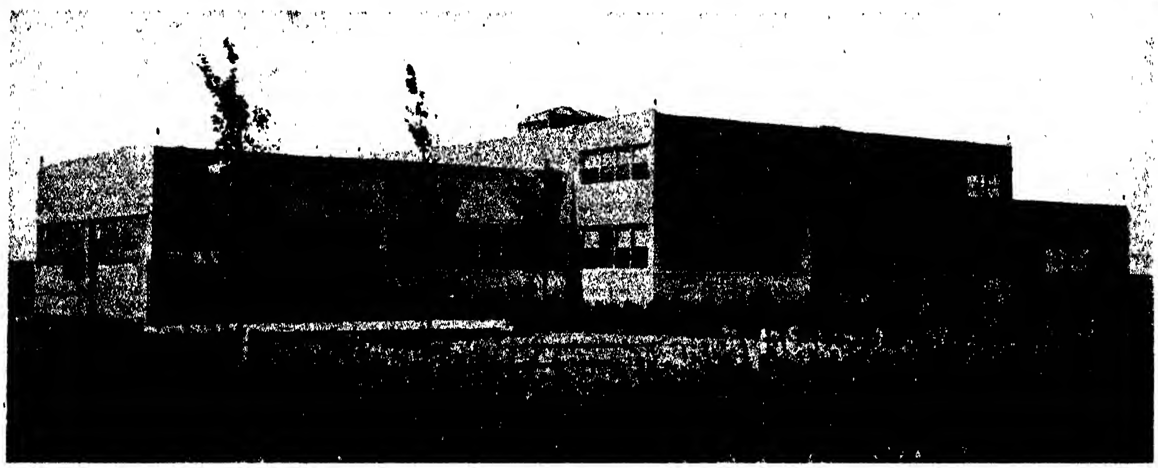


FIG. (A), above.—Monumentality, simplicity, dignity; no windows, top light, galleries. Marble. Art Museum, Cleveland.
FIG. (B), centre.—Expressed utility. Architecture reduced to space-enclosing elements. Monolithic concrete. Airport, Chicago.
FIG. (C), below.—Stylistic symmetry. Reading rooms indicated by large windows. Public character. Library, Philadelphia.

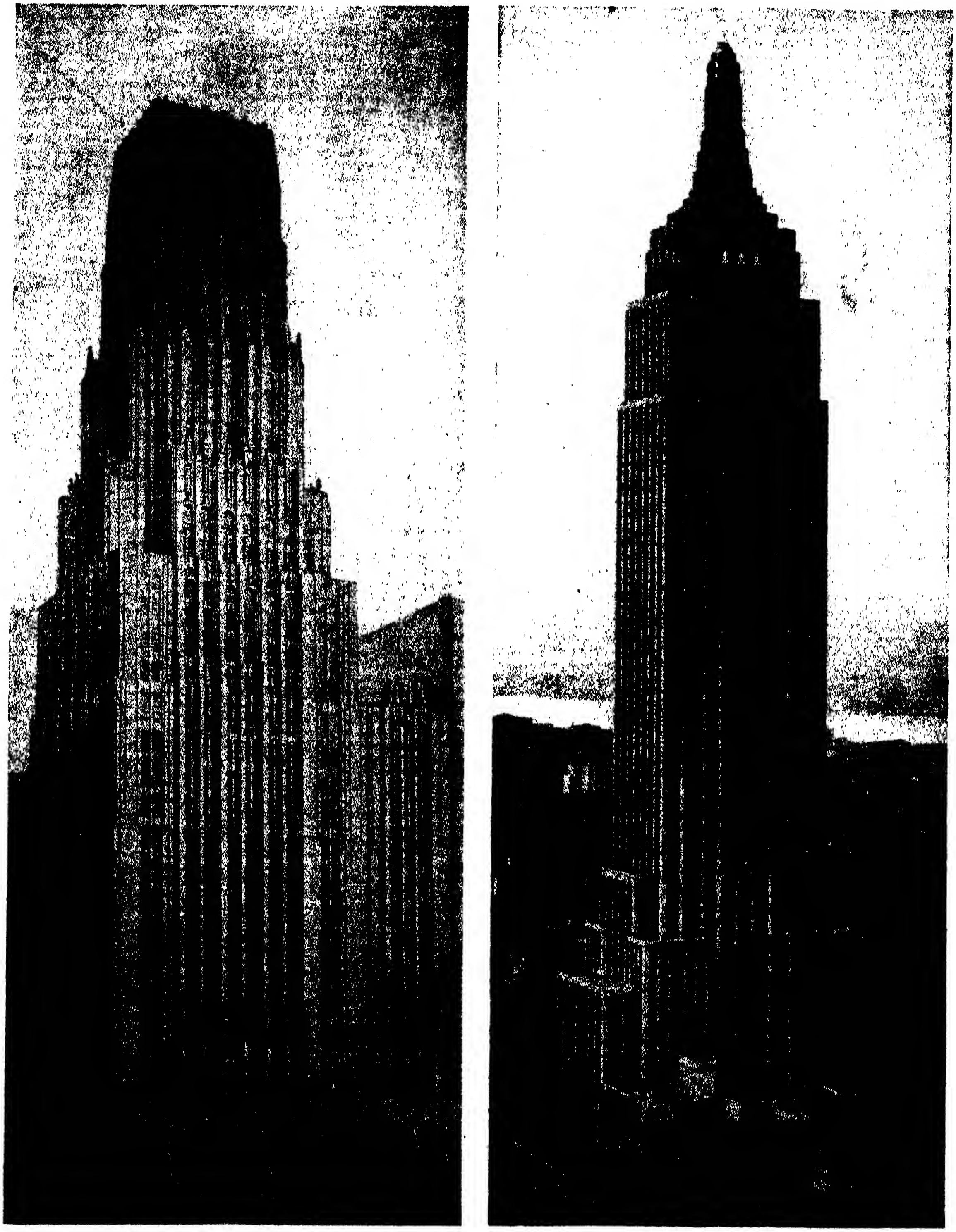
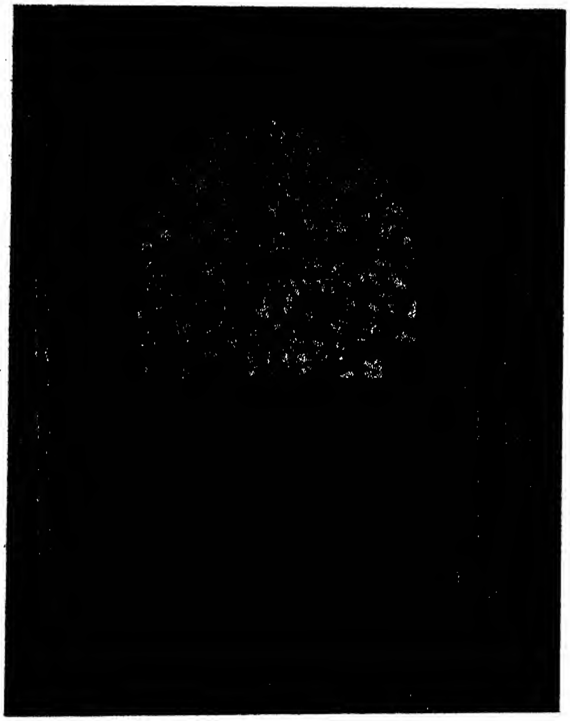
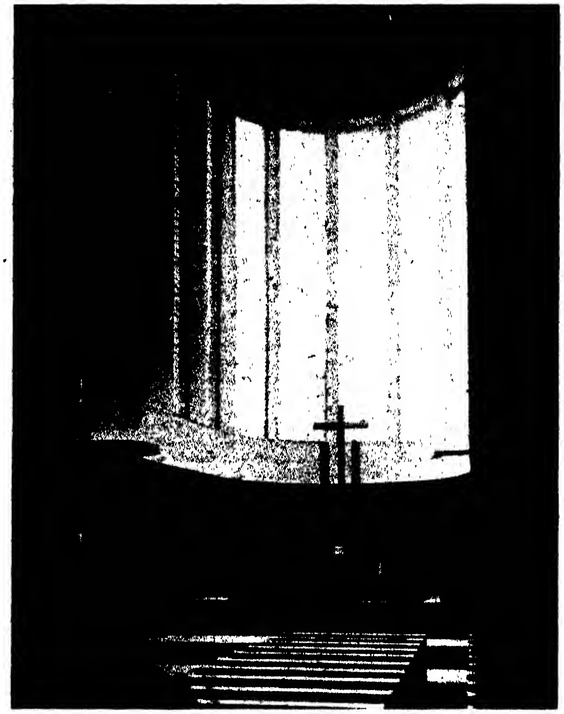


Fig. (A), left.—A study by E. Saarinen for Chicago Tribune. Early application of vertical, set-back principle of design and construction.
Fig. (B), right.—Ten years later than (A). The ultimate expression of soaring verticality. Limestone and steel. Empire State Bldg., N. Y.





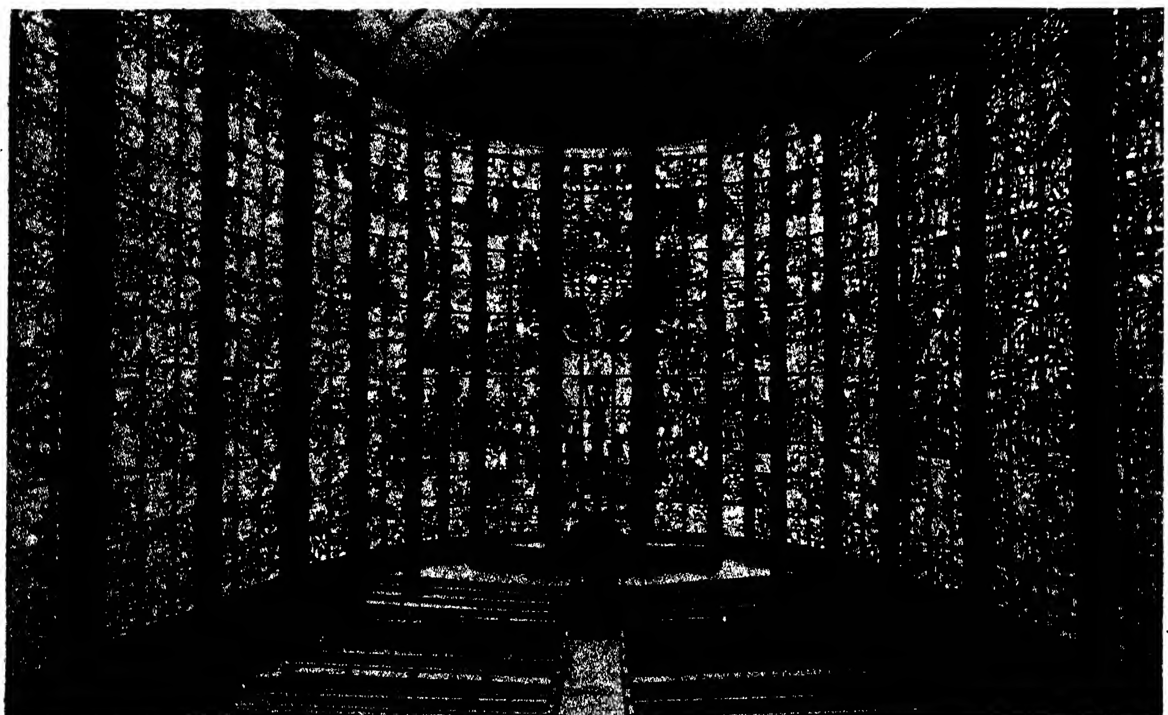
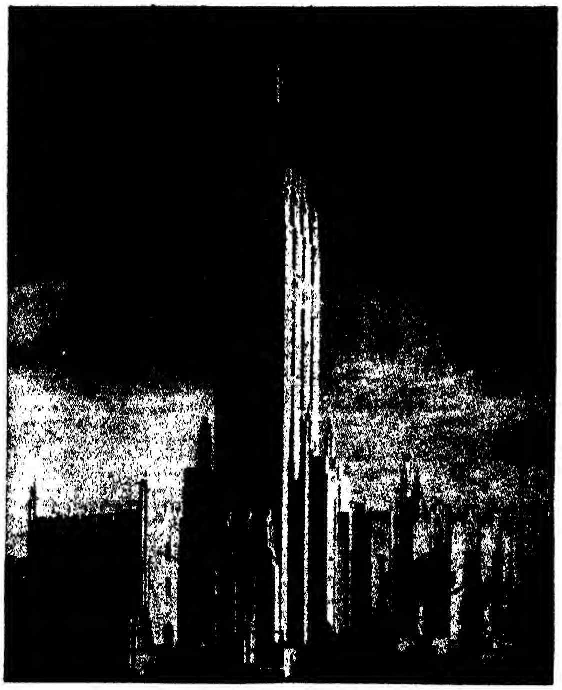


FIG. (A), above.—Atmosphere of reverence obtained by Gothic piers vaults and stained glass windows. Sainte Chapelle, Paris.

FIG. (B) above.—The mysticism of religion. Simplicity; light and shadow. Non-traditional. Church in Prague.

FIG. (C), below.—Metal and glass; steel, copper, and color combined for beauty and utility. Church in Essen. See Fig. 192 C.



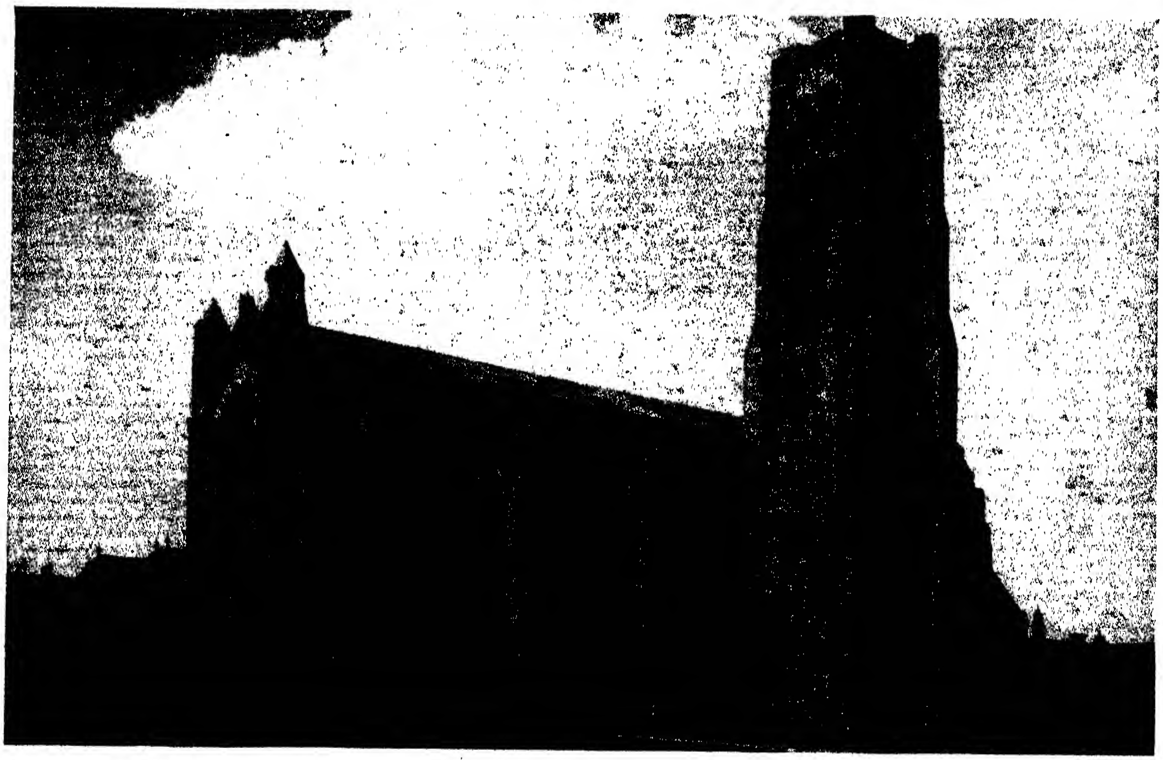
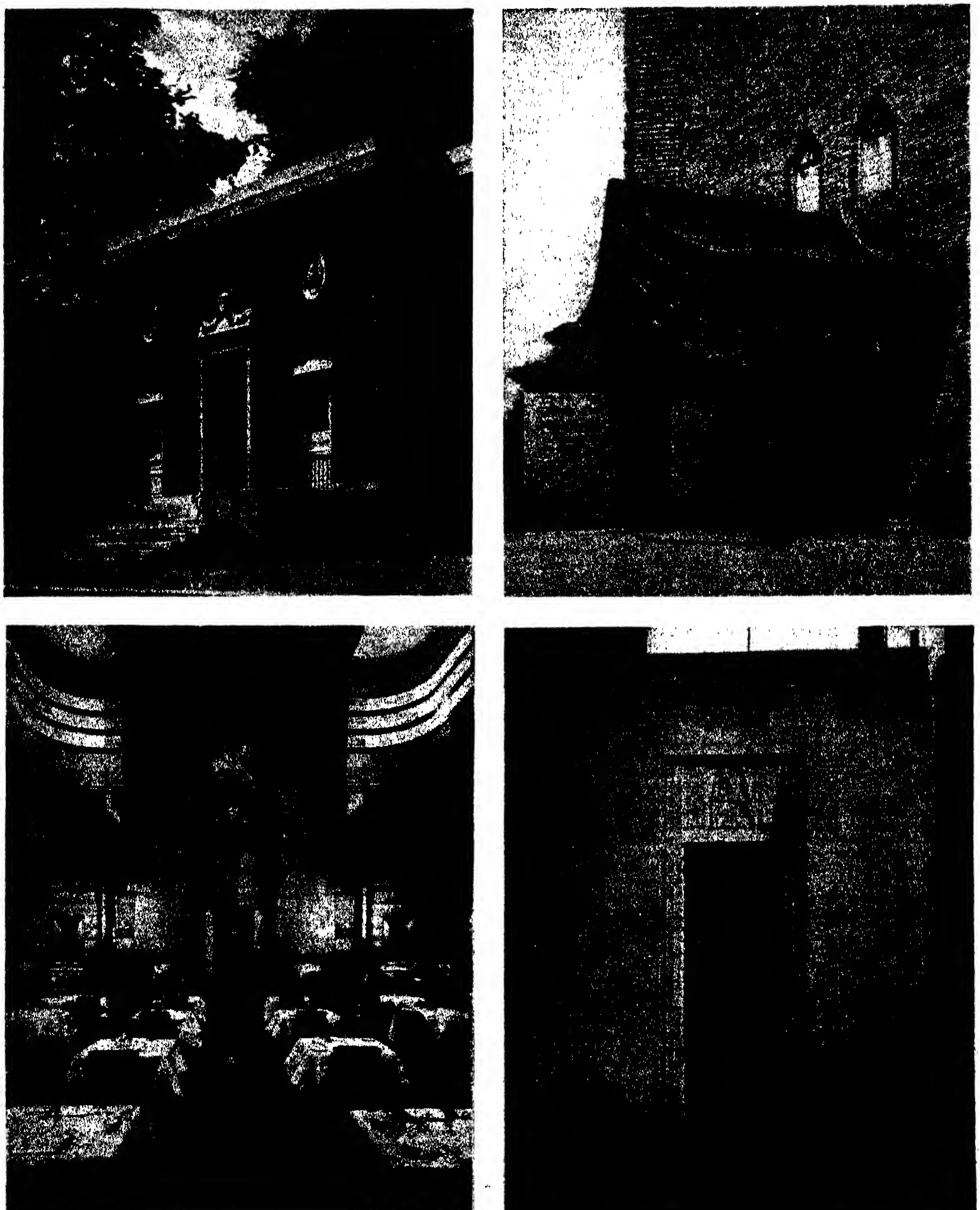


FIG. (A), above.—Ecclesiastical character in non-traditional manner. Limestone and terra cotta. Church, Tulsa, Okla. (Fig. 82 C.)

FIG. (B), above.—Contemporary Swedish architecture. Simple brick walls. Interest supplied by towers. Church, Stockholm.

FIG. (C), below.—Massive, simplified version of the Gothic. Chapel, University of Chicago. Bertram G. Goodhue, Archt.



Four examples of personal character—the intangible quality which comes from function, materials, and interpretation.

FIG. (A), above.—Grace, refinement. Brick. Community Bldg.

FIG. (B), above.—Bizarre, emphatic. Copper. Church, Berlin.

FIG. (C), below.—Simplified sophistication. Colorful restraint. Monel metal, marble, glass, etc. Restaurant, Montreal.

FIG. (D), below.—Potential power, expressive of electricity. Limestone veneer and steel. Commonwealth Edison Bldg., Chicago.

