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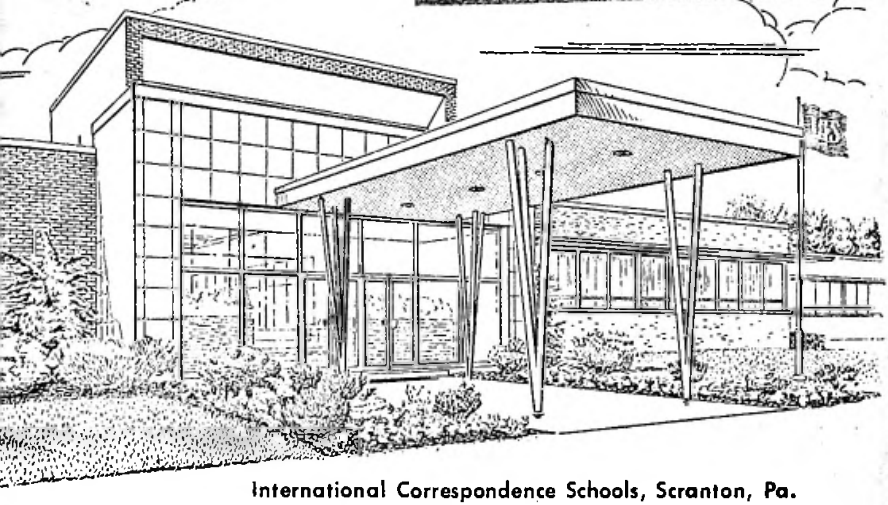

International Correspondence Schools, Scranton, Pa.

Architectural Drawing

Prepared especially for home study

By

WILLIAM S. LOWNDES, Ph. B., A.I.A.

and

FREDERICK FLETCHER, A.I.A.

Registered Architect

5637B-2 **Part 2** **Edition 3**

4 assignments

International Correspondence Schools, Scranton, Pennsylvania

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"The beginning is half the thing."
—Greek Proverb

* * *

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Architecture home study course

ARCHITECTURAL DRAWING

V. 8 PART 2

By

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Serial 5637B-2

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What This Text Covers . . .

1. Preliminary Considerations ..... Pages 1 to 25

Certain preliminary steps are necessary before you can start the working drawings for a building. The requirements of the client, the survey, sketches and studies, and cost estimates are explained.

2. Making Working Drawings ..... Pages 26 to 51

Working drawings are prepared after the design has been approved. The working drawings include plans, elevations, sections, and details.

3. Brick-Veneer and Block-Construction ... Pages 52 to 66

You will be interested in the details of brick veneer and block construction. Features common to bungalow construction are shown.

4. Steel Skeleton Building ..... Page 85

In the usual multistory building many floors are similar in plan and can be shown in one drawing. Technical considerations, such as the design of steel columns and beams, affect the plans.

5. Key to Criticism ..... Pages 85 to 86

5637B

ARCHITECTURAL DRAWING

Part 2

PRACTICAL PROBLEMS

FRAME RESIDENCE

1. Introduction.—To illustrate the application of the principles of drawing set forth in previous texts, a practical problem will be considered. The problem will consist of studying the development of a set of plans for a residence, as shown in the accompanying supplement, from the time the owner, or client, first consults an architect regarding it until it is completed. In addition to the special problem, other architectural features will be considered.

2. The drawing work in this text consists of four plates as follows:

Plate I .... First-Floor Plan, (Art. 42)
Plate II .... Second-Floor Plan (Art. 101)
Plate III .... Front Elevation (Art. 109)
Plate IV .... Fireplace and Chimney Details (Art. 139)

Each plate should be sent to the Schools for examination as soon as it is completed. Although only these four plates are to be sent to the Schools for examination and correction, the student will profit by drawing the various details that are described.

3. The Problem.—A client or owner wishing to build a residence for himself and family consults an architect regarding its design and erection. During the consultation the owner states his requirements and the amount of money that he wishes to spend. His family consists of himself, his wife, and a son 17

years of age. Provision must be made for these, and one bedroom must be provided for guests. The following rooms are, therefore, required in order that the house shall furnish the necessary accommodations.