PART FIVE

THE PROCESS OF DESIGN

CHAPTER XV

THE SCOPE OF DESIGN

The mere securing of knowledge is one thing; its application is another. Information may be acquired and stored away, but if the greatest amount of satisfaction is to be derived from the process, some use should be made of this acquisitive ability. The application of acquired architectural knowledge is our immediate concern.

THE APPLICATION OF KNOWLEDGE

The student in the drafting room or the designer in an office should approach the solution of a problem in architectural design with: (1) a knowledge of the developments of the past; (2) an understanding of present trends in social and economic conditions; (3) a comprehension of the creative principles of design; and (4) an ability to express ideas with pencil, brush, and clay. All the foregoing contribute to the success of creative work. If an individual has only the knowledge of the past, his solutions will simply be based on archaeology and will not be adapted to contemporary architecture. If he is a student of the shifting-society trends of this modern age but knows little of the basic principles of design, he will find it difficult to have other than a sociological approach to architecture. If he is familiar with the developments of the various movements in art and architecture and is also sensitive to the requirements of good design but is unable to express himself, he will be embarrassed in his efforts to qualify as an artist or architect. The surgeon may be an authority on anatomy, but unless he can perform—unless he has had experience in the operating room—this information will be of little value to him or to the public. The designer must be able to present his ideas in a convincing manner—either with pencil, pen, brush, clay, or wood.

CONTRIBUTING FACTORS

Architectural design is made up of two processes—one mental, and the other combining the mental and physical. The first is the conception of the idea, or the discovery of the scheme which may eventually lead to the solution of the problem. Occasionally this comes as an inspiration, but it is usually the result of considerable thought and study. The second is the development of this idea upon paper and its later realization in the permanent form of building materials. It is the development of this preliminary scheme which should command our attention on succeeding pages. We must find out what happens between the conception of the idea and the erection of the building.

STEPS IN ARCHITECTURE. The process of building grows from a demand stimulated by a definite need. There is practically no aimless building, for no sane person erects a structure that has no purpose. Architecture is therefore the result of:

1. A. The Need for a Building,
   growing out of obsolescence, expansion, etc., due to changes in physical and spiritual, economic and social conditions.

   B. The Demand for a Building,
   or a definite request resulting from an expressed desire of a client.

   C. The Solution of the Need,
   or the conception and development of the idea leading to the solving of the problem, by the following considerations in the process of design:

   1. Function.
      - a. Purpose of building.
        - Requirements.
          - Size, shape, and location of individual units.
      - b. Interests of occupants.
        - Analysis of needs in terms of use of building.
      - c. Influences on site, materials, and character.
   2. Location.
      - a. General.
        - Country.
          - Climate.
          - Social structure.
      - b. Specific.
        - Site.
          - Contour.
            - Level.
            - Sloping.
          - Shape.
            - Regular.
            - Irregular.
      - c. Influence on materials and character.
   3. Materials.
      - a. Relation to location.
        - Accessibility.
      - b. Influence of function upon.
      - c. Influence on construction and character.
   4. Creative Principles.
      - a. Aesthetic organization.
        - Principles of design—influence on volume, plan, interior, and exterior composition.
   5. Character.
      - a. Functional character of building.
      - b. Personal character reflected in materials and arrangement.
      - c. Location character.
        - Influence of site, climate, and adjacent architecture.

D. The Fulfillment of the Need.

1. The interpretation of the above considerations in terms of the materials of man and nature.

Design in the school or the office is thus based upon the processes which accompany the study of the influences that function, physical and social environment, materials, and principles of design bring to bear upon the scheme of a building. In school, the need and the demand for the building are supplied by the instructor or critic. The solution is to be developed by the student. The erection of the proposed structure, which should not be forgotten during the development of the problem, is left to some future date.

In the school room there is always a client; but in the office one deals with realities, and there are clients only in times of prosperity. The client presents a definite problem for development, with his needs already stated, or asks the architect to write the program. In the school drafting room, the instructor is the "client," and he either prepares the program calling for a building with specific requirements or asks the student to write his own program. The student is then called upon to present a design which will meet with the approval of the "building committee"—the jury—keeping in mind at all times the possibility that the building might eventually be constructed.

The function of a course in architectural design is not simply to create architecture on paper. The purpose and the appearance of the actual completed structure should be considered at all stages of the development of the idea. The drawings which are made are simply a means of expression. The building should grow logically from the requirements of function, site, and materials, whether merely presented on paper or constructed in stone.

Although it is necessary to consider the ability of self-expression, nevertheless the completed building is that which is desired. The study preceding this finished structure is an exercise in the adjustment of the demands of the human race for comfort, convenience, and aesthetic enjoyment, as opposed to the limitations of human knowledge of materials and construction and to human inertia. A need for a structure arises and an effort is made to satisfy that need, the architect always attempting to secure a solution as nearly perfect as the external influences of costs, zoning, and personal idiosyncrasies will permit.

The Functional and the Aesthetic

The designer should always keep in mind the effect which the building will ultimately have upon the owner or the occupants. Too often, student work fails to show proper regard for the influence of materials, construction, technical requirements, and cost upon the final appearance and operation of the structure. The design of buildings should be related not only to climate, site, etc., but also to maintenance and operation. All the rules of good composition may be satisfied, but if the client's activities are not housed in a satisfactory manner, the building is not a success.

Architects are becoming more conscious of the importance of the human element in architecture—the influence of the individual upon the building he is to occupy. Shelter should be truly expressive of the period in which it is developed, and modern shelter should reflect the life of the present era. Therefore it is recommended that considerable thought be given to social, economic, and geographic influence upon the development of a particular structure. The house, the church, and the factory have changed in appearance and function with different periods and peoples—the result of the demand for architecture which expresses the combination of the social and economic forces of the moment. The architect of the present and the future must be alert to changing modes of life. Students should begin early to think of these fundamental influences. Collateral readings in the social sciences should be carried on along with the courses in design in order that design may correctly interpret the civilization which we are experiencing.

Aesthetic considerations may constitute the spirit of architecture, but the practical requirements furnish the sinews of the structure. Along with a study of harmony, balance, and unity, should go that of materials, costs, and equipment. As soon as an idea takes form in the plan, the designer should begin to get the "feel" for the construction. He should begin to adjust the framework of the building to the functional and aesthetic arrangement. He should visualize the structural members—vertical and horizontal—which support the exterior shell. Solutions should not develop independently of materials and construction.

The information growing out of the answers to the following questions is always expected from the practicing architect. During the progress of a problem, the student may well keep in mind these same important factors:

How does the architect expect the structure to serve the client after it is built?

Approximately how much will it cost?

Is it economical in its use of materials and in its arrangement of parts?

What materials should be used: concrete, steel, wood, or masonry?

What relation should be maintained between the aesthetic design and the construction?

How is the building to be operated after erection? If it is a museum, is the circulation satisfactory—economy of physical effort? Are the lighting and the ventilation adequate—preservation of comfort? Can it be controlled easily—economy of supervision? If there are several exits or many isolated corners to be watched, more guards are necessary, and there is a duplication of effort.

The answers to questions of the foregoing type will indicate the success of the solution. The ingenuity of the student or the criticism of the instructor will add to this list. Even though the primary purposes of architectural design in a school are (1) to stimulate the imagination, (2) to develop good taste, and (3) to encourage the ability to organize, the student must be prepared as well as possible for the more practical requirements of office procedure if the adjustment between school and practice is not to be too difficult. Experience on a construction job or in an office prior to graduation will help in this connection.

Architectural design, in order to be real, goes further than paper architecture. The successful solutions of a building should be arrived at by the following approach:

A. Functional Considerations.
- 1. Arrangement of volumes affected by:
    - a. Use.
    - b. Site.
    - c. Climate.
    - d. Construction.

B. Structural Considerations.
- 1. Construction influenced by:
    - a. Function.

    b. Materials.
    c. Climate.
    d. Costs.

C. Aesthetic Considerations.

1. Composition of plan and enclosing surfaces influenced by:
    a. Function.
    b. Site.
    c. Climate.
    d. Materials.
    e. Creative principles.

D. Economic Considerations.

1. Service rendered to client or to occupants of the building.
    a. Finance.
    b. Equipment.
    c. Operation.

The method of securing the above information and the way in which it may be used will depend upon the organization of the educational system in which the student is enrolled. In addition, the architectural staff, the library with its professional magazines, the instruction in the allied departments of engineering and allied arts, visits to buildings under construction, and special lecturers available in the larger cities—all offer opportunities to become better acquainted with the broad scope of modern architecture. All this will make architectural design seem more real. The student should soon realize that architecture is an art, a profession, and a business.

Chapter XVI

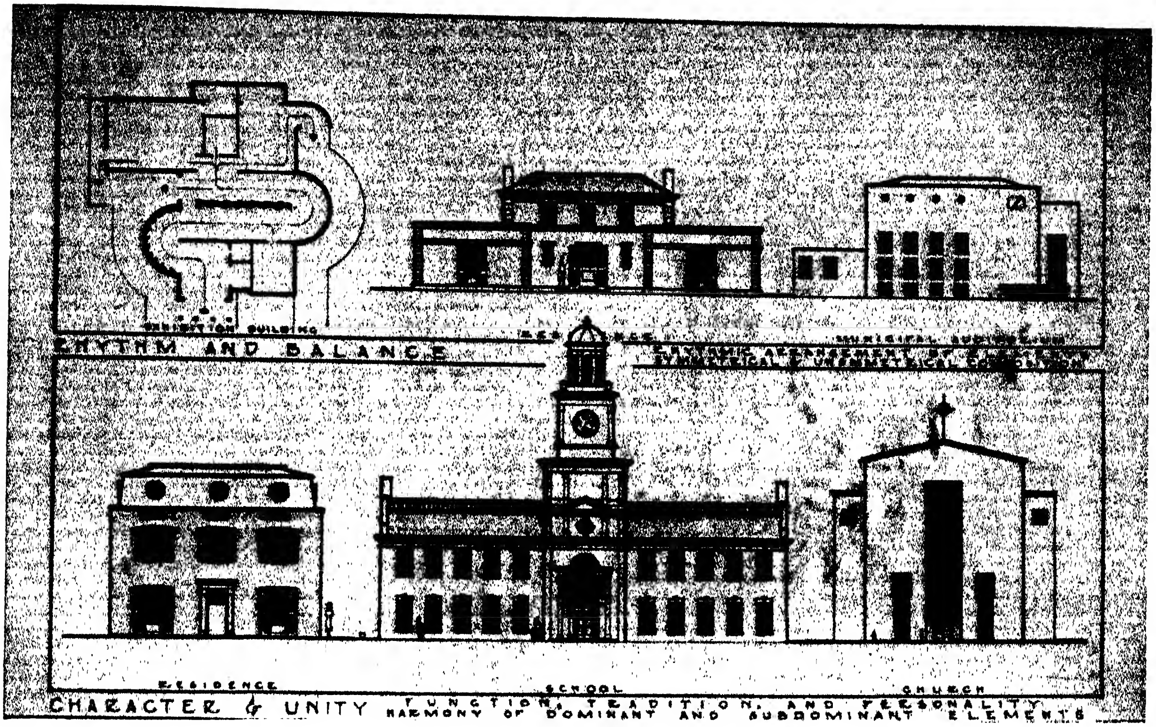
TYPES OF PROBLEMS

There are two well-known types of organized education or instruction. One is the lecture method, which may be informal, when the followers of a cult sit at the feet of the master—as did the scholars of the East—or formal, as in the modern class room. This is the way in which facts are revealed or information is imparted to the students. The other type of instruction is the problem method, in which the student is confronted with a situation which must be solved. It may be a point in legal procedure for the law student, a design of a bridge for the engineering student, or the development of a scheme for an office building for the architectural student. The study of architectural design belongs to the problem type of education. The student must learn certain fundamental principles but the application of these principles and the resultant designs are of primary importance.

HISTORY. Since the study of architectural design is a part of formal education, it must necessarily have organization and sequence. Present-day architectural training in America is the result of years of development, which has been influenced by the practice of architecture itself and by contacts with the educational systems of other nations. The early buildings of this country were designed by amateur architects and craftsmen with the aid of handbooks of Renaissance details. Later, during a major portion of the nineteenth century, young men were trained as apprentices in offices under architects whose approach was often that of a civil engineer or master builder. Elaborate studies and complex working drawings were unknown. Architectural education consisted in learning the characteristics of the historical styles, the stereometry of masonry walls, and the construction of wooden floors, beams, and trusses.

During the last quarter of the nineteenth century, prospective architects came under the influence of the École des Beaux-Arts in Paris. This school and its related ateliers contributed many of the ideas of procedure and much of the terminology used in the drafting rooms of our schools and offices. France was the popular leader in the fields of art, architecture, food, and manners, and for more than half a century American students traveled and studied in that country. The sequence of problems from the Analytique through the Class B projet to the Class A projet, together with such devices as the esquisse and the rendu, were borrowed from the Bohemian studios of the left bank of the Seine. As a result of this French influence, the Beaux Arts Institute of Design, New York, was founded early in the present century and did much to develop a national consciousness and unity in the study of design.

In recent years, however, architectural education in the United States has gained a position of preeminence and no longer needs to lean upon the shoulder of European inspiration. Gradually our schools have developed their own philosophies of teaching architecture and a confidence in their own methods. This might be called the period of eclecticism, for, while most of the schools are trying to attain the same results, there seems to be considerable freedom in the methods followed. American schools are choosing and developing their own



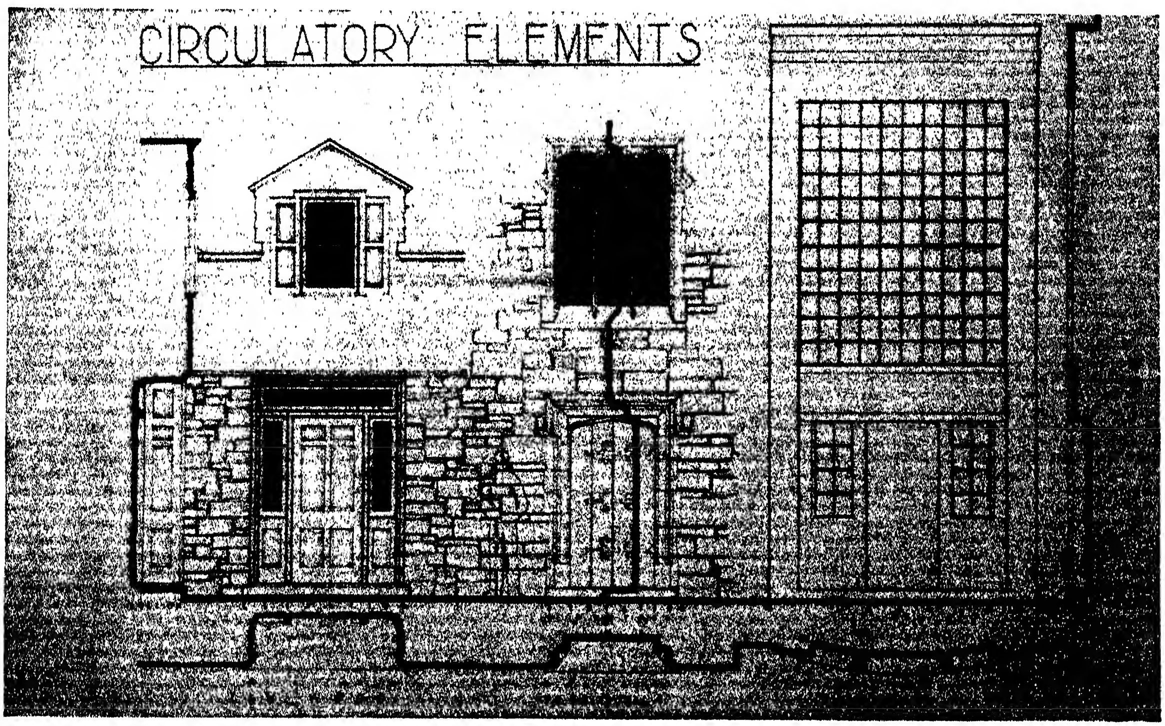


Fig. (A), above.—Exercises dealing with the principles of design as applied to plans and exteriors.

Fig. (B), below.—A study of various types of doorways—Colonial, Gothic, and non-traditional—as part of a course in theory.

particular systems for the training of future architects. Many of the artificial devices of the Beaux Arts method have been abandoned and students now approach the study of architectural design with considerable freedom from conventional steps. Where uniformity of type of problem and presentation once existed, dissimilarity is now the rule. Of course the problems must be presented in a visual way, but the presentation may assume a number of shapes and patterns. At one time a formal, two-dimensional drawing was the only acceptable method of explaining the solution of a building. Now, drawings and sketches, space models, clay models, construction details, photographs, written reports and devices of all kinds are employed as legitimate vehicles of presentation.

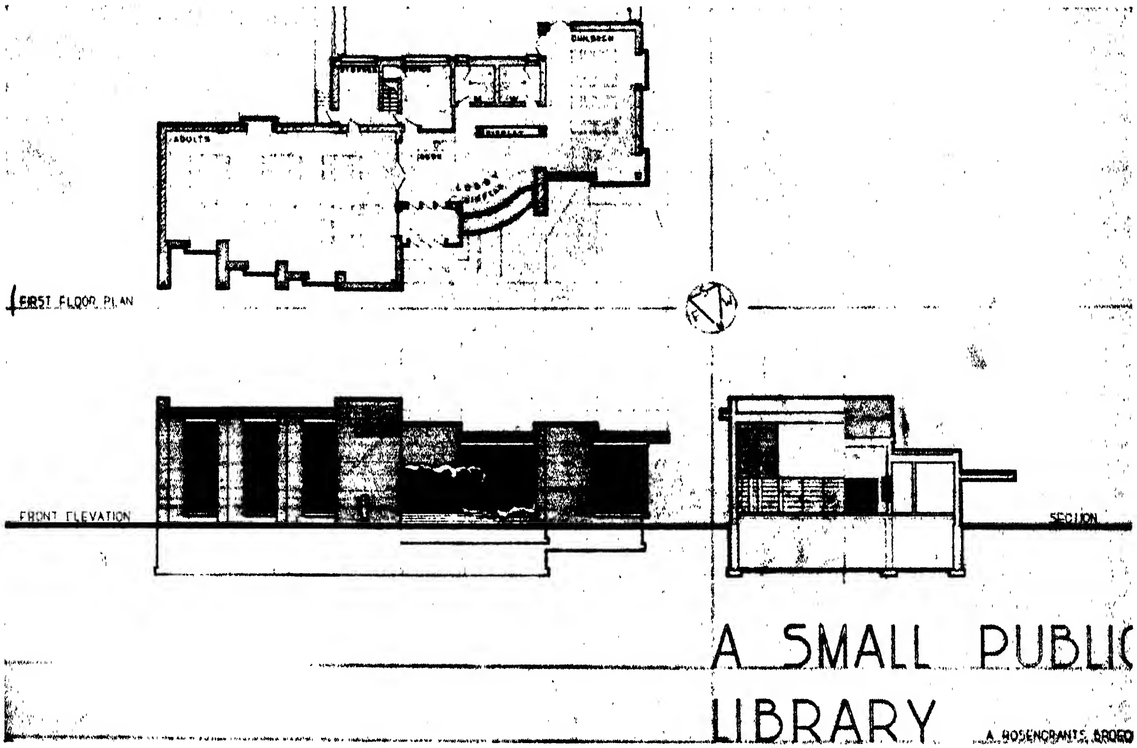
However, in spite of the various approaches to the teaching of architectural design, there is a certain uniformity in the curricula of architectural schools. This results from the necessity of training a number of young men to fit into the same society, to practice architecture under somewhat the same conditions, and to meet common requirements of registration boards. Throughout all the schools there is a general similarity in the major divisions of the work. The courses are grouped under such headings as Design, Construction, Presentation, Principles, and Backgrounds. Most schools are attempting to give the student an understanding of the culture in which he lives and the type of architecture best adapted to this particular civilization. It is chiefly in the methods of accomplishment that they vary.

TYPES OF PROBLEMS. The problems which are assigned at definite intervals to students of architecture should be progressive and sequential in nature and complexity. They may vary in length from one day to several weeks, depending on the hours per week which are devoted to a study of design. Problems may be classified as follows:

- Major Problems.
  - Elementary.
  - Intermediate.
  - Advanced.
- Minor Problems.
  - Sketch problems.
    - Elementary.
    - Advanced.
  - Theory exercises.

The Major Problems

These problems are criticized by the instructor and naturally constitute the greater part of the work in architectural design. They are usually of several weeks' duration and are studied completely and presented carefully. They may call for group or individual participation; that is, the entire class may take the same problem, or each student may choose his own subject and write his own program. When all students are given the same problem, there is bound to be competition and comparison of results. A student thus learns by seeing how his classmates have designed the same building. Life itself is a series of competitions for attention, position, and prestige, so the undergraduate might as well become accustomed to it during his school career. However, some schools believe that since each student has his own individual tastes, backgrounds, reactions, and abilities, he should be allowed to develop in accordance with these peculiarities. With this in mind, the student



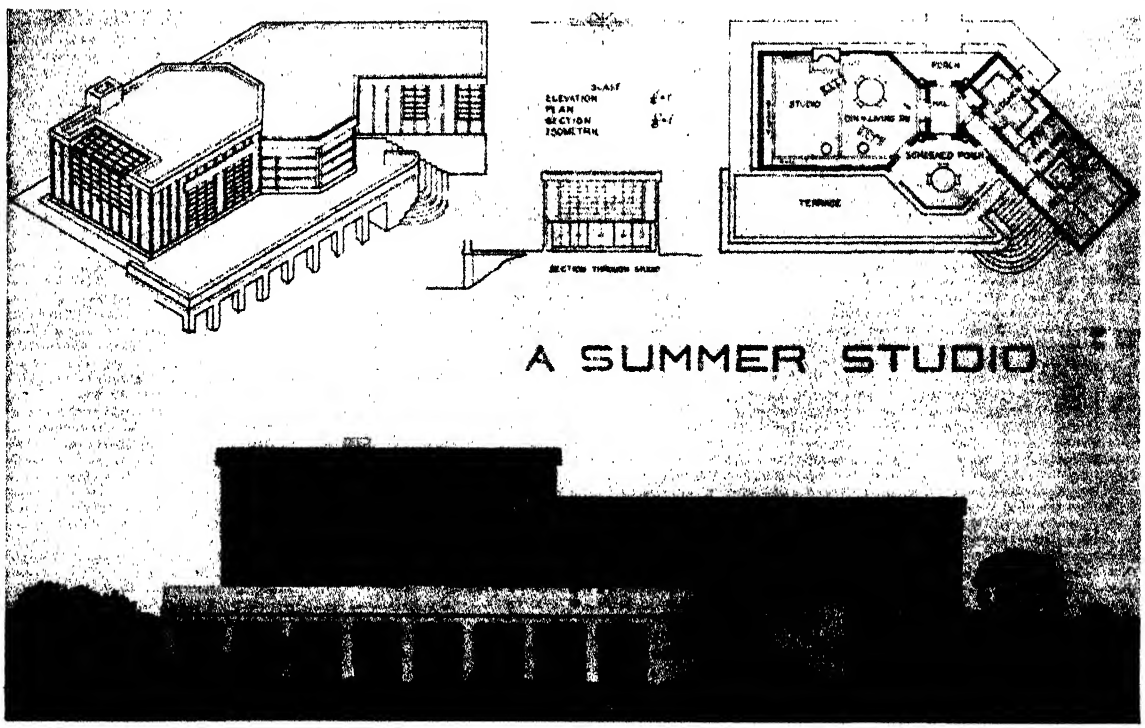


Fig. (A), above.—An elementary problem consisting of a few elements presented as a line drawing.
Fig. (B), below.—An elementary problem with the elevation rendered in water color.

may be given considerable latitude in his self-determination. Regardless of the system employed, education, to be the most effective, should be conducted so that the student may be allowed to educate himself. Criticism should carry him only to a certain point, and from there he should be permitted to proceed alone. Instruction and assistance in a mathematics class are given for a definite time. When quiz day comes, the student is on his own. The design critic and the student designer should collaborate during the early stages of the problem, but there comes a time when the instructor should step aside and allow the undergraduate to carry on. It is in this way that confidence and ability will be created.

It is, of course, difficult to give a concise definition of the different types of major problems, because their interpretation will vary with the separate schools. Those that would be considered elementary in some institutions would be of intermediate grade in others. On the whole, however, design should proceed from the simple to the difficult, from small buildings to larger ones, from a few easy drawings to several more ambitious ones.

Elementary problems may be distinguished by the following characteristics:

1. Few plan and exterior elements.
2. Simple functional requirements.
3. No complex human activities.
4. Elementary construction of bearing walls and simple roofs.
5. Simplified presentation.

Intermediate problems should come after a sufficient number of the earlier exercises have been done to insure a familiarity with the fundamentals of program analysis and plan composition. These problems will be more complex in nature and more difficult of solution. In general, these problems may embrace:

1. Plans composed of several units of varying sizes and functions.
2. More complex requirements, both architectural and human.
3. A greater number of exterior elements.
4. Simple skeleton structural systems instead of bearing walls.
5. More ambitious type of presentation.

Advanced problems belong to the later years when the student is mature enough to grasp the significance of the several phases of architectural design. These problems may deal with plan organization, construction, and finance, and may be much more complex in their nature than those of the earlier years. They may be concerned with the following:

1. Larger buildings, with several floors, or related, detached parts.
2. Group planning—with several buildings.
3. A large number of requirements related to function or use.
4. A more complex group of occupant activities.
5. A more elaborate structural system.
6. Demand for greater skill in presentation or rendering.

Summarizing a comparison between the various grades of design, it is found that the distinguishing characteristic is the size of the proposed building, as follows:

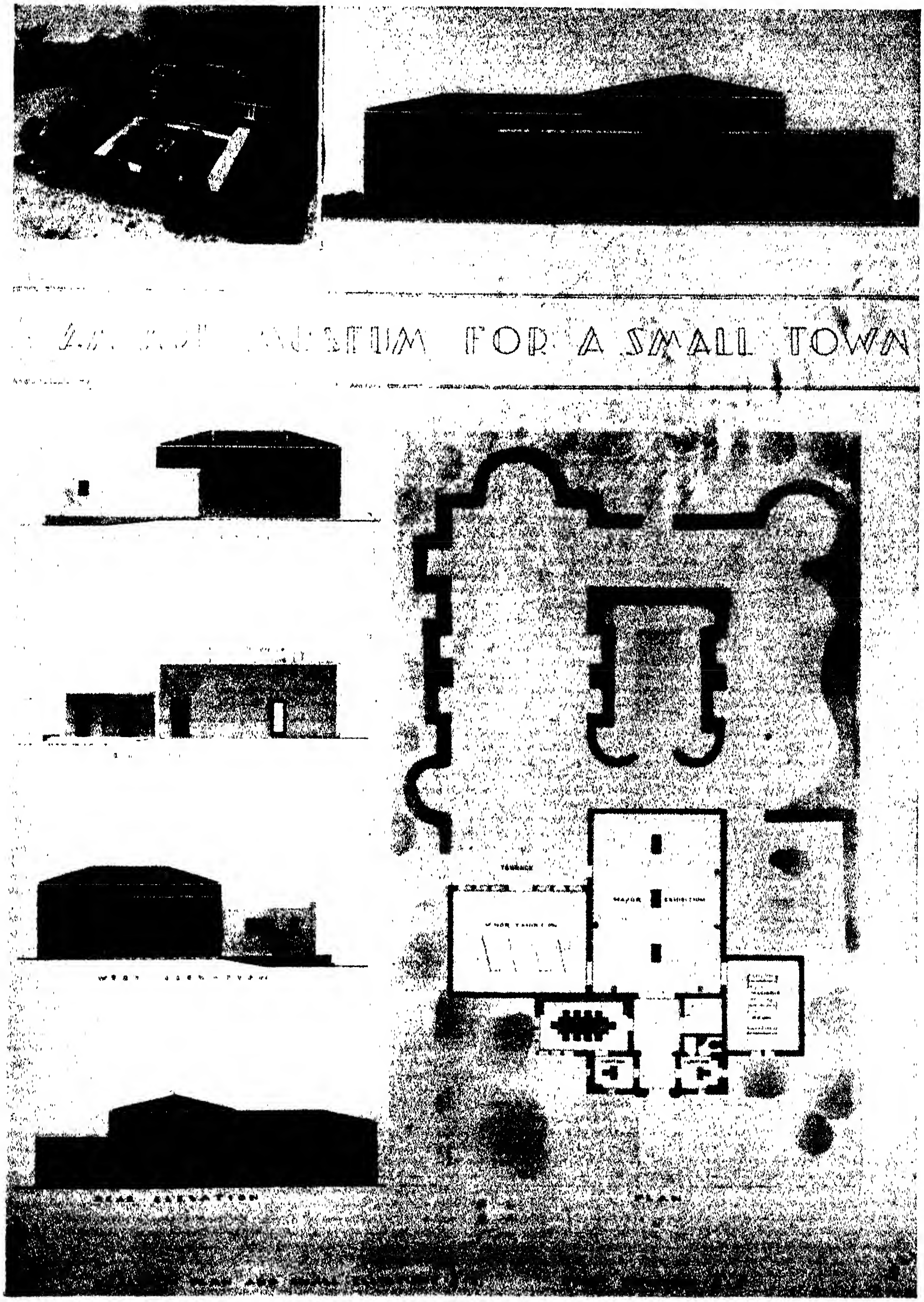


Fig. (a).—An intermediate problem rendered with airbrush and accompanied by a photograph of a model.

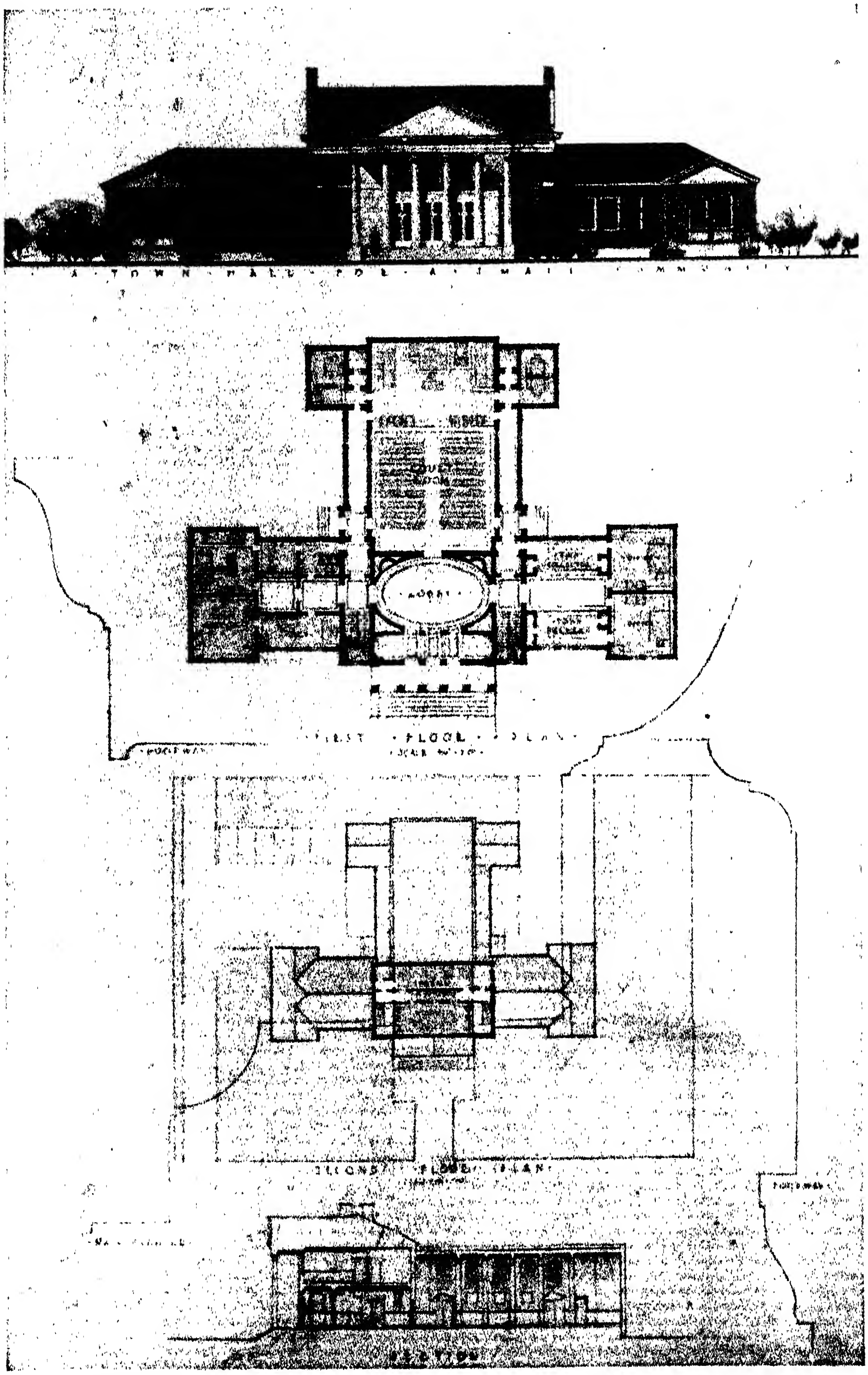
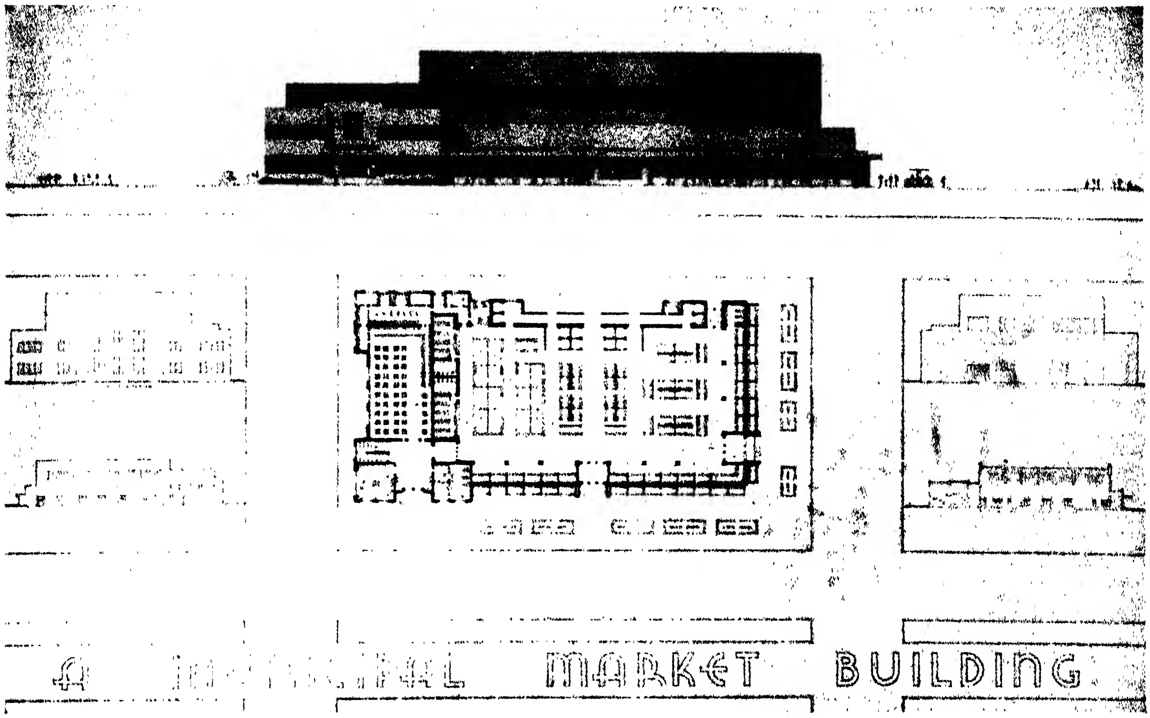


Fig. (a).—An example of the intermediate grade of design, interpreted in a traditional manner. Symmetrical composition, water-color rendering.



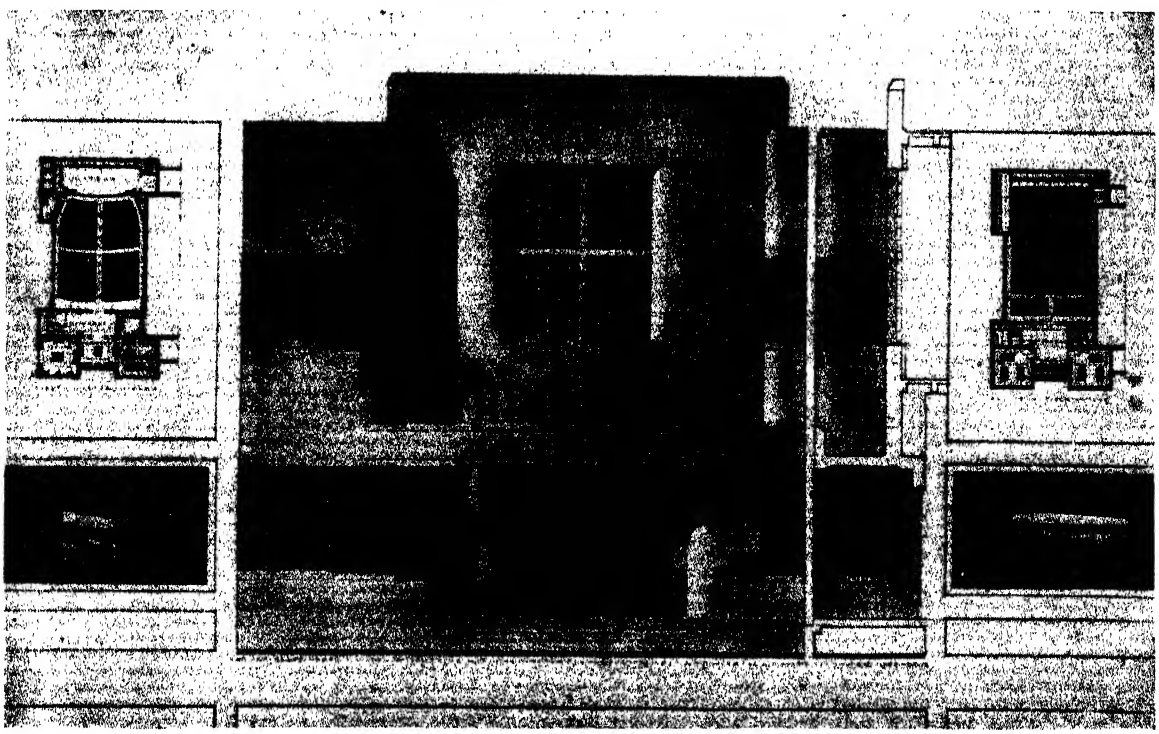
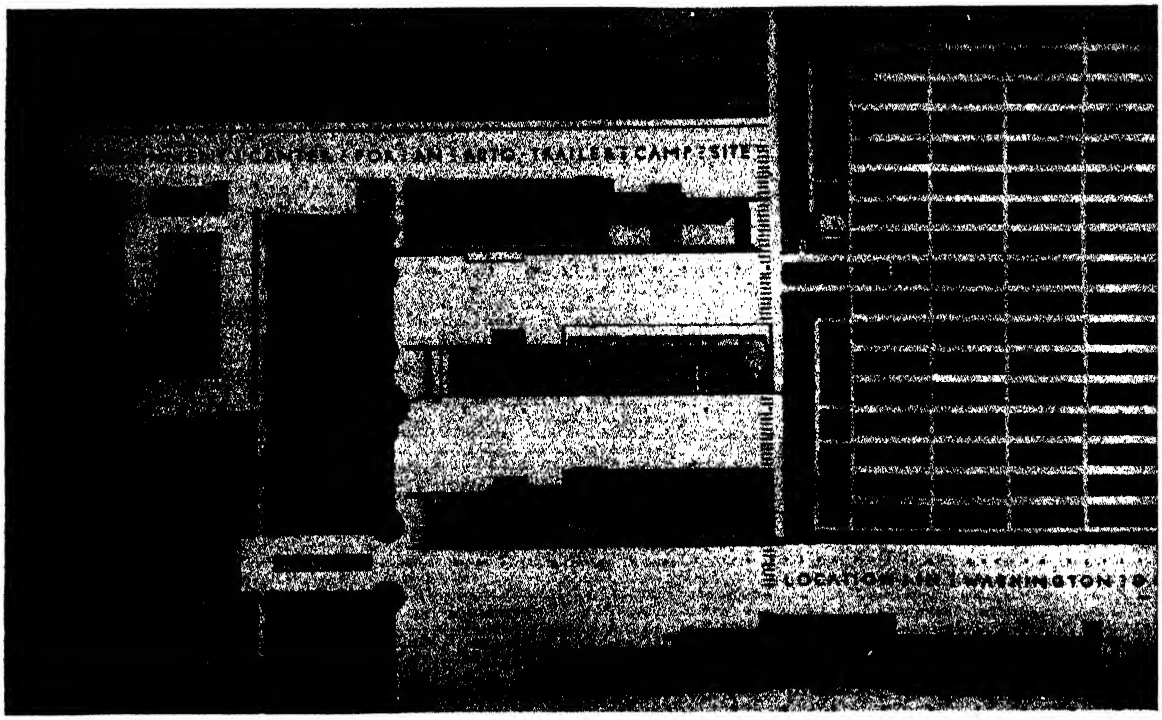


Fig. (A), above.—A problem in advanced design presented in a symmetrical manner by means ot airbrush and drafted lines.
Fig. (B), below.—Details, plans, and photographs of the building shown in Fig. 297 A.