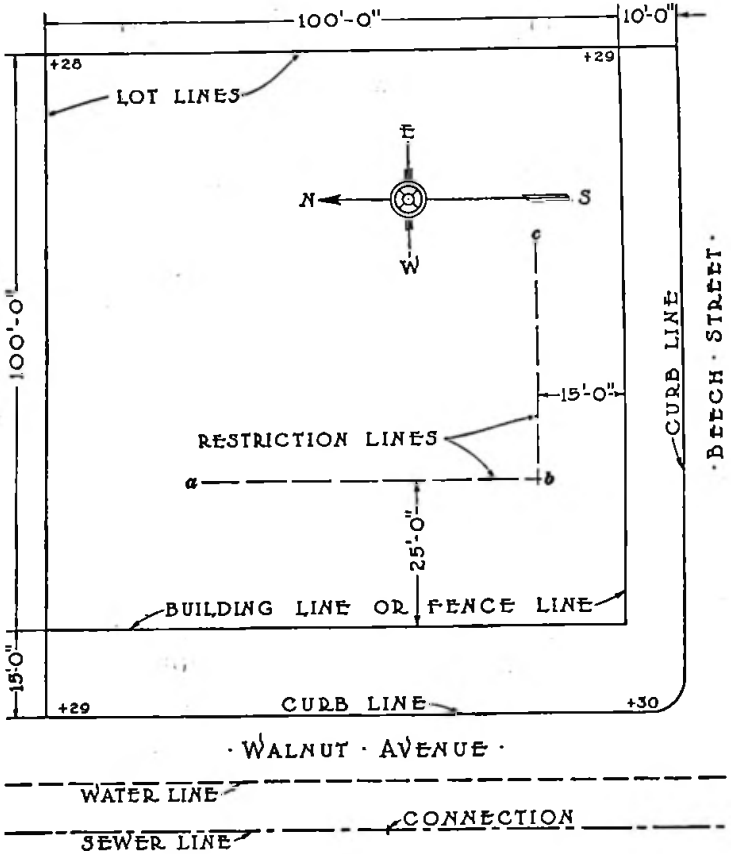

Fig. 1

On the first floor: (1) A large, cheerful living room, provided with a fireplace, and having windows on two or three sides so as to obtain sunlight during the greater part of the day and to afford pleasant outlooks in different directions. (2) A porch opening off the living room which can be enclosed by glass or screens. (3) A central hall extending through the house from front to rear, containing the main staircase, a coat closet, and a toilet room. (4) A dining room large enough to accommodate eight persons. (5) A kitchen containing the usual accessories, such as dressers, cabinet, sink, range, refrigerator, etc. The kitchen should open into the hall so that a servant can answer the front-door bell without going through the dining room or the living room. (6) Stairs running from the cellar to the second floor. (7) A porch at the kitchen door with a suitable roof for shelter. (8) A den or study, which may be used as a guest room if desired, may be included in the first-floor accommodations, if convenient.

On the second floor: (1) A large bedroom, with a dressing room and a connecting private bath, for the owner and his wife. (2) A bedroom for the son. (3) A guest room. Each bedroom is to have a suitable connecting closet. (4) A bathroom accessible from the hall.

In the cellar: (1) A laundry. (2) A boiler room and coal bins. (3) A recreation room.

General matters decided upon are that a direct steam-heat system is to be used, that the building is to have a stucco finish, and that the walls and roof are to be insulated.

4. Survey.—The owner has had a survey made of his lot, as shown in Fig. 1, which shows a lot 100 feet × 100 feet in size, and practically level. It also shows that sewer and water pipes run through Walnut Avenue. The house is to face the west on Walnut Avenue. The lines *ab* and *bc* show the distance that the actual building must be kept back from the building lines, in accordance with the terms of the deed to the property. The architect must consider the presence of such restriction lines in the deed to a property on which a building is to be erected, as the client will be held responsible for any violations of the provisions of the deed.

5. Rough Sketches.—During the discussion with the client, the architect who can use his pencil freely may make rough sketches which, while far from accurate, will nevertheless express his ideas or the suggestions of the client. Sketches such as an

architect would make under these circumstances are illustrated in Figs. 2, 3, and 4. For instance, Fig. 2 shows a rough sketch of a First- and a Second-Floor Plan which, for the purpose of discussion, is clear enough. A suggestion for a treatment of the fireplace side of the living room is shown in Fig. 3.