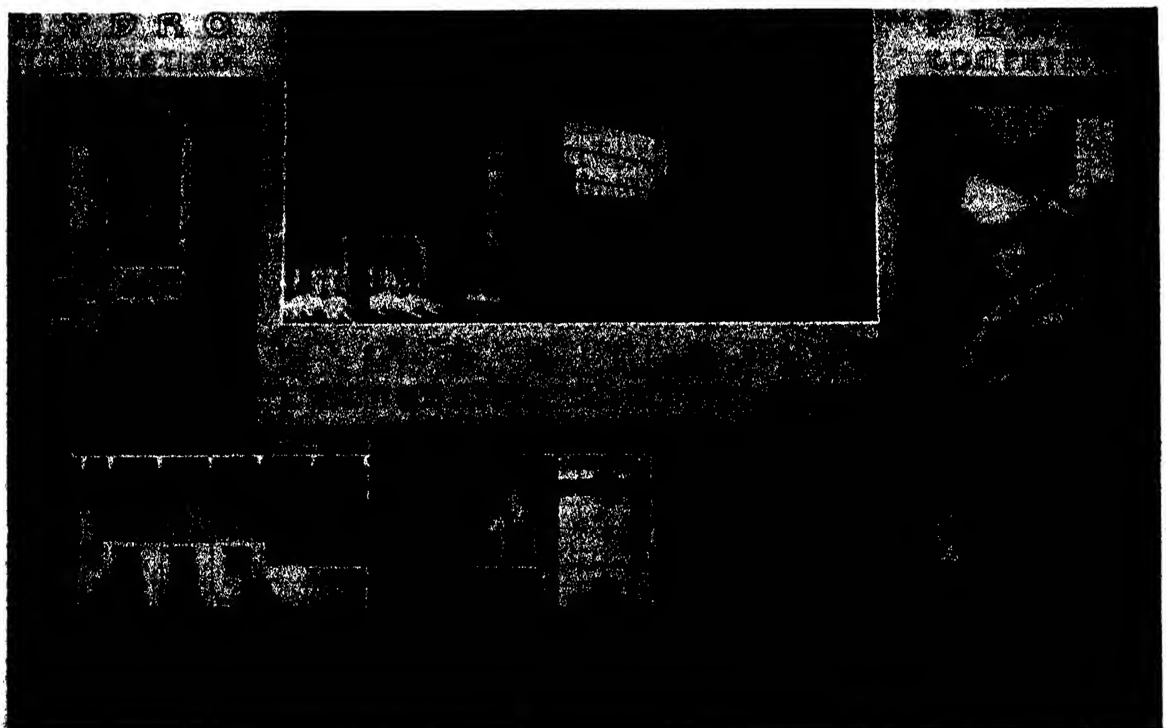
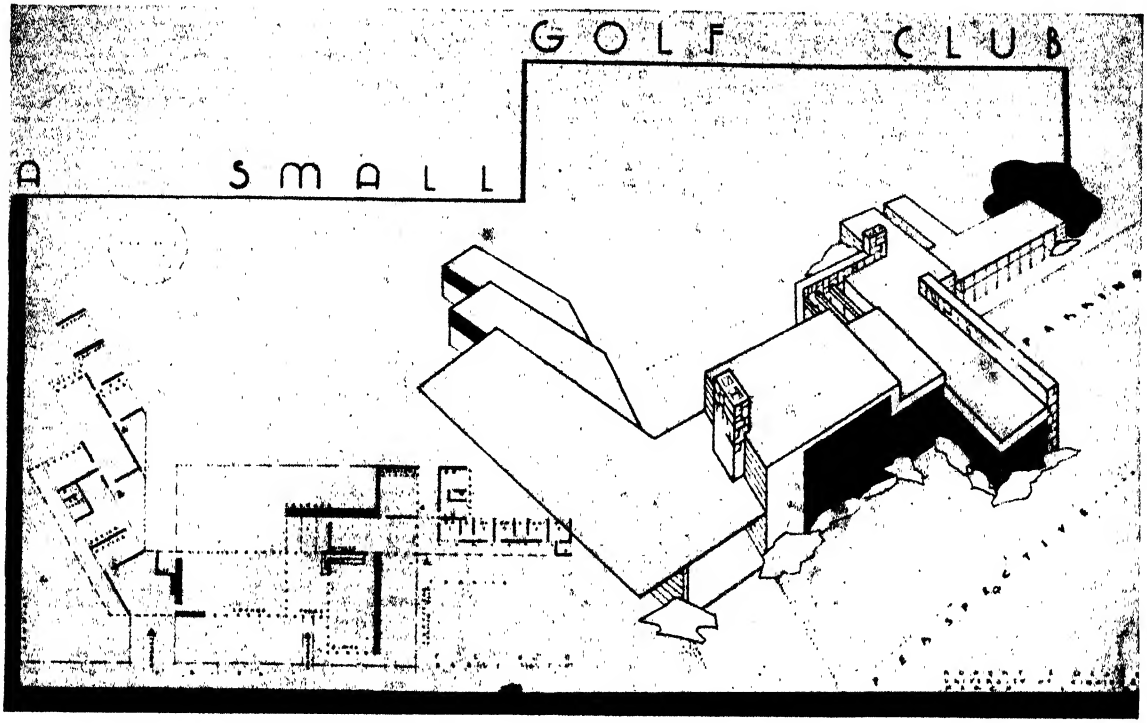


Fig. (A), above.—A problem in advanced design calling for a detailed study of the plot and of all of the various parts of the building.
Fig. (B), below.—A competition drawing for a hydroelectric plant with special emphasis upon the use of light. Rendered with airbrush.



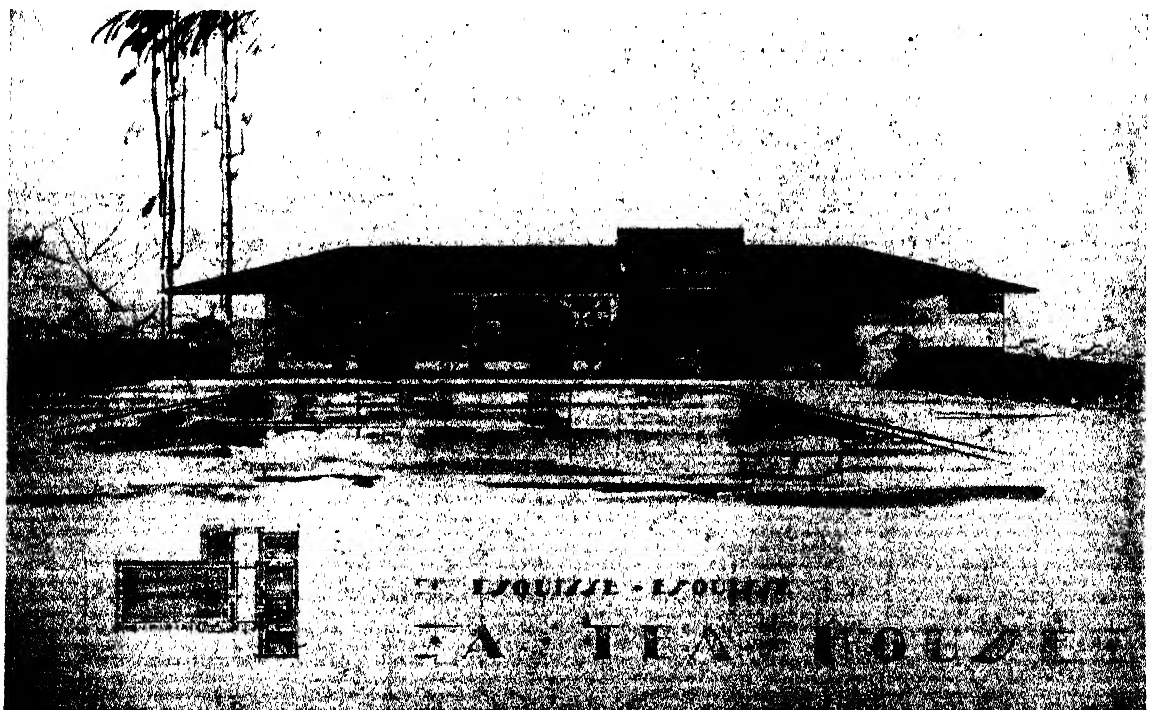


Fig. (A), above.—Ten-hour sketch problem presented in a mechanical manner in black ink. Compare architecture and rendering with Fig. B.
Fig. (B), below.—Sketch problem executed in a more traditional and realistic manner. Pencil and water-color technique.

Elementary	Intermediate	Advanced
Filling station.	Small garage.	Automobile factory.
Park shelter.	Auditorium in a park.	Zoological garden.
Marionette theatre.	Motion picture theatre.	Opera house.
Private dining room.	Small restaurant.	Hotel.
Town hall.	City hall.	State capitol.
Private gallery.	Small museum.	City museum.
Week-end cottage.	Suburban house.	Country estate.

The Minor Problems

In addition to the major problems, which comprise the main portion of the work in design, sketch problems are given to stimulate the imagination and to encourage the art of presentation. They usually consist of exercises which can be studied and drawn in sketch form on water-color board in one day's time. They call for rapid and logical thinking on the part of the student and also for the ability to express one's idea in a free but forceful manner. While the major problems are done with criticism from the instructor and help from the library and other sources, the sketch problems are executed without any assistance whatever, and are similar in nature to an examination of the student's knowledge of architectural forms and their application to current problems.

Exercises in connection with the teaching of theory of design are also desirable, especially in the early years of a course. There is much valuable information and philosophy which can be organized in the form of formal lectures or informal discussions. The points emphasized in these group conferences of students and instructor may be illustrated by exercises dealing directly with such subjects as:

> Planning for various human activities; informal and formal plan composition; relation of architectural and landscape plans; fundamental structural systems; construction details; application of the creative principles of design—contrast, balance, unity, character—to plans and exteriors.

These exercises may take the form of library research, and may be presented in the form of notes of readings and freehand sketches of typical examples. They may also be given as regular short problems of one day's or one week's duration, presented on sketch board, and devoted to the study of some particular phase of the theory of plan organization, exterior composition, or construction. Or they may consist of exercises calling for the making of small models of plastiline to illustrate the treatment of mass and the securing of contrast, balance, and unity. A study of these principles of composition in Chapter XIV will provide a background for these exercises.

TITLES OF PROBLEMS. The selection of programs for problems in design should not be left to chance. In some schools, the instructor writes part of all the programs; in others, programs are chosen and written by the students under the supervision of the critic. Regardless of the method, an effort should be made to insure that the student's experience in design extends into most of the various fields of architectural planning. He should not confine himself to a few types of buildings because his contacts with the many and varied possible kinds of structures will be limited. During his years in the school drafting room, he should design churches, factories, houses, museums, hospitals, and shops.

The following classification of buildings according to function will serve as a guide to the selection of typical programs:

> Ecclesiastical, educational, commercial, residential, industrial, recreational, fraternal, governmental, memorial, transportation, rehabilitation.

Under each of these general headings are to be found several types of structures. For instance, the term "educational" may include schools, colleges, museums, libraries, kindergartens; while associated with recreation are golf, tennis, beach, night or city clubs, playgrounds, theatres, and sports arenas. The list may be expanded indefinitely, but this is sufficient to show a method of checking on the various types of problems available for study.

This does not mean, however, that it is necessary for the student to design every kind of building in existence. This is a physical impossibility. Instead, he should choose only representative examples of each of the major types, so that he will have experience of a general nature. He need not be familiar with every detail of the requirements of many structures. A program should include only the items of major importance which might affect the general architectural scheme. The requirements should be real, based upon fact, and potentially productive of a building which will function in a practical and satisfactory manner. But if the program becomes too long and involved, the student may become lost in a maze of technical requirements which have little bearing upon the fundamental solution. The student should have some experience with a number of types of buildings, instead of spending a great deal of time on a few problems. If desired, an occasional problem may be selected for a more complete study, with construction details and written reports. Programs should be chosen which will give familiarity with all types of plans—formal and informal—with various kinds of exterior massing and treatment, and with a number of buildings according to function. The student should be interested in developing a method of study rather than learning a great deal about the ever-changing technical requirements of a few buildings. His choice of programs should emphasize principles and procedures and should stimulate his powers of organization.

Chapter XVII

THE DEVELOPMENT OF THE PROBLEM

In order that the process of design may be sequentially organized, it is desirable that it be divided into definite steps, each with its own allocation of time and type of study. These usually consist of the following:

1. Program Analysis.
   The analysis of the major requirements of the problem.
2. Preliminary Studies.
   Informal studies of the general scheme, together with research in the library and in the field.
3. Intermediate Studies.
   The further development of earlier studies, with more attention paid to details and accuracy.
4. Presentation Drawings.
   The final drawings, with photographs, models, construction details, and reports.

There is, of course, no clear-cut line of demarcation between these various steps in the development of a problem. When a student begins the study of a design for a building, he is interested in arriving at a satisfactory solution as quickly and efficiently as possible. In order to do this it is desirable to work out a systematic method of procedure, based on the above sequence. The different stages of this allocation of time tend to merge with each other. The analysis of the program is a process which continues to some extent even until the presentation of the final drawings. The designer is always studying and modifying. As the problem develops, each change may call for other adjustments, so that a problem in architectural design is always in a state of flux until it finally crystallizes into the form of the presentation drawings. In spite of this overlapping of the different steps, a general division of time and labor is recommended as an aid to a well-organized schedule, otherwise confusion may exist.

There can be no definite amount of time assigned to each of the individual steps in the development of a problem. But one thing which is certain about the development of a problem is that there is a great deal of lost time and motion during the process of study. This is particularly true of undergraduates and of those who are less experienced in the matter of design. Skilled designers can foresee possible mistakes before they are made, but beginners must try out their ideas in order to discover that the scheme will not work. Most of the time is lost during the early stages of a problem, during the period assigned to analysis and to preliminary studies. The student should arrive at a general solution as soon as possible in order to leave sufficient time for the proper development of all the various phases of the problem. In this way the intermediate studies and the final presentation of drawings will be thoroughly studied and correctly executed and will show the designer's interpretation of the problem in a concise and logical manner.

Program Analysis

Unless the student proceeds in an orderly manner from one step to the next, the probable lack of familiarity with terms and methods will bring about a state of confusion which will prevent an understanding of fundamental principles. For this reason a consideration of the method of applying one's efforts to the solution of a problem is of primary importance at this point.

THE PROGRAM. As soon as the student enters the drafting room or atelier to take a problem he is handed a printed program or is asked to prepare one. The purpose of the program is to present a clear-cut statement of the nature of the problem. The program describes in a brief manner the function, location, and general requirements of the proposed building or portion of the building. The scale at which the drawings are to be made and the nature of the presentation are also indicated. It is from this program that the student is required to develop the preliminary sketches, which will be discussed later in this chapter.

ANALYSIS. As soon as the program is carefully read, the student should begin to form mental images of the proposed building. He should ask himself questions about the problem and write the answers down, correcting and modifying them until he is confident that he has a clear visualization of the general character of the structure. If the subject is a complete building, such as "A Park Shelter," the student inquires as follows:

Should the building be light or heavy, delicate or robust?

Should it be enclosed or open?

What type of plan is to be preferred, square, circular, or rectangular?

How is it to be roofed?

It is only by such a mental process that the student can put himself into a receptive frame of mind which will encourage the flow of ideas contributing to the solution of the problem.

If the building is a more complex one with several elements, the student may ask the following questions:

Which units are of major and of minor importance? Which should dominate the composition? What are the purposes of the various rooms? Are they for *circulation*: corridors and lobbies; for *assembly*: auditoriums and lecture rooms; for *display*: exhibition halls, and galleries, for *withdrawal*: rest rooms and private offices; for *recreation*: lounges and gymnasiums; for *study*: reading rooms and libraries; or for *work*: shops and laboratories? This list could be expanded still further, but it serves to illustrate the use to which units are put. The function should determine their size, shape, location, and general treatment.

The student should now put down upon paper the titles of the different parts of the plan in the order of their importance. Their areas should be compared and studied. Do their use and the site call for a symmetrical or unsymmetrical building? In arriving at a solution, many schemes and combinations may be tried. Small block plans, Fig. 309, which include the proper elements, should be made, and these should be organized about axes so that there is logic and order to even these first sketches. Plans and elevations, together with a perspective or a small, quickly executed clay model, should be made. The model will permit an inspection of mass and will emphasize the fact that architecture has a third dimension, a point that is often disastrously overlooked when one is working only in elevation. Sketches analyzing simple programs follow on succeeding pages.

The student should sketch on tracing paper with a soft pencil, trying out all the various ideas which present themselves. He is now interested only in general proportions. He should draw small plans, sections, and elevations, discarding those which do not apply and retaining those which offer possibilities of development.

COMPARISONS. In order to illustrate the way in which a program may be analyzed by sketching, and how function, site, and materials may affect the character of a building, there are presented on page 305 four small, one-unit structures which are similar in size but dissimilar in appearance and use. They represent four types of character—funereal, recreational, domestic, and utilitarian—but they are all developed from the same type of plan by the use of different materials and a consideration of different requirements. The comparison follows:

MAUSOLEUM (Fig. 305 A)

FUNCTION—To protect the bodies of the dead and to perpetuate their memories.
SITE—In a cemetery or a private park, probably level.
MATERIALS—Stone, dressed and laid up in such a manner as to create a monumental effect.
CHARACTER—Should be dignified and have a feeling of permanency.

CONCESSION BOOTH (Fig. 305 B)

FUNCTION—To provide a space for the display and sale of refreshments and novelties.
SITE—In an amusement park or on a private estate, usually level.
MATERIALS—Light and temporary, such as wood and cloth; capable of being easily erected and quickly removed.
CHARACTER—Should be decorative and festive, with bright colors to attract buyers.

GATE LODGE (Fig. 305 C)

FUNCTION—To mark the entrance of an estate and afford shelter for those in charge.
SITE—Possibly in a wooded area, level or sloping.
MATERIALS—Should correspond with those used in other buildings of the estate—brick, fieldstone, etc.
CHARACTER—Domestic and informal, with no attempt to rival the main buildings.

FILLING STATION (Fig. 305 D)

FUNCTION—To provide quarters for the sale of gasoline and oil and a shelter for the attendants.
SITE—Facing a city street, level and open to permit an advertising-value view of the building.
MATERIALS—Light but permanent, economical of construction; possibly steel and glass.
CHARACTER—Utilitarian, but with the elements composed in accordance with the rules of good design in order not to detract from the appearance of the neighborhood.

Thus numerous types of structures may be developed from a unicellular plan, as the result of the influences of purpose, location, and construction.

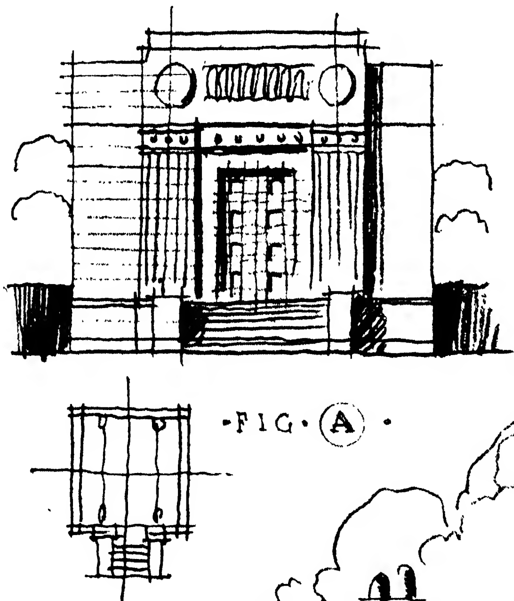


FIG. (A)

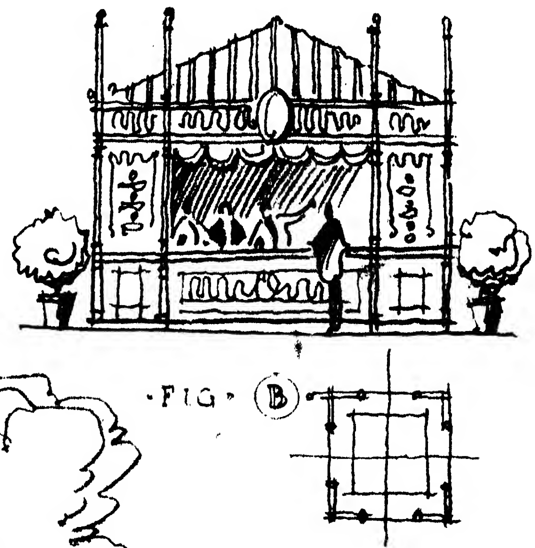


FIG. (B)

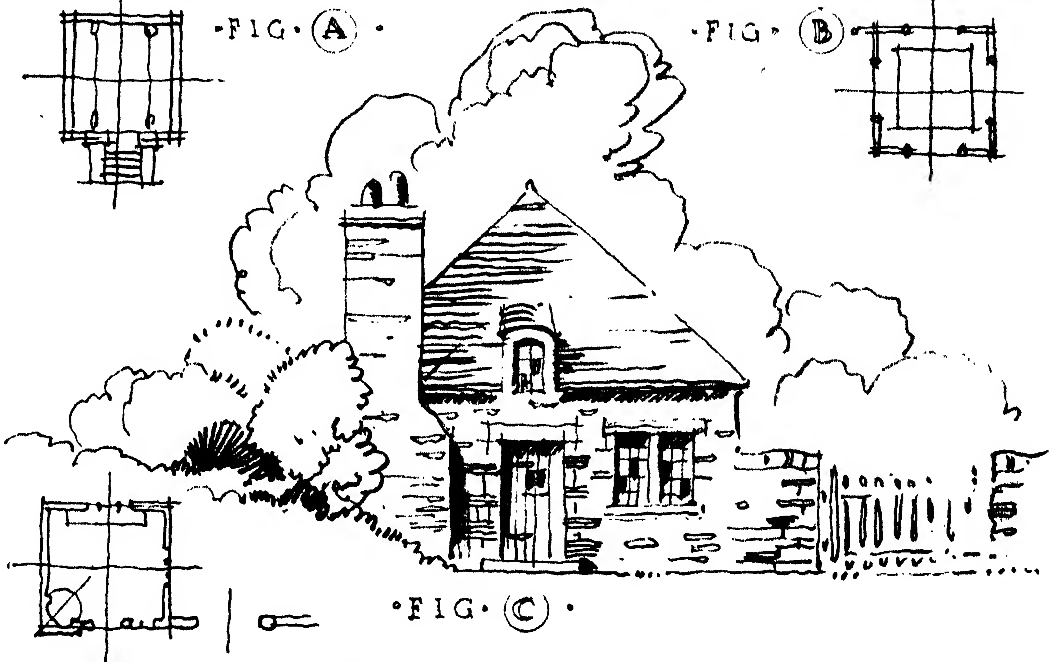


FIG. (C)

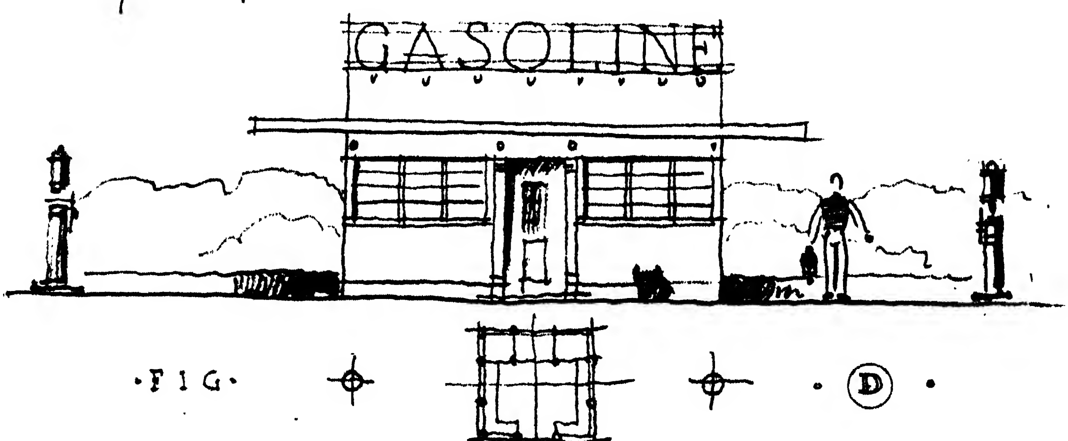
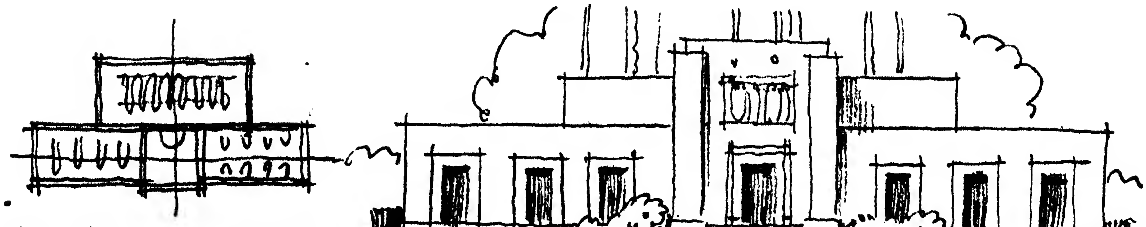


FIG. (D)



·FIG·A· A·LIBRARY·

Fig. 306 A above shows a sketch for a small library. The public character of the building is reflected in the comparatively large lobby which gives access to the reading rooms. The stacks at the rear are adjacent to the librarian's desk in the lobby, which makes for ease of circulation and supervision. The exterior reveals a simple, dignified building designed in the contemporary manner with a restrained use of detail. The reading rooms are indicated upon the main elevation by the use of large windows to light the interior.

·FIG·B·R·R· STATION·

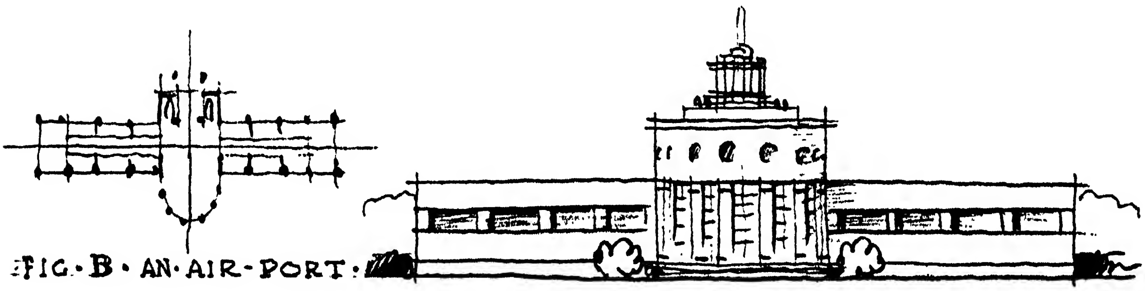
The railway station above, Fig. B, is one planned for a small suburban community. It is unpretentious and would harmonize with the character of the architecture of the village. The waiting room, from which open the ticket office and the baggage and checking rooms, is the most important element of the plan and deserves the central position which it occupies. Upon the exterior the public character of the building is disclosed by the use of the three large entrances.

·FIG·C·A·MUSEUM·

The small museum, Fig. C, belongs to the educational type of building, as does the library previously mentioned. Here, instead of studying books, the public will study objects of art, which usually requires top light. This makes windows undesirable and gives that character to the building which is so distinguishing. Ample wall space and ease of circulation are typical of the plan, and the exterior assumes the dignified and slightly monumental appearance which was also found in the library.

·FIG·A·· BEACH·CLUB·

The airport in the above sketch is simply a new relative of the railway station. It is one of the modern buildings which have resulted from this age of science and commerce. There is so little precedent for the design of air terminals that they may develop unhampered by tradition. Usually they are located some distance from the city and do not have to harmonize with the architecture of a civic centre. The plan should be direct and business-like, whereas the exterior may express the trim lines of the airplane itself.

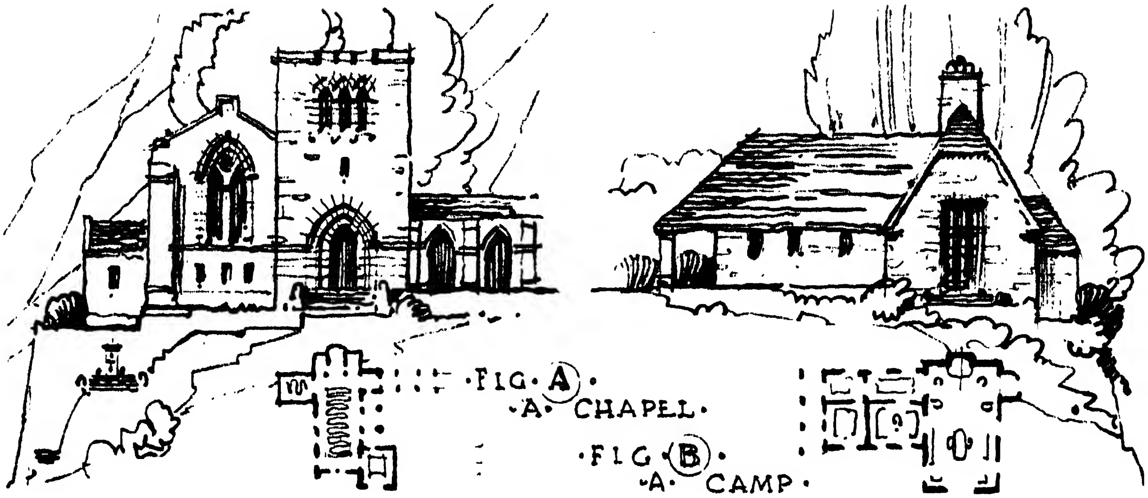


·FIG·B · AN·AIR-PORT·

The beach club above shows a plan which is unsymmetrical in its arrangement. This results from the number and the type of the units and from the desired character of informality. The seaside, with its sparkle and color, demands an architecture which is domestic rather than monumental, gay rather than sober—a place for relaxation. The lounge should be so placed that a view may be had of the beach and advantage may be taken of the ocean breezes. The plan generally should be open and spacious.

·FIG·C·A·TOWN-HALL·

The designing of a town hall involves the problem of developing a plan which functions in a logical manner together with an exterior which has the dignity worthy of a public building. The various offices of the village on the first floor and the assembly hall or court rooms on the second floor should be readily accessible to the townspeople. The different functions of the building are revealed by the above drawings, the importance of the second floor being indicated upon the elevation.



·FIG·A· ·A·CHAPEL·

·FIG·B· ·A·CAMP·

An unsymmetrical and informal arrangement is typical of the two buildings shown above; the chapel in Fig. 308 A and the camp in Fig. 308 B. The purpose of the ecclesiastical building is to seat the congregation so that its members may face the altar and participate in the ritual of the worship. The English Gothic style has been so satisfactory in its interpretations of religious architecture that it has served as the source of inspiration for this example. The tower constitutes the dominant element upon the exterior and gives dignity and importance to the building. The entire composition reflects a feeling of permanence and serenity which are conducive to the spirit of reverence.

A camp is built to escape from the restrictions of city life. The heat and noise of the streets are to be left behind and forgotten—the plan should be open, to catch the breezes of the lake or mountains. The servant problem is often omitted from camp life—the plan should be simple to make for ease of maintenance. In the example above, the large living room is the important feature of the building. Here are centred the indoor activities of camp existence. The bed rooms and the kitchen occupy the minimum amount of floor space, because the making of one's toilet and the preparation of food, though necessary, are often casual processes during a vacation. The exterior appearance of a camp should be informal in its use of local materials.

The shop, Fig. C, presents a problem which has not been discussed in connection with the preceding examples—the necessity of earning money. The success of its solution will be based largely upon the manner in which articles may be displayed for sale and the ease with which the operation of merchandising may be carried on. Assuming that the standing of the merchant and the quality of the merchandise are satisfactory, the greatest appeal of the shop will be a visual one—that of the exterior. The architect must be familiar with the psychology of selling; the design must insistently, but with dignity, call attention to the windows and to the entrance. Refinements in character will make it possible for one to tell whether the building houses a perfumer's shop or a green-grocer's store.

·FIG·C·· ·A·SHOP·

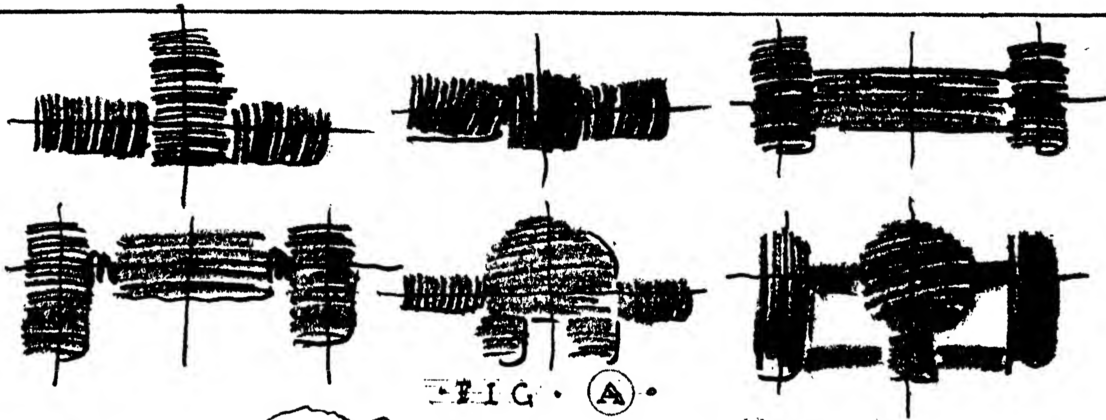


FIG. A

FIG. B

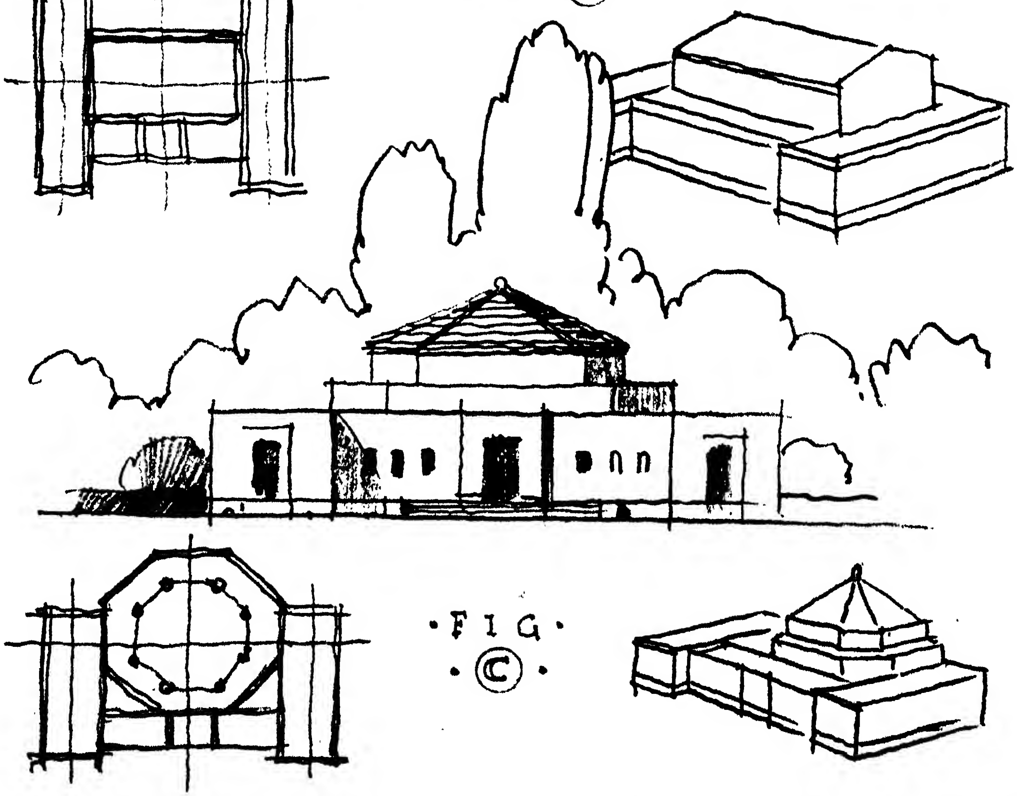


FIG. C

With the average problem, many sketches and much mental effort may be necessary before a satisfactory idea presents itself—the nature of the work, however, usually not demanding drawings beyond the ability of the student to perform. He may, nevertheless, feel inclined to become discouraged because ideas do not readily come to his rescue and to believe that he has no ability in design. Perhaps only time and trial will reveal the truth or falsity of this assumption. The path of the architectural designer is beset with many harassing impediments, but they may usually be overcome by diligent application. Very few are the brilliant designers to whom clever solutions come without much study. It is only through efforts similar to those on page 309 that a place is reached where the student is in a position to select a scheme for further development. It is evident that several of the sketches here shown must be discarded because they do not fit the requirements of the problem. They may lack proper character or may not be entirely satisfactory in their proportions or scale.

During the analysis of the program, the student is asked to select the scheme which he thinks best represents the correct solution of the current problem. This requires considerable study and sketching upon the part of the designer. and, in addition, confidence in his own decisions. He must choose between the ideas which he has developed. Mental efforts alone do not create architecture, but the student will benefit from his work in proportion to the amount of thought which he devotes to it. The student must learn to rely upon his own ability; he must not lean too heavily upon the shoulders of the critic. He may develop under the guidance of the instructor, but his own imagination and individuality should influence the solution of the problem.

THE ESQUISSE. After a scheme has been chosen by the student as his interpretation of the best solution to the problem, it may be presented in the form of a sketch known as the "esquisse." This is a freehand drawing made in ink on tracing paper at a small scale, similar to those on page 309, or presented in sketch-problem form. Its purpose is simply to show the main idea of the "parti," and for this reason it should not attempt to go into detail. It indicates where the major plan elements are located, whether the plan is symmetrical or unsymmetrical, whether the mass is vertical or horizontal, and whether the general character is light and graceful or heavy and rugged. This is all that should be attempted in the esquisse, for the student cannot be expected to tell in a short time a story which is to require several weeks' work.

The esquisse, instead of being completed in a few hours' time, may also be studied more thoroughly for a period of several days. It may be done with help and criticism and may take on the nature of a preliminary sketch. In either form it represents a definite stage in the development of the problem and helps to insure satisfactory progress toward the completion of the work.

The program and the esquisse in the school or atelier take the place of the client in actual practice. They impose restrictions more or less similar to those which are met in an office. The esquisse itself also prevents undue influence from critics, fellow students, and solutions which may be found in the library. There is always a temptation to make the current problem fit a similar situation which has been seen in the documents or magazines, rather than to allow the requirements of the program to dictate the final results. The esquisse makes this difficult to accomplish and also prevents aimless and careless thinking in the process of design. The student must reach a decision, early in the problem, about the merits of the general scheme and then carry out its development as his own effort instead of being intrigued by the work of others. The esquisse helps to insure originality, and even though the subject may be announced in advance—allowing time for research—the requirements of each problem vary so much that it is difficult to come to the drafting room with many preconceived and inflexible ideas.

SCHEDULE. After the general scheme has been selected, with or without the esquisse, the student should work out a schedule which will cover the development of the problem. Experience will tell the amount of time which should be devoted to the various steps associated with the studying of the required drawings. During the first week or two, the student will usually be concerned with small-scale studies which show only general relations and proportions. During the last part of the scheduled time, he must bring the drawings up to final scale, and make decisions regarding the more specific details which are to be shown. Care should be taken to see that satisfactory progress is made from day to day and from week to week, and that the student does not simply mark time with some idea which has little application or appears impossible of solution. The last few days of the four or five weeks spent on a problem should be devoted to the preparation of the final drawings—to inking and rendering. If sufficient time is not allowed for this phase of the work, the results will appear hurried and incomplete.

Preliminary Studies

The first step following the analysis of the program will be the criticism of the preliminary efforts. This may be an individual matter upon the part of the student, the critic, or both, or it may be in the form of a general discussion of the program and an indication of the several possible variations of the solution. The student should then make his first study of the criticized sketch, which should be at a scale larger than that of the earlier drawings, or probably at one-eighth or one-quarter inch equals one foot. This sketch should consist of a plan, elevation, and section of the subject, and it should be ready for the instructor to see when the time comes for him to inspect these efforts. The student must have ideas beyond those revealed by the early sketches, and he must also be able to express these thoughts. The presence of a student in a school of architecture presupposes a proved or fancied ability in design. If this ability is not present, either in active or potential form, no amount of instruction in the process of developing a problem will insure a successful design. However, a logical and intelligent method of procedure will help to bridge the gap between the desire to design and inherent or developed ability.

The preliminary studies made during the first few days of a problem should be done freehand on tracing paper. They should attempt to show only general proportions and character, leaving the actual details for later consideration. The sequence of these sketches should be from the general to the particular, but the results should be based upon thought and not mere impulse. Here it is that the student with the ability to put his ideas down upon paper in an understanding manner has the advantage over the one who cannot so express himself. The drawings of the individual who has little to say and no means of saying it are usually meaningless. Often the person who has much to say is handicapped because he does not know how to present his acquired knowledge to those who may be interested.