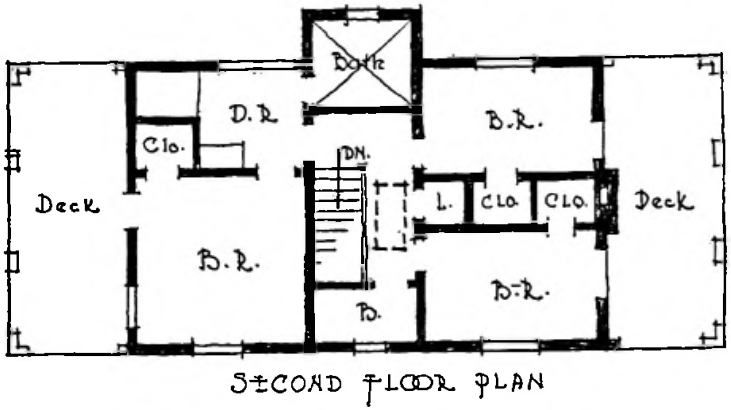

Fig. 2

6. A view that gives a clear idea of an exterior treatment is shown in Fig. 4. Sketches such as these, which can be made in a few moments by a skilful draftsman or architect, greatly

facilitate discussion and assist the client in formulating his ideas. They do not necessarily bind the architect to any final scheme, as he is still at liberty to make any improvements and further studies that may seem desirable.

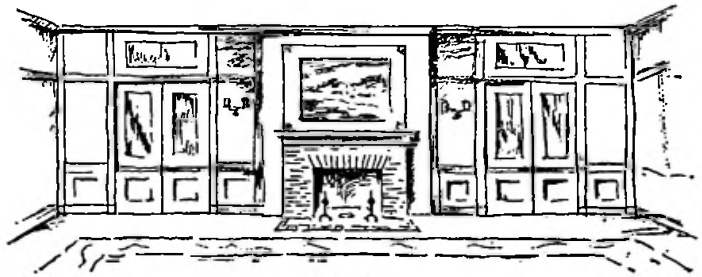

Fig. 3

Fig. 4

7. Since the question of cost is always an important one, the architect should be prepared to give a rough approximation of the cost. From his own experience or from that of architects who have erected buildings similar to the proposed building, the architect should have some knowledge of the cost per cubic foot of the building under consideration. He can then roughly estimate the cubic contents of the proposed building and multi-

ply this by the price per cubic foot and obtain an approximate cost. This will probably vary from the actual cost by from 5 to 25 per cent, but the figure is as near the actual price as possible until the working drawings and specifications are completed. This approximate estimate will determine whether the client can pay for a stone house or a brick house, or whether he will have to build a frame house in order to obtain the accommodations that he requires. In this case the client decided that he can afford to pay for a good frame house, but he does not want the house covered with clapboards or shingles.

8. The architect suggests a simple and dignified treatment in stucco on a wooden frame such as the one shown in Fig. 4, and the client asks the architect to submit sketches of such a building that will meet the conditions and will not cost more than a specified amount. The architect is then prepared to make the preliminary studies and sketches.

PRELIMINARY STUDIES

9. **Making Preliminary Studies.**—The next operation the architect must perform, after obtaining the client's ideas regarding requirements and the survey of the lot, is that of making a thorough study of the problem of designing a house that will meet the client's requirements. This is generally done by making several small studies, called preliminary studies, in which different arrangements of plan and elevation are shown approximately.

10. **Symmetrical Plans.**—Examples of preliminary studies are shown in Figs. 5, 6, and 7. Thus, in Fig. 5, a symmetrical arrangement of plan is shown in the lower left-hand corner. This sketch is made on quadrille-ruled paper, each square of which is considered as representing a space 5 feet × 5 feet. It is easy to lay out on this paper sketches such as those in Figs. 5, 6, and 7 without the aid of drawing instruments. The plan shows a first floor arranged to meet the requirements of the owner. The rooms are arranged symmetrically with reference to a central line, or axis x-y which arrangement permits the use of a