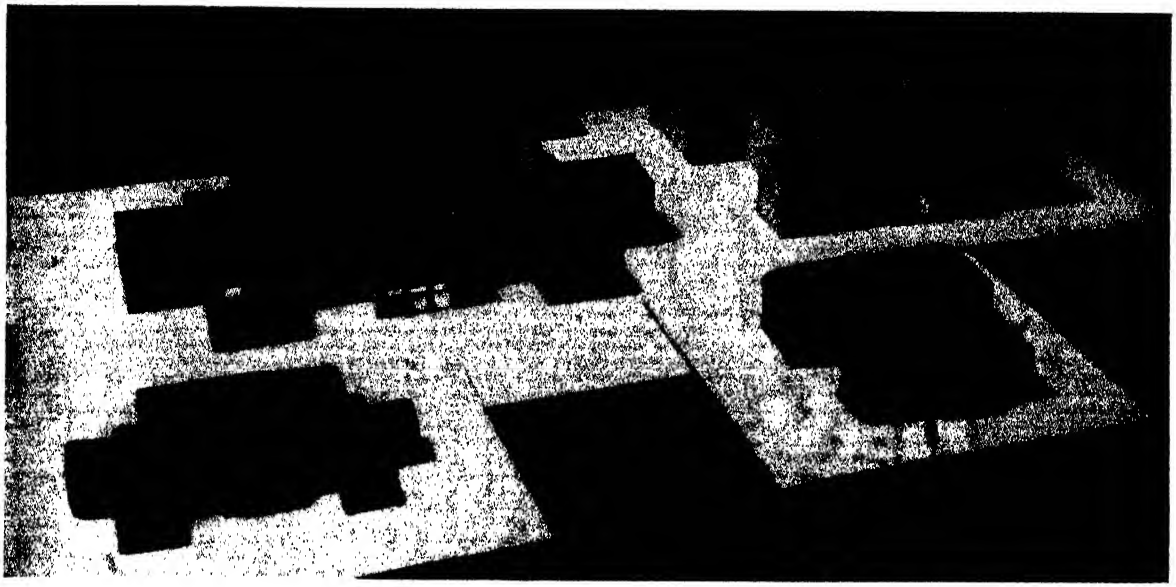
These early sketches may be developed in connection with space models, as shown on page 313. Small models of this type enable the student to study the volumes of the different units of the building and their relationship to each other. These models, together with small clay models to show mass, give a quality of realism to architectural design which is lacking in two-dimensional drawings.

The student should not be in a hurry to draw with the T-square and triangle, for to do so at too early a stage simply hampers progress. During the first few days, he may even forget that he owns such instruments. Drawing freehand not only trains the hand and the eye, but it also encourages more rapid thinking on the part of the designer. The student should begin with the plan and proceed to studies of volumes, masses, and surfaces. The frame of mind with which the student approaches these preliminary studies is of utmost importance. If he interprets walls and windows, in plan or elevation, with hard, mechanical lines, he may fail to make satisfactory progress. The preliminary sketches should be regarded as being as plastic as a piece of clay, to be pulled in this way and that at the will of the designer. This is the reason why the T-square and the triangle should not be used until the "parti" is well established. These implements do not lend themselves to the flexible state in which the idea should be kept until it is finally crystallized. Many freehand studies, which are more sensitive to changes in proportion and character, may be made in less time than is required to do a single drawing with the instruments. There is no need of making a laborious drawing when a quick sketch, or a small space or mass model will be more satisfactory. Lack of ability often discourages progress in the study of design, but failure to understand an adequate method of study is frequently responsible for poor results. Students are often too economical of tracing paper and pencils, or of effort of mind and hand. An inspiration does not usually come by simply looking at the paper—only by sketching will thoughts and possible improvements present themselves as aids to the solution. An idea should be tried; and if it is not successful, another attempt should immediately be made upon a sheet of tracing paper placed over the first. The early efforts should not be quickly discarded—the drawings should be built up, one over the other, the student profiting by the advantages or mistakes of each successive sketch.

One item so often overlooked in connection with school problems is the influence of construction and materials. The areas enclosing architectural space are not abstract surfaces. They are composed of brick, stone, metal, glass, or wood, each with its own particular thickness, weight, and other physical characteristics. These qualities should be considered during the process of design.

As soon as the plan is developed and as volume is created by the vertical growth of surfaces, the designer should try to visualize the structural system which will rise from the foundations. If the building is a small one, the structural scheme may consist of simple, bearing walls with a pitched or flat roof. But even these elements have size, thickness, and strength. With larger buildings, there is usually a skeleton structural system of wood, steel, or concrete composed of vertical piers or columns, and horizontal beams, trusses, or arches, The space-enclosing surfaces, or walls and roofs, are usually applied merely to these structural members; but all should be related correctly with reference to function and appearance. Construction and exterior design are so closely connected that they should be studied together. The exterior should express the structure, and the structure should contribute to the success of the exterior. School problems need the collaboration of both the design and construction critics, as is the procedure in the architectural office.

LIBRARY RESEARCH. Thus far in this chapter our remarks have been confined



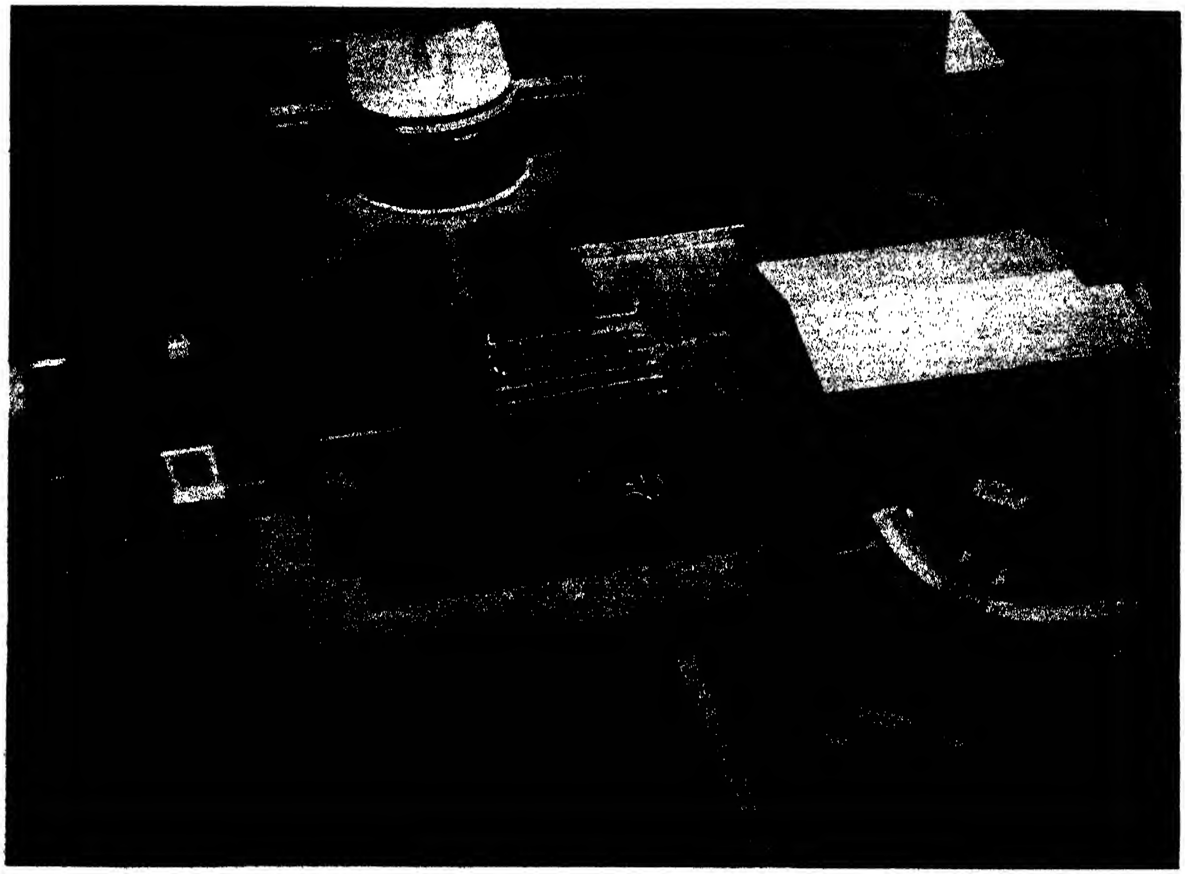


FIG. (A), above.—The early stages of problems in design, showing the use of small clay models and their development into balsa-wood space models.

FIG. (B), below.—A composition of small architectural models executed for the purpose of studying massing, volumes, proportions, and fenestration.

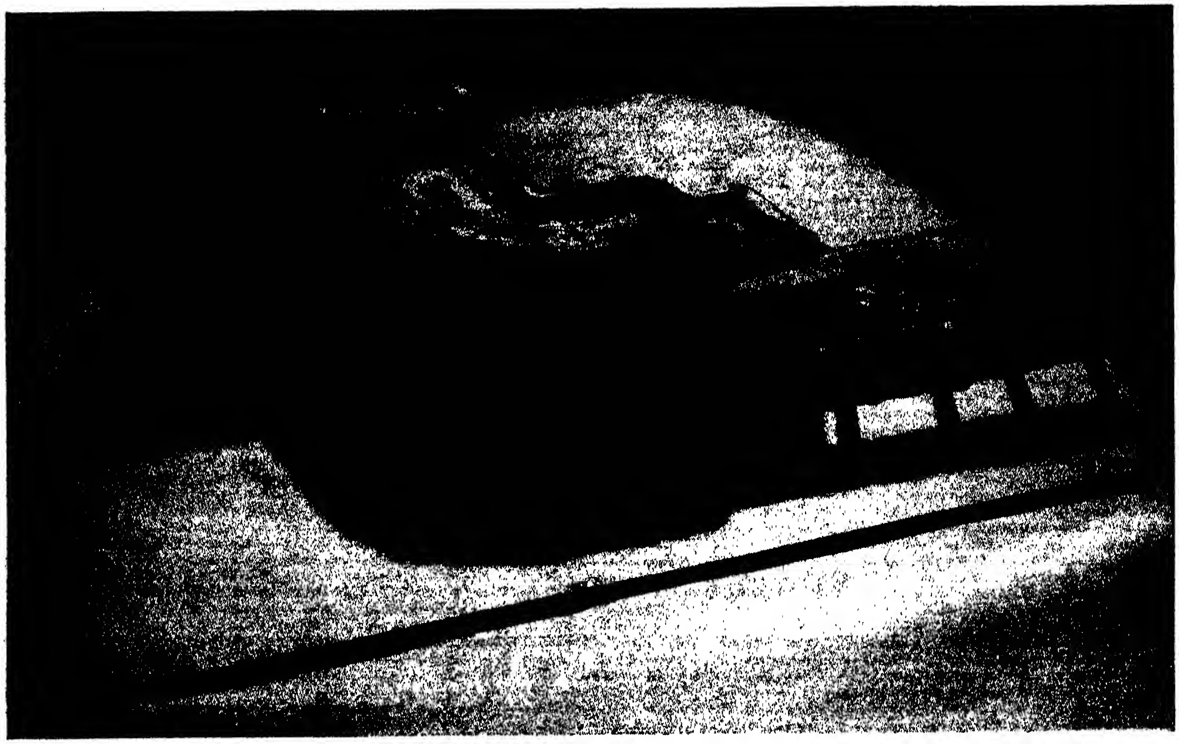
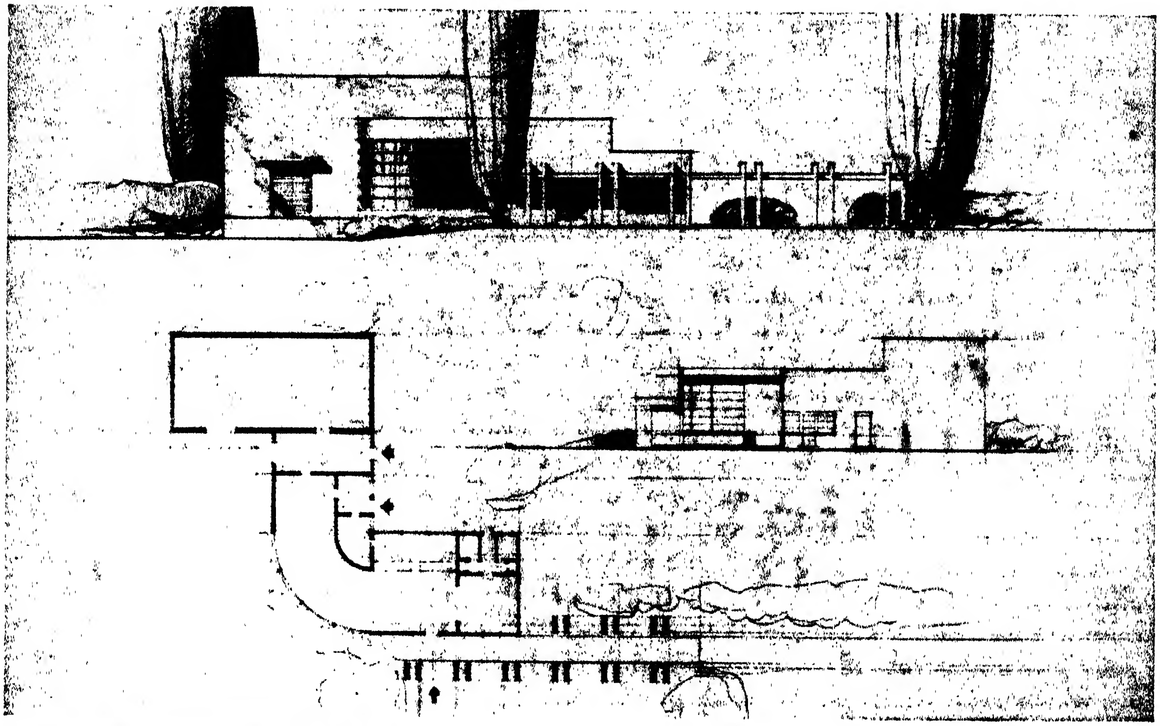


FIG. (A), above.—A clay model of the problem shown on page 315. This is an early step in the development of preliminary studies.
FIG. (B), below.—A space model showing the relationship of volumes, made to help interpret the preliminary study shown in Fig. 315 A.



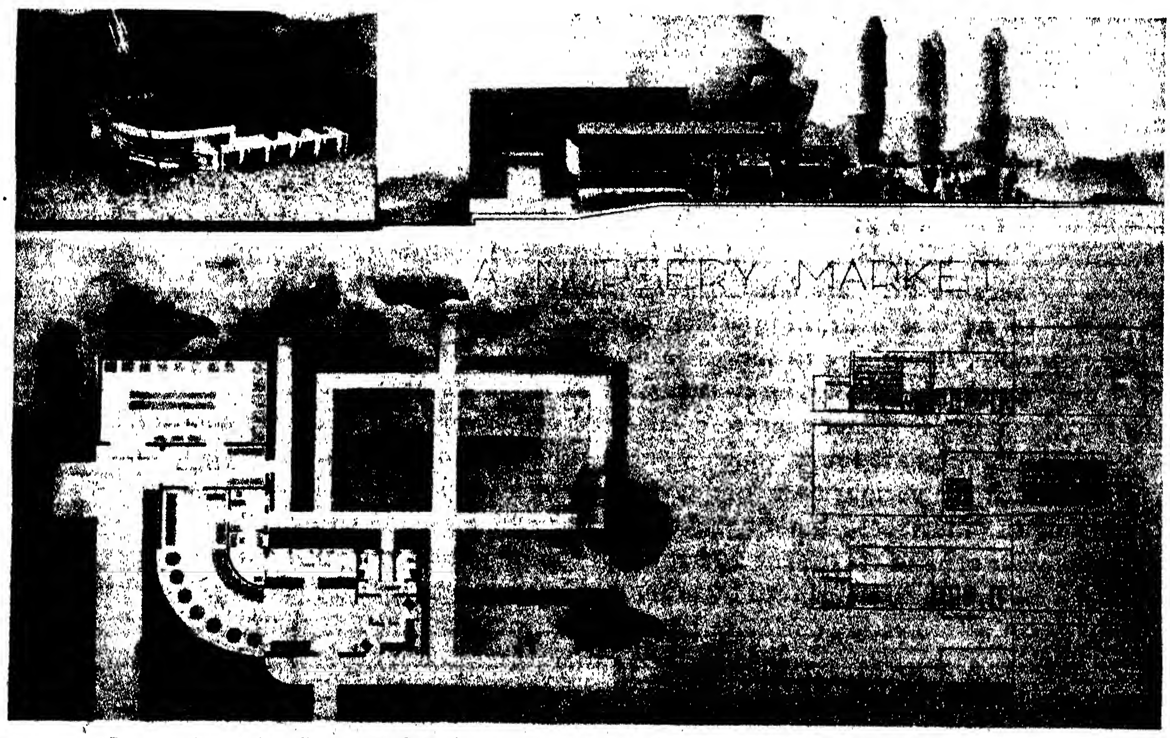


Fig. (a), above.—A preliminary study made in pencil on tracing paper as one of the steps in the development of the finished problem in Fig. b.

Fig. (b), below.—The completed problem which has been developed with the aid of preceding sketches and models.

to a discussion of the process of analysis and of a method of making the studies necessary in the development of a problem. Little has been said about the research which may be carried on during the preliminary steps in the study of design. After the beginning student has made the first few sketches and has tried out his own original ideas, he finds that he has said all that he is capable of saying. There is little improvement in the successive studies which he makes, and new ideas refuse to come to him. He must now profit by criticism from the instructor or by reference to the documents in the library. The architectural library is the student's best friend, and, at the same time, it is his worst enemy. It can be used correctly or incorrectly. The examples in its books may serve as sources of inspiration or they may be slavishly copied. Excellent results can be secured from library study which is not carried on during the progress of the development of a problem when specific information is needed. Sketches made at odd moments or during the intervals between problems permit general observation and absorption of ideas.

The designer with an adequate vocabulary does not need to rely upon the documents so much as the one who has less knowledge of architectural elements and their use. A vocabulary is acquired by observing and sketching. If the student will systematically keep notebooks in which he makes sketches and tracings of plans, sections, elevations, and details of various types of buildings, he will build up a fund of information which will come to his aid when he is taking an esquisse or attempting to develop the problem itself. The books which illustrate the works of the past, and the magazines and the completed buildings which show the architecture of the present, offer many opportunities to study plans which are symmetrical or unsymmetrical, simple or complex, and monumental or domestic, together with their accompanying exteriors—walls, doors, windows, columns, and mouldings. This is too valuable a practice to be neglected.

When the library is used in connection with the current problem, an effort should be made to find the best possible examples. Not all the architecture of the past and present is good. The student must learn to choose, relying as much as possible upon his own critical taste. He should not use a motif just because it has been employed before. A choice should not be made too quickly; an idea should not be discarded too hastily. If the search is simply for some source of inspiration and not for any particular detail, examples should not be passed by because they are not exactly like the problem which is in mind. Time should be taken to analyze a drawing which offers any possibilities whatever. There may be some new note, something to suggest a new lead or to encourage another attempt which may disclose the solution. The illustrations in the documents should serve to stimulate the creative impulse rather than to deaden it by offering ready and easy answers.

After examples are found which seem to offer assistance, the student should study the ways in which the various elements have been used and how they have contributed to the success of the illustrated building. An effort should be made to discover the reason for the particular type of treatment and to see if the same reasoning will apply to the current problem. Before being influenced by other architectural examples, the designer of buildings should again ask questions, as: Are the requirements similar? Are the materials the same in both cases? Have the buildings the same character? Is the spirit of the style compatible with present-day needs? What modifications should be made? If library research becomes analytical instead of imitative, the library will be used in an intelligent and correct manner.

There are, of course, those insurgent minds of every decade that would divorce the present from the past. According to them, the results of civilizations, the influence of buildings, and the teachings of educational systems must be discarded. Architecture must grow only from function and materials. On the face of it, this kind of philosophy has merit, but this age can scarcely be expected to forget entirely the mistakes and the lessons of its predecessors. As long as we are conscious of the past and care to profit by its developments, the library is a necessary adjunct to an architect's education and should be consulted when the occasion demands.

No attempt will be made here to list the various books which will prove of value to the student of design. The number is too great, and, in addition, libraries vary in their degrees of completeness. The instructor and the librarian are more familiar with the needs of the student and with the books of their particular library. However, the student should learn to rely upon his own knowledge of library sources. He should formulate his own list of books which will aid him, directly or indirectly, in his design work. Some may give information about the elements of architecture: the structural, protective, circulatory, and decorative, as listed in Part Two of this text. Others may give technical information about equipment and materials, while some may help disclose the correlation between architecture and the allied arts of painting and sculpture or the related fields of engineering and commerce. Or still others will assist in giving a clearer vision of basic backgrounds and influences. The student should soon learn where to find the examples of the various periods of historic development and those of the contemporary movement. He should know where to go for line drawings or rendered studies. If he is familiar with his working library, much valuable time will not be lost in an aimless search for information

Intermediate Studies

After freehand sketches of the contributing examples are made in the library, or if necessary, after the book has been taken to the drafting room, these new ideas should be tried out with clay, balsa wood, and paper and pencil for the student's contemplation and for the critic's approval or disapproval. A problem in design is developed by the mental effort of thinking and the physical effort of drawing. The problem must be studied until a satisfactory solution with reference to function, proportions, materials, and character is secured. But a designer is seldom entirely satisfied with the results obtained—nor should he be. There is almost invariably room for improvement. The answer to a problem in architecture is not like that to a problem in mathematics. In the latter there are several definite steps which must be taken and which usually lead directly to the one and only answer. In architecture the correct solution is a matter of personal opinion. It may be either good, bad, or indifferent, according to the way in which the practical and the aesthetic requirements have been met and to the training and personal idiosyncrasies of those who may judge the results.

The intermediate studies usually consist of accurate drawings of the various plans and elevations called for in the program which are executed at final scale. They should be complete enough to be transferred to the final paper with only minor changes. These studies are usually assembled into a single composition, so that they will constitute a study of the sheet arrangement of the required drawings. They may be accompanied by a rough draft of the final written report or by an accurate model of the building to be photographed later, if these items are called for in the program.

Presentation Drawings

When the intermediate studies are completed to the satisfaction of the instructor and the student and in keeping with the time limitations, the student is ready to prepare the final drawings. Two types of drawings may be made to represent the plans, elevations, and details of buildings. They differ in their purposes and methods of presentation. One is the working drawing which is made in an office on tracing cloth or paper. From this, blueprints are printed which aid in the actual construction of the building. This type of drawing is more accurate than the other, so that the dimensions may be scaled. It shows the use of the various materials and the location of the mechanical equipment. It is a business-like drawing with little attempt made to create an effect. Any effort to arrange the elevations, plans, and details on the sheet in an interesting manner or to use good lettering and draftsmanship is usually the result of the necessity for clarity and readability and of the pride which the architect and the draftsman may take in their work. There is little conscious effort made to impress a jury—to appeal to the contractor or material man with a beautiful drawing. In office procedure the working drawing follows the rendered plan; but, with the school-design problem, both types may be presented together or a simple working drawing may sometimes be substituted for the rendered presentations.

The rendered drawing, quite in contrast to the first one discussed, is the result of the desire to tell only in a general way the story of the arrangement and character of the building. It is a conventional representation of the horizontal relations of the various units of each floor and does not attempt to give detailed information about sizes, materials, or construction. The walls, openings, and equipment are indicated as an arrangement of tone, color, and line with the primary purpose of revealing the general scheme of the structure. This second type of plan is the one in which we shall be interested for the remainder of this chapter.

SHEET COMPOSITION. After the various presentation drawings and their respective scales are decided upon, it is then necessary to make a final study of the sheet composition. A few years ago when symmetrical, traditional buildings were in the majority, symmetrical arrangements of the various required drawings were the rule. Now with unsymmetrical massing dominating architecture, and with the influence of modern advertising, commercial, and display art being felt on all sides, architectural presentation has taken on a more informal and less stereotyped character. The shape of the plan and the contours of the building may suggest novel but logical ways of laying out the sheet arrangement. It must be remembered, however, that the primary purpose of the drawings is to explain—not to confuse. Clarity of expression should receive first consideration. Nevertheless, if interesting and arresting decorative effects may be secured legitimately, they need not be ignored. School problems are given to teach theories of color and composition as well as theories associated with functional planning.

DRAFTING. When the designer has secured a satisfactory layout of the sheet, he is ready to transfer his design to the final paper. His solution may be drawn directly, or it may be "rubbed" from an accurate pencil drawing which has been made in the reverse manner and which is fastened face down on the board and rubbed on the back with the edge of a coin or a similar object. The drawing is then ready to be inked with dilute, black or colored ink, and is ready for the next step preparatory to rendering.

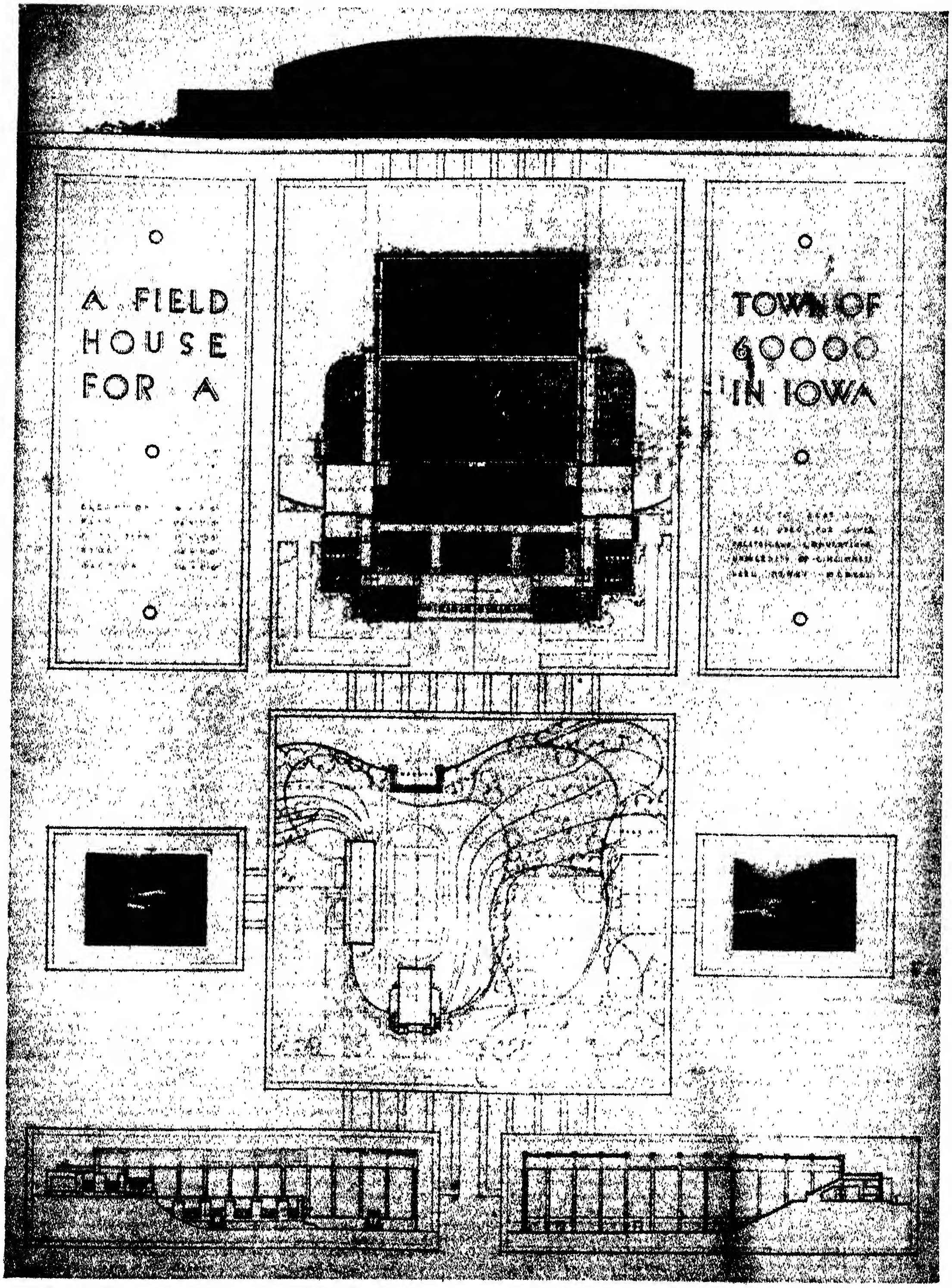


Fig. (a).—Simplified, symmetrical presentation of an advanced problem. Opaque paint used for elevation and drafted lines.

A word of caution should be said at this time about the quality of draftsmanship. Drawing represents only one step in design, and design is but one phase of architecture. Nevertheless, most of the great architects of the past and present have been and are master draftsmen. The student should study the reproductions of their drawings in the magazines and in the examples of historic styles in the documents. By so doing, he may realize the necessity of setting a very high standard for his own efforts. The final pencil drawing of a problem should be clear and accurate, but not mechanical (Fig. 315 A). A soft—rather than a hard—pencil should be used; a sensitive, accented line is preferred to one which is engraved into the surface of the paper by sheer determination and lack of appreciation of the character of architectural drafting.

Full advantage of the use of centre lines, guide lines, and plenty of paper and pencil should be taken by the student. It is difficult to make any improvements when passing from pencil to ink. Straight drafting requires only intelligence and strict application. The true test of one's ability to draw is to be found elsewhere. The place where most students betray their inability to control their hand—the lack of training, or absence of coordination between fingers and brain—is in the execution of the freehand work. The studies for the ornament and sculpture are almost invariably neglected because the average individual feels a weakness in this direction. Nothing tends to mar the appearance of a drawing more than poorly executed freehand lines. These elements should be studied on tracing paper, and not on the final sheet, until the correct proportions and a clean-cut line are obtained.

POCHÉ. Drawings are indicated on the final sheets chiefly by the use of lines. Tones of color may be applied to areas, but they are usually for the purpose of calling attention to important parts of the building and creating visual effects. The main lines of the plan are those representing the walls, and these lines are called the "poché." This indication of walls shows their location, character, and weight. Walls are usually represented by lines that are darker than the spaces they enclose; at least they should be the most conspicuous part of the plan in order that the scheme may be easily interpreted.

Poché is a very important part of the study of the design because it reveals the influence of materials and the nature of vertical surfaces. Changes in direction in these plan elements call for corresponding reflections in wall treatment. Or, in the reverse manner, the poché is the result of the downward projection of interior and exterior elevation details. Paneled walls, recessed niches, projecting pilasters and columns, are all shown by the contour of the poché. In developing a plan, the first studies indicate only the direction and weight of the walls. The elevation and the section must be studied in order to determine their design and character. This information is then translated to the plan and gives to poché its significance and importance, as on pages 319, 321 and 325.

The materials of man and nature affect the construction of a building and the indication of poché. In the days of true masonry, the walls were very heavy, and the drawings of Classical and Renaissance plans reflect this condition in the weight of their poché. Massive piers were necessary to counteract the thrust of the round arches and vaults—their positions and importance were quite evident in plan. With the development of steel construction, there is a concentration of the superimposed loads at isolated points, which in turn are much smaller than the piers of former times. The walls now become enclosing rather than bearing, and this has created a poché which is lighter and often lacks the decorative quality of the earlier work, as in Fig. 321 A.

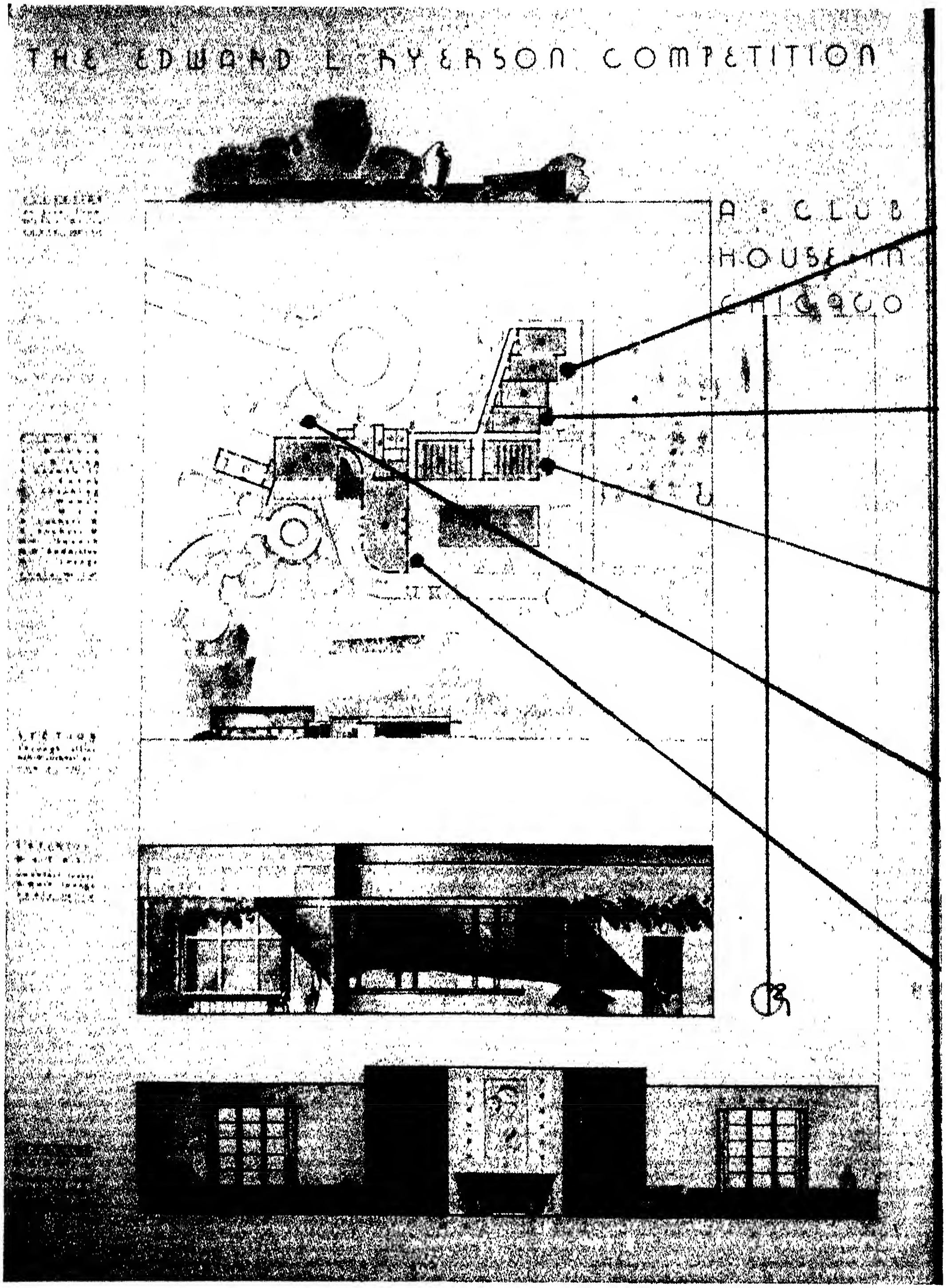


FIG. (A).—An informal and unsymmetrical composition which focuses attention upon the various plan units.

In spite of this change in the character of poché, there are several general rules which should be followed in order that the conventions of construction and practice may be met. Usually the larger rooms will have the thicker walls or the larger piers, because the spans are greater and the loads are heavier. Exterior walls are thicker than interior walls of equal height. The walls separating small rooms and corridors are lighter than those enclosing a large hall. Poché should thus indicate the location of the structural members and the importance of the various parts of the building. In so doing, it is sometimes necessary to take certain liberties with the poché. The plan should not be misleading, but, at the best, it is only a conventional representation, and it must be made to maintain its function of revealing the fundamental scheme of the building. The poché may sometimes be slightly exaggerated or minimized in order to call attention to some particular part of the plan which warrants this importance. The character of various units may be emphasized so that the contrast will not escape the eye of the observer. It is essential that clarity should be one of the cardinal virtues of plan composition. This is obtained by the conventions of plan indication—by poché, mosaics, entourage, and rendering.

MOSAICS also assist materially in making the plan readable. They may consist of a representation of the floor decoration, the arrangement of the furniture and equipment, the indication of sculpture, or the reflected ceiling plan. They give interest to the drawing, but they go further in that they suggest the purpose of the rooms and the possible treatments which may actually be applied to the floors and ceilings. The character of the mosaics shows whether that part of a plan is a ball room, a court room, or a laboratory; whether it is festive, dignified, or utilitarian; whether the decoration is light and sparkling, rich and heavy, or simple and direct. A consideration of the mosaics should not be left for the last week of a problem. Instead, they should be studied in line and in tone during the successive stages in the development of the plan itself. They are an integral part of the plan and influence its final solution.

The study of mosaics often is one in abstract design. The various geometric forms are combined with curved shapes to produce patterns with pleasing contrasts, accents, and rhythms. However, these conventionalized diagrams all have a meaning. They represent the marbles, metals, woods, and composition used in modern floor treatment, the arrangement of the furniture and equipment, and the coffered and beamed ceilings of important rooms. Mosaics, as well as poché, attract the eye by the contrast of tone, shape, and direction. Richly decorated halls with brilliant accents contrast with the white, simple treatment which is often reserved for circulation. Service rooms receive a dark, all-over pattern so that they may become secondary in importance to the lighter and primary units. A study of Classical, Renaissance, and contemporary plans, together with those of school problems and national competitions, will help in an understanding of the theory of mosaic treatment. Practice in the use of these decorative forms will create a vocabulary which will aid in plan presentation.

ENTOURAGE. We may now go from the interior to the exterior. During the development of the plan, the relation of the building to the site should receive the necessary attention. The subject of the program, the character of the topography, and the shape of the lot will determine the location of the building. After this is fixed, a consideration of the "entourage," or the landscape treatment, is the next step in the study of the problem. Just as an actual building project is not complete until the planting is done and the structure is related to the landscape, so the rendered plan is unfinished unless the entourage is developed.

The entourage forms the decorative feature of the exterior as the mosaics do for the interior. Both are compositions in pure and applied design. The student should realize, however, that he is working with material objects, and not simply with lines and tones. The patterns seen upon this exterior part of the plan are made up of terraces with their mosaics, and of balustrades, walks, fountains, hedges, trees, and grass plots, all used to frame the building and to give it the required setting. The entourage may be formal or informal, simple or ornate, depending upon the character of the building itself. It should emphasize the major axes and entrances and provide the necessary exterior circulation. One of the important elements of entourage composition is that of contrast. There should be contrast of areas of planting and paving, contrast of shapes of objects, and contrast of tone secured by change in materials.

Entourage also assists in the establishment of character. The decorative gardens of the residence for an ambassador reflect the effort of a country to create an impression of wealth and power, whereas the simple walks and terraces of the grounds of a small library harmonize with its quiet dignity and are in keeping with the unassuming personality of an educational building of this type.

When the entourage is indicated upon the elevation there need be little attempt to secure the quality of realism. An elevation is a conventional representation of a portion of the building, and the landscape treatment should be similar in character. Naturalistic trees attract too much attention on the average problem and detract from the interest of the architecture. The landscape, surrounding buildings, and distant background which give scale and a sense of completeness to a drawing should be reduced to a few simple planes. Various compositions should be tried with water color, charcoal, or chalk before any attempt is made to draw or render the entourage upon the elevation. As a rule, little foreground should be shown. Three-dimensional objects in perspective do not combine well with the two-dimensional character of the elevation. The trees and hedges should be composed in such a manner that small dark areas occur at the ends of the building and form a definite termination to the horizontal movement of the eye across the façade. Other elements of landscape treatment may be used to accent major portions or entrances, either as a background or as a foreground frame. If a perspective is shown, it may be accompanied by a more naturalistic rendering since an effect of realism is desired.

The student will soon realize that the indication of a satisfactory entourage, either in plan or elevation, is one of the most difficult phases of rendering. It will require considerable sketching and observing upon his part before he can become even passably proficient in the execution of these conventionalized natural forms. Again reference to library sources—competition drawings, the works of architectural delineators, etc.—will be of value in allowing the student to profit by the experiences of others. However, practice in indicating the examples of nature with the brush and pencil is more important than library research.

RENDERING. In rendering the project, the student should keep in mind that a simple treatment is usually more satisfactory than one which is more ambitious. On the whole, a few washes of monotone, or of two or three colors, are more desirable than a liberal use of dark tones or brilliant colors which tend to hide the architecture. An effort should be made to reveal the beauty of the building rather than to conceal its faults. The character of the problem will again exert its influence, this time upon the type of rendering which is best suited for its presentation. A casino or a restaurant may call for more color and a freer handling of the medium than a court house or a museum. The choice between formality (Fig. 319 A) and informality (Fig. 325 A), conventionalization and realism, depends upon the type of building which is to be illustrated.