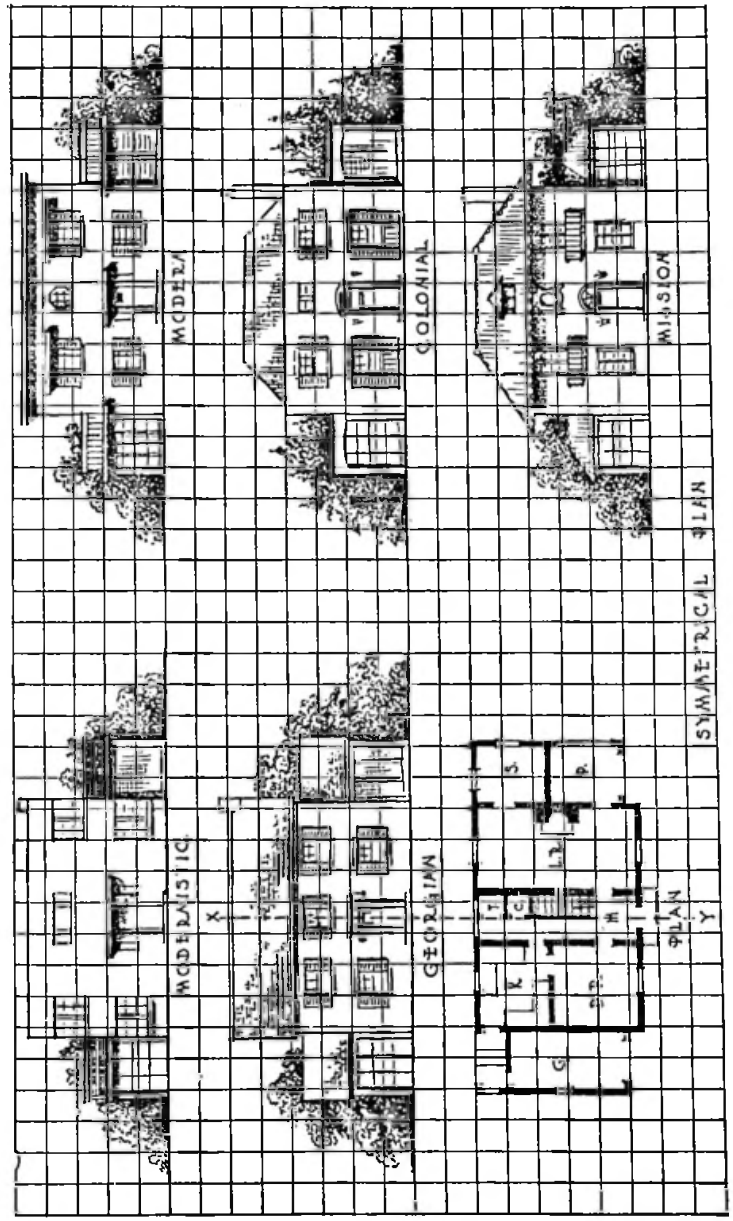

FIG. 5

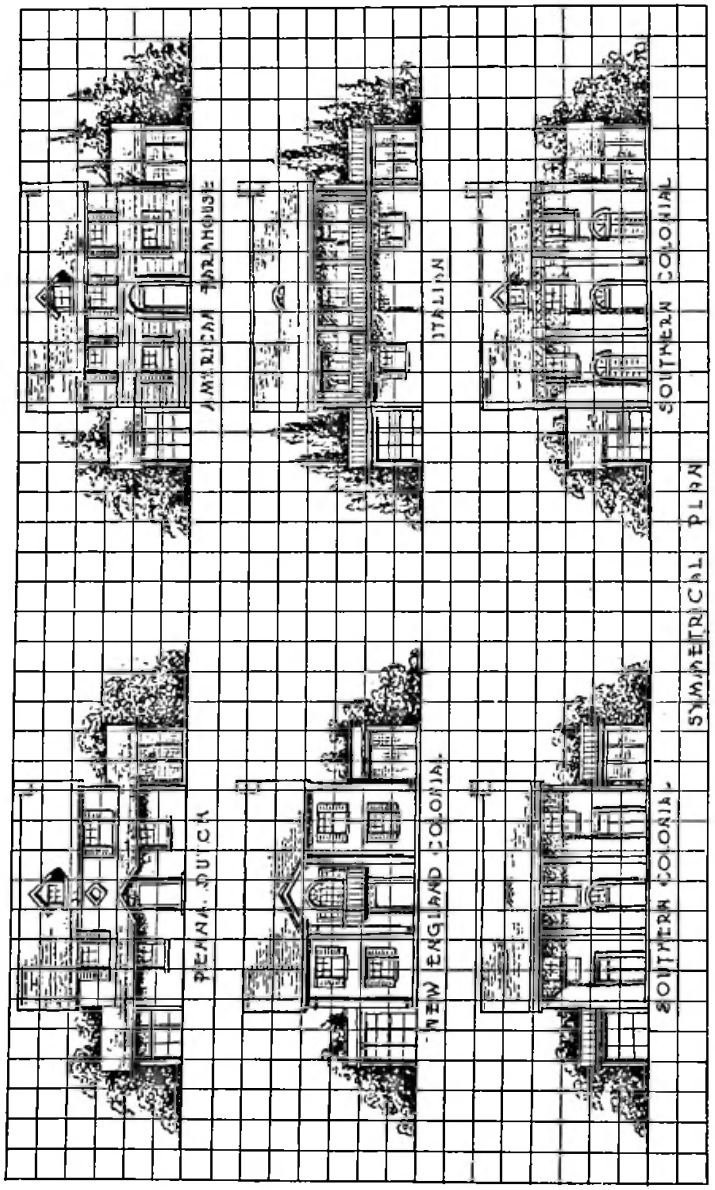
PENN. DUTCH
AMERICAN FARMHOUSE
NEW ENGLAND COLONIAL
ITALIAN
SOUTHERN COLONIAL
SOUTHERN COLONIAL
SYMMETRICAL PLAN