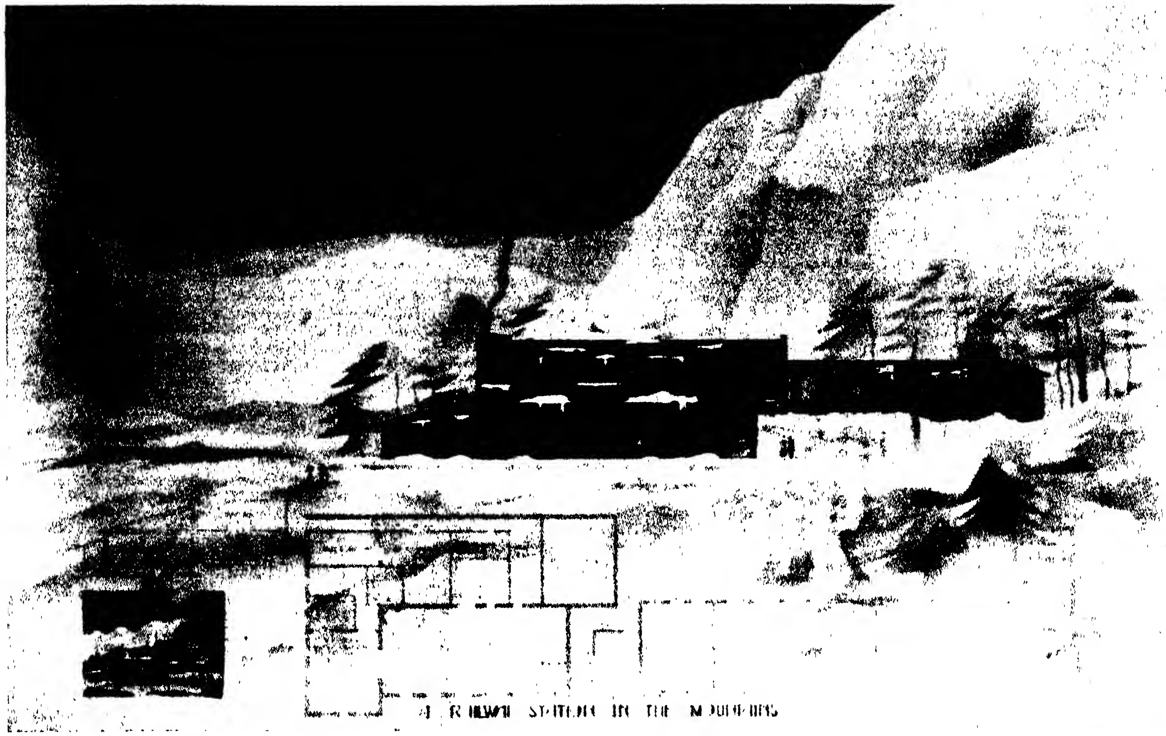
The final drawings of a problem in architectural design may be presented in one of several ways depending upon the type of building and the effect desired:

1. Drafted only—
   with various weights of black, dilute, or colored lines.
2. Drafted, with accents—
   with shadows or planes shown by light washes or spray.
3. Conventionalized rendering.
   Architectural indication of surfaces, entourage, and details reduced to a convention, not realistic.
4. Realistic rendering.
   Building and entourage presented in a realistic manner with reference to details and colors.

Any of the above methods may be presented on roll or sheet paper or illustration board, either white or colored. Effective use may be made of opaque color on yellow, brown, or gray board. The fields of the allied decorative arts will serve as sources of inspiration (just as with the sheet layout) for the presentation of problems in architectural design.

The effects which come from rendering may be secured by many methods. Chinese ink or ivory black may be applied with the sable brush or the airbrush for the formal monotone presentation. If a suggestion of color is desired, abbreviated palettes containing two warm and two cool colors, or a red, a yellow, a blue, and a green, of water color may be developed by the student. A combination of raw sienna, burnt sienna, emerald green, and cobalt blue—with a varying amount of each color in each successive wash—will give a subdued effect of realism. Or even yellow ochre, carmine, and Prussian blue, if properly handled, may provide the necessary subtle tones and strong accents. If one is inclined toward the yellows and browns, a palette of aureolin, burnt sienna, sepia, and burnt umber will give interest by simply indicating changes of texture and color. These are only suggested palettes. The combinations are limited only by the laws of color harmony and by the ingenuity of the student or the critic, but their application should usually be simple and conventional instead of complex and realistic. In addition, water color may be used with pencil technique—or pen and ink, or pastels and chalks may be employed to secure the desired effect.

The scale of the drawings should determine the selection of the medium. If the elevation is small and the design is intricate, it is desirable to use water color in carefully executed washes in order to preserve the quality of the draftsmanship. If the elevation consists of a few simple planes and is drawn at a larger scale, the graded and flat tones of the background, shadows, and openings may be secured by the use of pastel, chalk, or airbrush, as in Fig. 325 B. Preliminary studies should be made before beginning the final



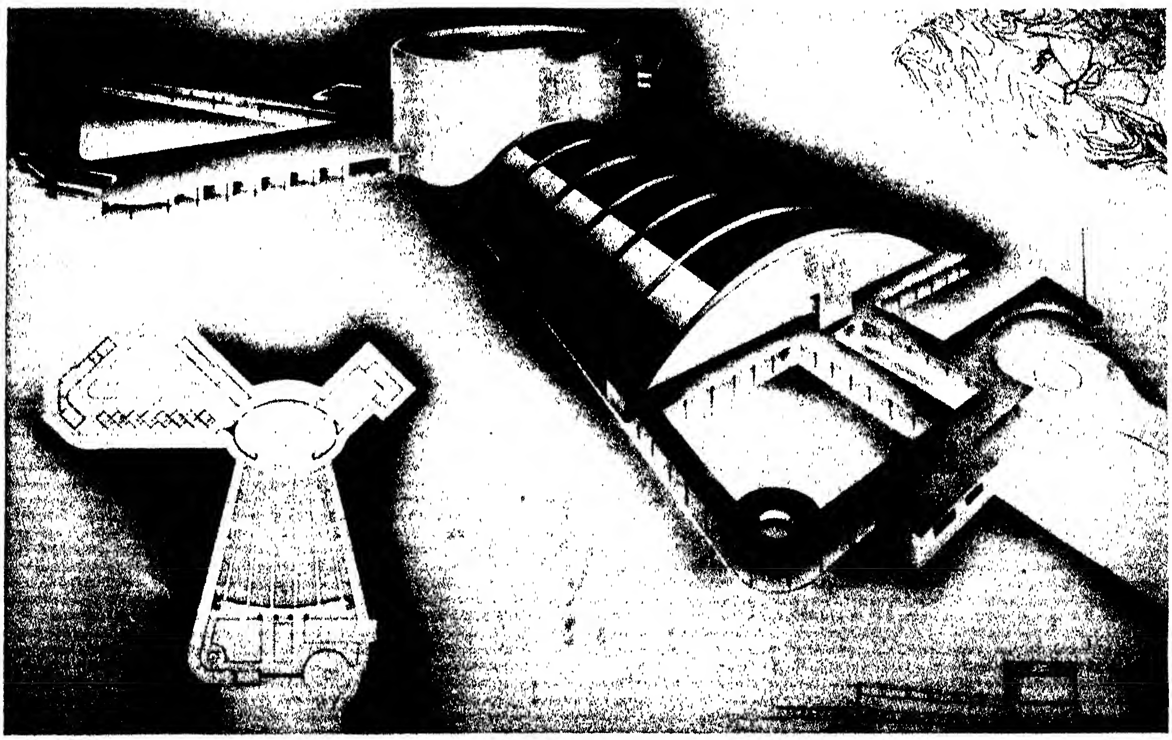


Fig. (A), above.—A realistic rendering with a conscious effort made to create the impression of an actual setting.

Fig. (B), below.—An example of conventionalized presentation with no attempt at realism. Areas, forms, and values accented by graded tones.

one, and each successive step should be thought out in advance. If mistakes are made, a water-color rendering may be taken to the sink and lightly sponged. This often leaves a soft and desirable effect which may form the basis for a successful rendering. Few renderings are hopelessly lost, but it is better to proceed cautiously until the final accents appear. If the air-brush is used and the tones are not satisfactory, additional color may be sprayed over the first color until the correct effect is secured.

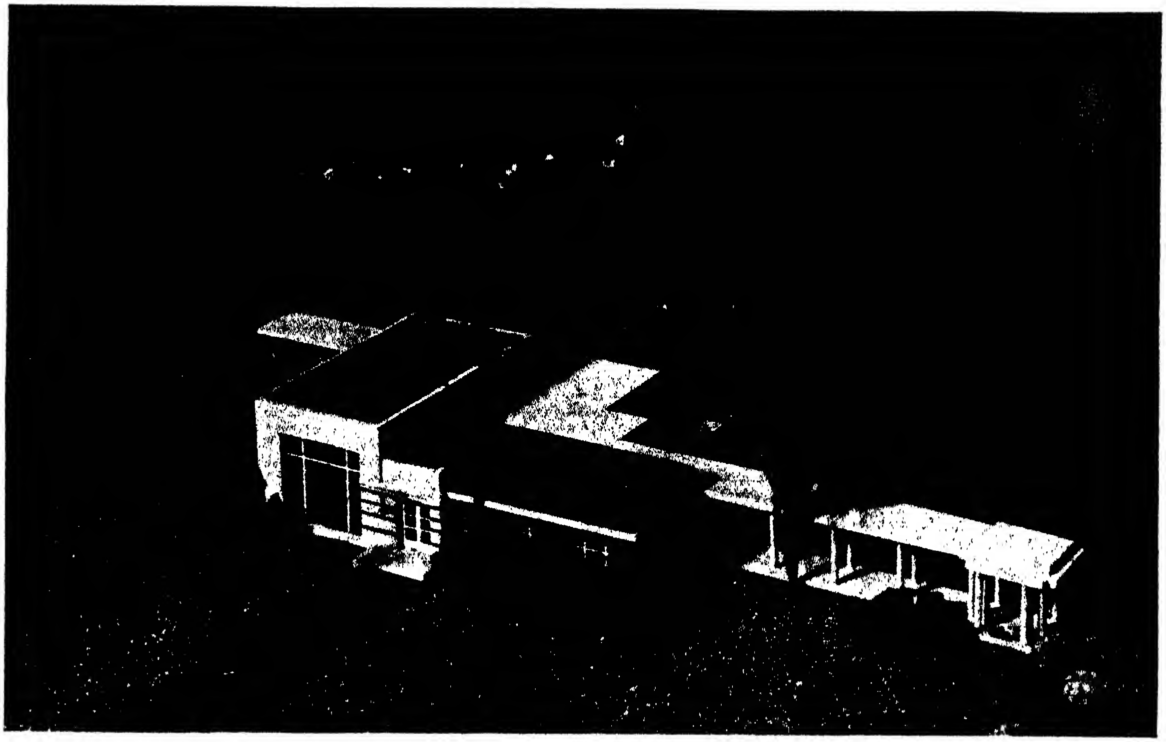
Presentation should be as direct as possible. The tendency to become involved in a brilliant rendering, which may confuse rather than clarify, is to be avoided. The attention should be focused upon that part of the design which is intended to be the centre of interest. In a monotone rendering, the various planes or portions of the drawing near the edges of the composition may be dark, reserving for the climax of the entrance motif or the main façade the lighter and more conspicuous tones. If color is used, one may rely upon the principle of receding and advancing colors. The cool colors—the blues and greens—will serve for the distance and middle distance; the warm colors—the reds and yellows—may be used for those objects nearer at hand.

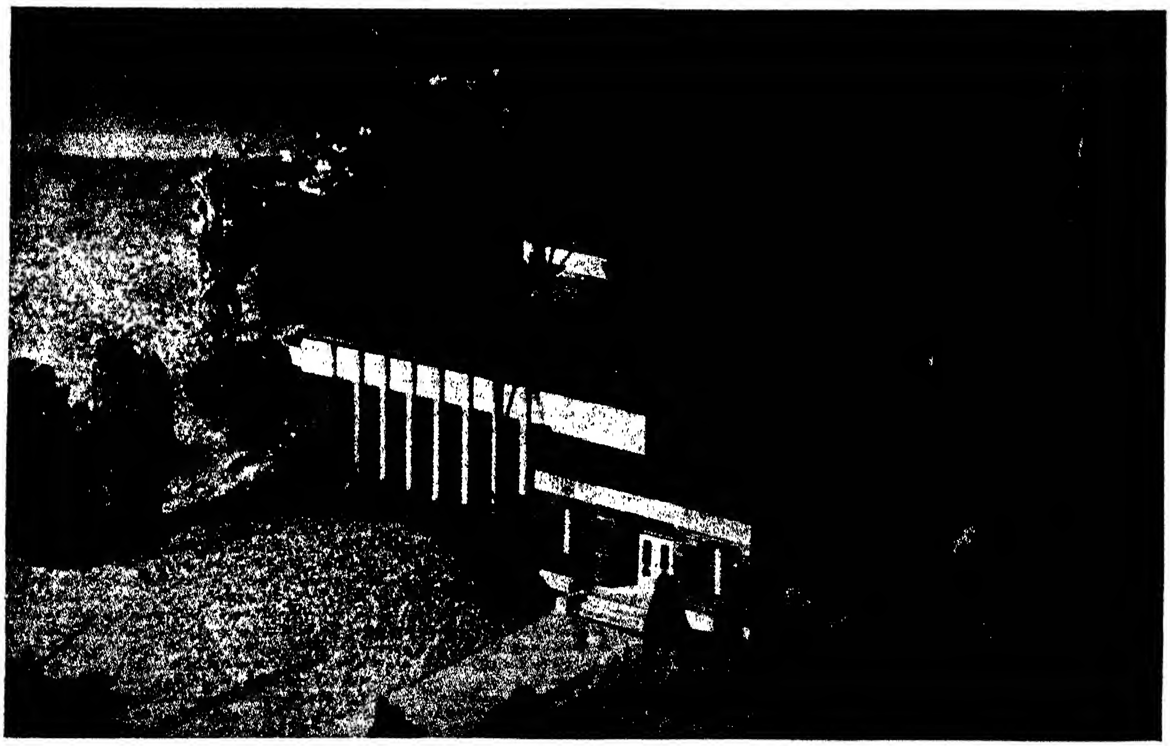
A word of caution may be said at this point about the quality of the rendering. There are those problems which require a very careful, formal, and sometimes almost mechanical, rendering, such as with certain competition drawings. Aside from these, renderings, though demanding accuracy and neatness, should be executed with a certain freedom and spontaneity. However, the edges are to be watched in all cases. Unless the washes are carried up to the lines bounding the various areas, the effect will be ragged and will mar the beauty of the architecture. The student may turn his tilted board so that the narrow width of the area to be covered will be parallel to the horizontal strokes of his brush. Common sense should make rendering as simple and easy as possible.

The colors may be placed around the edge of an old dinner plate, with the centre reserved for the supply of water. By mixing the colors on the plate as needed, and by changing the speed at which the washes are run to influence the "settling," the necessary variation may be secured. The student should not be afraid to grade his washes from dark to light or to allow a little of the white paper to show through occasionally. Color combinations which produce transparent washes should be used. Flat, dull, muddy, and uninteresting tones are to be avoided. Instead, a successful rendering will have sparkle, contrast, and interest, secured by sky washes and wall tones of varying intensities and by the legitimate use of accents and of reflected lights and shadows. If the usual water colors do not give the proper accents, opaque colors may be used in small quantities for shadows and details.

Contemporary, non-traditional architecture, with its simple planes, lends itself readily to air-brush rendering. With this method, the areas not to be sprayed with color are blocked out with masking tape and paper, leaving the exposed surfaces to receive the paint. Tones may be applied in a flat or graded manner, and lines of opaque water color may be ruled on to provide the necessary accents. Many interesting effects are possible with this medium, and the student may be encouraged to experiment. This type of rendering, shown in Figs. 325 A and B, is mechanical and accurate and quite in harmony with the quality of present-day architecture.

Another rendering technique that may be used with simplified exteriors makes use of opaque water colors applied in light or heavy flat washes, as in Fig. 319 A. Many pleasing





FIGURES (A), above, and (B), below.—Photographs of models developed to give a more accurate understanding of the third dimension in architecture, and of the actual site and landscaping. These are used as presentation studies, as in Fig. 315 B.

color harmonies may be secured by the addition of white to the pure pigments. Ruled lines of darker or more brilliant colors may be used to give definition and interest.

FINAL REQUIREMENTS. The final presentation should consist of those drawings or other explanatory material called for in the program. These may be the usual plans, sections and elevations together with construction details, structural drawings, models or photographs of models, and written reports covering the essential features of the building. The reports may discuss the general scheme, the structural system, materials, costs, maintenance, or some unique feature associated with the way in which the building functions. On occasional problems it may be desirable to supplement the usual type of presentation with simple working drawings, thus giving a clearer understanding of the nature of materials and their influence on design.

Design problems in school were long accused of being "paper architecture." This accusation was due partly to the limitations of two-dimensional drawings which failed to show the size, shape, and mass of the related parts of a building. That criticism is largely dissipated by the construction of models, as shown on page 327, and by the use of photographs of models as part of the presentation drawings, illustrated on page 296.

If a photograph accompanies the final drawings, the plans, sections, and elevations, are more easily explained and understood. These models are the natural development of the earlier mass and space models. They may be made quickly of sketch board and balsa wood and painted in tones of gray which will photograph correctly, or in actual colors, if a color filter is used. The models may then be placed on a topographical table, where the actual contours may be worked out in sand. Realistic landscape treatment may then be developed by the use of sponges, weeds, moss, and other materials arranged to simulate the actual physical environment of the building. A painted backdrop, or one made from an enlargement of a photograph, may then be placed behind the model. Flood lights, located to provide the correct direct and diffused light, will enable the student photographer, or a professional, to secure the proper pictures to use with the presentation drawings.

Occasionally criticism is leveled at school problems to the effect that they are incomplete and need further study. Inaccuracy and lack of application are not to be condoned, but sometimes the nature and purpose of a design problem is overlooked. These problems are, at the best, only preliminary drawings executed by undergraduates with limited experience. They present only the general scheme of the building, much as the earlier studies in the office do for the information of the client. In the office these studies are translated into other studies and finally into working drawings with all the modifying influences of materials, construction, and mechanical equipment. Attempts to effect such integration in the school drafting may be too time-consuming or beyond the ability or experience of the student. This does not mean that school problems should not be real or as complete as the time will permit. There should always be enough consideration for the so-called practical features to insure a building capable of functioning efficiently. The student and the instructor must decide whether they are going to do two problems in a thorough manner each year or several in a less complete way.

It must be remembered that a school problem is not an office job—in spite of efforts to make it one. The environments and attitudes of the office and the school are not the same. The school problem offers an opportunity to teach planning, abstract design, good taste, landscape treatment, sheet composition, theories of color, drafting, freehand drawing, and lettering. The school is interested in training the student in the art and science of designing a building—not in the actual production of the building. In this respect, the school and the office differ in their objectives. Schools may teach best the fundamentals of planning, in a practical as well as a theoretical way, keeping in mind that they are responsible for the basic principles of architectural training which can be secured most easily in institutions organized for the express purpose of education. Experience in an office or on a construction job during the summer months of a regular course, or in connection with the practical work of a school giving cooperative training, offers the most satisfactory method of making architectural design real and vital. Courses in working drawings and construction may help to give an understanding of what are sometimes called the practical features of design, but nothing can take the place of actual experience. Architectural design can best concern itself with those theories which the office is not equipped to teach.

SKETCH PROBLEMS. These quickly executed problems of one day's duration represent both preliminary and final drawings. Their primary purpose is to assist in training for quick analysis and rapid presentation. A clear-cut and decisive interpretation of the program is desirable as the first consideration, but this should be followed by a sketch which is as explanatory and professional as the ability of the student will permit. The correct amount of time should be assigned to the study and the drawing of the required perspectives, elevations, and plans. Each individual student should be familiar with his speed in delineation, so that he can give adequate thought to the final presentation. The nature of the problem should determine the nature of the rendering. Some buildings may call for a more mechanical type of drawing than others; but, on the whole, sketch problems should be presented in a free and spontaneous manner with pencil, pen, and ink, or water color. Realistic or conventionalized methods may be employed, as shown on page 299, the choice depending upon the kind of architecture and the inclinations of the student.

A Summary

It is now to be hoped that the finished problem in architectural design will show:

1. A knowledge of the architectural movements of the past and the present.
2. An understanding of the honest expression of function in terms of the materials to be employed.
3. An appreciation of the fundamental principles of composition which lead to simplicity and beauty.

In developing the solution of a problem, the student should allow his convictions and enthusiasms to be tempered by the social order in which he finds himself. If new modes of living are to produce buildings unlike those of today, he must be prepared to design them. Whatever the inclinations of the student may be, he must realize that his efforts should be based upon a respect for the past, an alertness toward the future, and a regard for truth and sincerity. The contemporary architectural movement will survive only by the observation of these cardinal principles.