FIG. 6

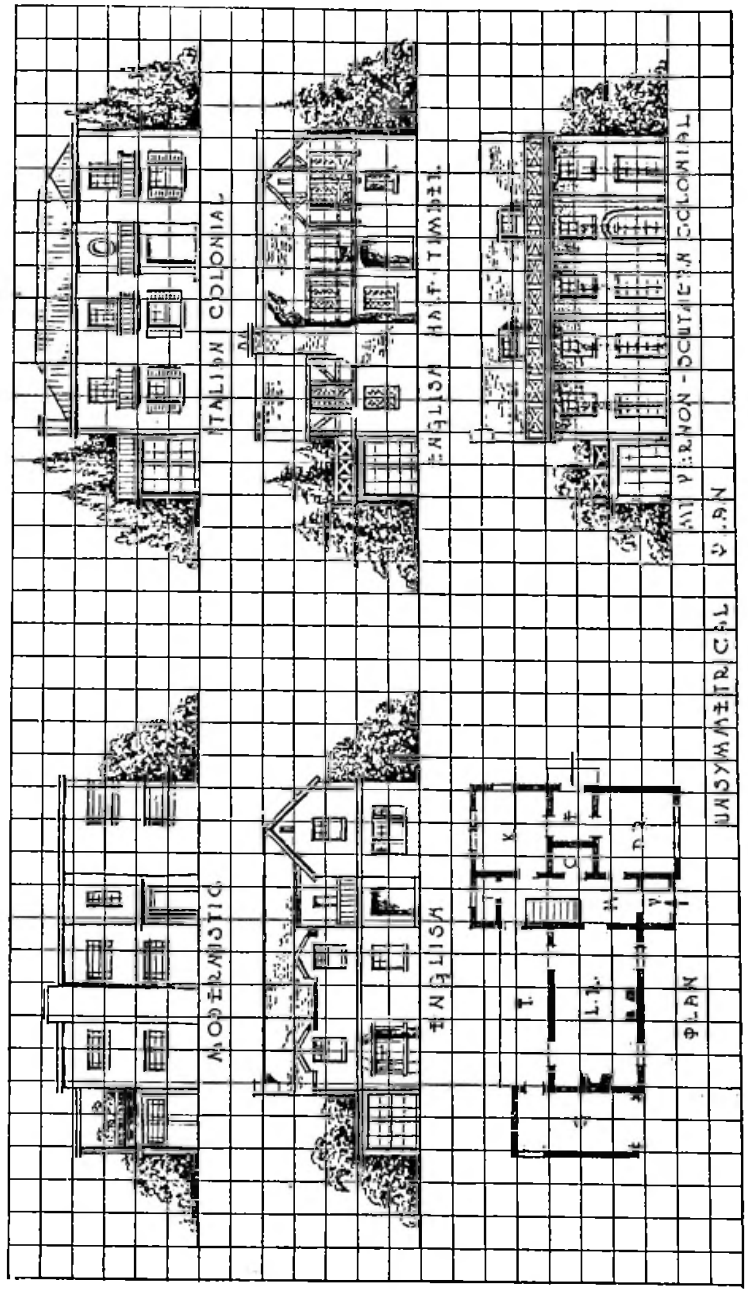
MODERNISTIC
ENGLISH
ITALIAN COLONIAL
ENGLISH HALF-TIMBER
MT. VERNON - SOUTHERN COLONIAL
PLAN
UNSYMMETRICAL PLAN

FIG. 7

symmetrical composition of the parts of the front elevation with regard to this axis.

The axis extends through the middle of the hall. The living room balances the dining room and the porch balances the garage. This arrangement permits of using any of the symmetrical elevations shown in Figs. 5 and 6. The feature of symmetry is carried out more particularly on the front elevations as shown in the illustrations. Windows and doors should be arranged as symmetrically as possible on the other elevations of the building.

11. Unsymmetrical Plans.—In unsymmetrical, or picturesque, plans, the various parts of the building are arranged without regard for axis lines. An example of an unsymmetrical plan is shown in Fig. 7. Five elevations in different styles that will fit this plan are also shown. There is no attempt to balance the parts except in the design in the lower right-hand corner, where a symmetrical front is shown that will fit the plan by making a small modification in the plan.

12. Use of Styles in Architecture.—Although many clients will accept the taste and judgment of the architect, some will require that a specific historic style be used in the design. The architect, therefore, must be familiar with the historic styles of design as well as with the styles that are in vogue in different parts of the country.

13. The architect sometimes specializes in the use of one or two styles of design, or he may choose more or less freely among the varied styles that have been used in the past. He may, as is the case with certain architects of the day, be disposed to cast aside the results of centuries of development and try to invent a new form or style of architecture. Other architects do not attempt to restrict their designs by copying historic or prevalent examples, but endeavor to use available building materials in a tasteful manner so as to produce buildings that are well adapted to their purposes and pleasing in appearance. Many of these last-mentioned architects are producing work that will be considered as the best work of the time in which they are built.

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RESTORATIONS AND ALTERATIONS TO A RESIDENCE IN MAINE

5637-B

DESIGNED AND RENDERED IN WATER COLOR BY ARTHUR L. GUPTILL, ARCHITECT

FIG. 8

14. It may be said for the symmetrical plan in Fig. 5 that any of the elevations shown in Figs. 5 and 6 will express, in a pleasant way, the nature and purpose of the plan and that each elevation when properly studied, drawn, and constructed would have an individual charm and would be perfectly satisfactory. The same comments may be made regarding the plan and elevations in Fig. 7.

The preliminary studies serve to demonstrate to the architect the various solutions that are possible under the conditions and enable him to select the best solution of the problem. The preliminary studies are not always shown to the client or owner.

PRELIMINARY SKETCHES AND ESTIMATES

15. **Making Preliminary Sketches.**—When a satisfactory scheme has been determined upon by the architect, the next step is to make a set of preliminary sketches for the owner. These will show the plans and elevations to the best advantage and are made for the purpose of showing the client the architect's conception of a building that will meet the client's requirements. The preliminary sketches generally include a perspective sketch of the front and one side of the building, which represents the building to the client in its most attractive form. An example of such a perspective view is shown in Fig. 8, which shows a finely rendered water-color perspective sketch of a proposed house. The preliminary sketches also include plans that are drawn in a sketchy but attractive way. In some cases the arrangement of the gardens, walks, and other accessories is shown as illustrated in Fig. 9. A set of preliminary sketches nicely prepared is of the greatest help in bringing the client to a decision. It sometimes requires two or three sets of sketches to determine just what the client requires, and it will save the architect considerable labor and expense if he can bring the client to a decision with the first sketches. These sketches are also helpful to the architect, who can see how his design is going to look. In making these preliminary sketches the architect has an opportunity to incorporate refinements and improvements on the original ideas and to present modifications of his client's ideas that may appear desirable.

16. The process of making the preliminary sketches will next be described. Having determined upon what seems to be the best of the preliminary studies, the First-Floor Plan is laid out on a piece of tracing paper, using the $\frac{1}{8}$- or $\frac{1}{10}$-inch scale. Various parts of the building, such as walls, stairs,

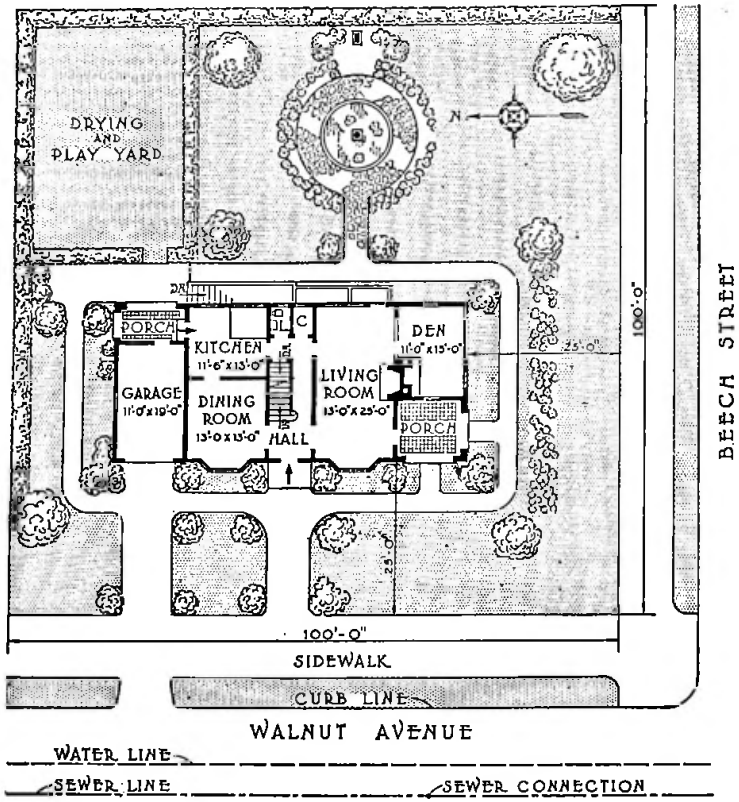


Fig. 9

doors, windows, and chimneys, are laid out at their approximate sizes. The rooms are laid out at the desired sizes. The entire plan is drawn in outline, in a sketchy manner, and a second piece of tracing paper is laid over this plan upon which the second floor is laid out. The walls, stairs, and chimneys must be carried up before the rooms are laid out, as these features must be provided for in any plan. The limits of the

space required for the stairs must be carefully calculated. The supports of the second-story partitions must be provided and chimneys of sufficient size to contain the flues must be drawn.

After these points have been considered, the bedrooms and bathrooms are laid out, together with closets, halls, stairs, etc. It will probably be discovered that the bedrooms and other rooms do not work out properly and that a change is necessary in the First-Floor Plan to allow for a good Second-Floor Plan. The Second-Floor Plan is modified so as to produce a good arrangement and the first floor is then changed to correspond. As these floors are the most important ones in the house, it is necessary that they be satisfactory. They should be changed and redrawn as often as is necessary until they are both satisfactory, after which a Cellar Plan should be started on a piece of tracing paper placed over the First-Floor Plan. An Attic Plan may be laid out over the Second-Floor Plan if desired.

17. The elevations are next studied with regard to the principles of design. It may be necessary to change partitions, chimneys, stairs, or any of the other interior parts of the plan to allow of a suitable arrangement of window openings. For this reason, it is not desirable to draw the plans too carefully until the elevations are satisfactory. In fact, the drawings of both plans and elevations should be made in a sketchy manner until the arrangement of all parts is satisfactory.

The outside of the building is seen by the public and the design should be a good example of the artistic work of the architect, as well as a credit to the taste of the owner. It should, therefore, be most carefully designed. This does not mean that the interior arrangements should be sacrificed to the exterior appearance, but that the skill of the architect should provide a good arrangement throughout. The study of elevations and of the plans should be carried on together. It is necessary, first, to obtain a good plan in the principal stories before starting the elevations. The architect should not hesitate, however, to modify his plans somewhat in order to obtain a good elevation. By sufficient study the architect should be able to obtain good elevations as well as good plans.

When all these drawings have been studied so as to produce satisfactory results, the finished preliminary sketches that are to be shown to the client are begun. It is these drawings that should be finished so as to be attractive and satisfactory to the client. They need not be drawn accurately, but they should have been studied so that accurate working drawings may be made from them without the necessity of making vital changes in the arrangements of the parts.

18. Examples of Preliminary Sketches.—Examples of the preliminary sketches that are submitted to the client are shown in Figs. 9, 10, and 11. A First-Floor Plan of the house, together with a layout for the entire lot is shown in Fig. 9. This plan shows how the various requirements for the comfort of the client and his family are provided for not only with regard to the building, but also in the arrangement of the grounds. Clients too often neglect to consider what should be done with the treatment of the lot, and many architects also do not pay much attention to this subject. The architect can exert considerable influence upon a client in persuading him to give his lot architectural treatment. The appearance of the house is often marred or spoiled by inappropriate surroundings, hence it is of considerable importance to the architect that his house shall be properly set. By planting bushes and trees, and by building pergolas, fences, or walls, objectionable features in the neighborhood can often be successfully hidden, and the desirable views improved.

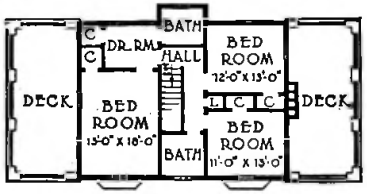


FIG. 10

19. In Fig. 9 the plan of the house is shown with the walls filled with black ink, but they may be done in water colors or crayons if desired. The rooms are named in neat lettering and their sizes marked, the tile floors in the porches are shown, and the boundaries of the lot and the sidewalks are shown. Trees and bushes are indicated on the front lawn, and bushes, hedges, etc. in the rear. At the rear of the house, grass plots and paths

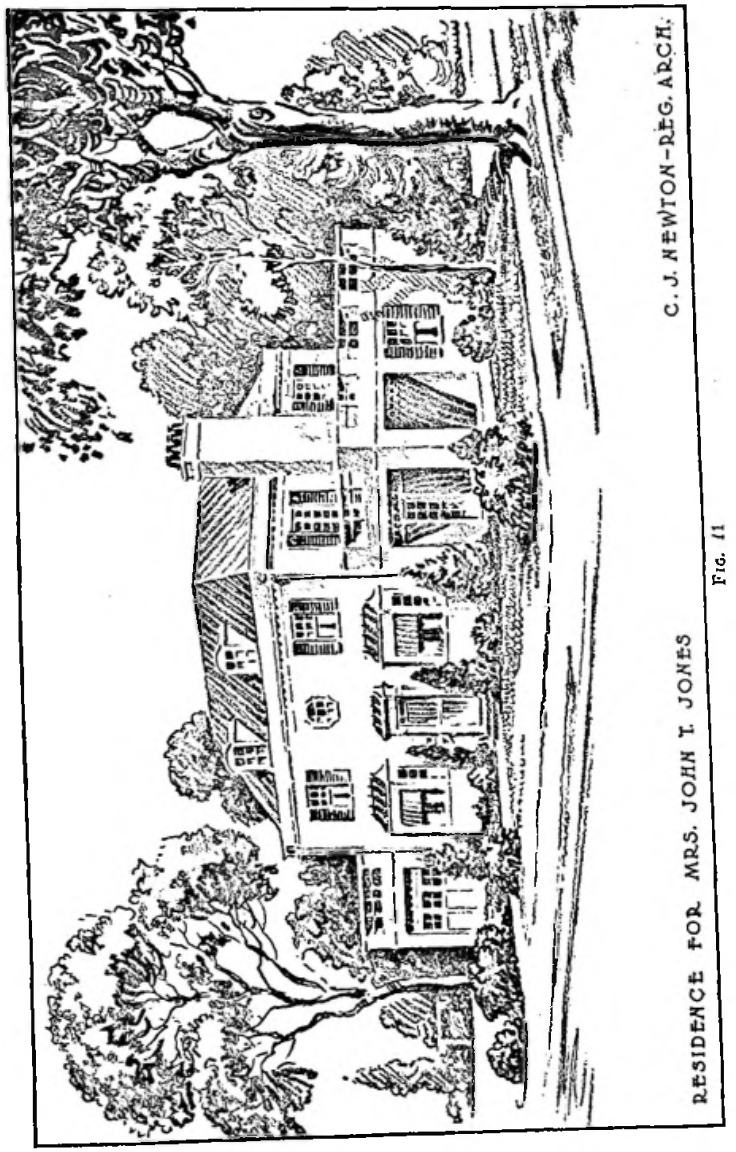


FIG. 11

are shown in a neat design including a sundial and a fountain. A yard for drying clothes is placed at the north of the building near the steps to the cellar. This yard also provides a place for children to play.

A drawing such as this will give the owner a suggestion as to how he may make his property very attractive, and, instead of confining his home to the house, he may develop his entire property so that he will receive enjoyment from all of it.

The second floor shown in Fig. 10 is a simple drawing showing the walls of the building blackened-in and the fixtures, stairs, etc. shown in line. It is neatly lettered and the sizes of the rooms marked. It is a good idea to mark the sizes on all rooms, bathrooms, etc., as it will facilitate answering questions regarding their sizes during the discussion with the client.

20. In showing the exterior of the house, it is generally clearer to show a perspective view giving two façades as they would appear from some convenient point of view. In a perspective drawing the paths, the planting, trees, etc. can be shown, and the client will obtain a realistic view of the proposed design. This is much more satisfactory to a client than two or three elevations which he may or may not understand.

A perspective view of the proposed house showing the building and some of the accessories is shown in Fig. 11. It is in this case that a knowledge of perspective drawing and of rendering is extremely useful to the architect. It is a well-known fact that a cleverly rendered perspective will be of considerable influence in winning a client over to the architect's design. It thus becomes the best method that the architect possesses to influence a client in accepting a design which the architect believes to be the best that can be made.

21. There are several mediums, such as water colors, pencil, pen-and-ink, and colored crayons, that can be successfully used in making attractive presentations of architectural drawings. Some architects can use one better than another. A rendering in lead pencil of the house under consideration is shown in Fig. 11. This form of rendering produces a realistic

effect, as it gives not only the form but also the lights and shadows.

Skill in rendering drawings can be obtained by practice, and the ability to make attractive drawings is of inestimable value to an architect. Architects who have not the faculty for doing this kind of work often pay high prices to have such work done for them, and a draftsman who can make good renderings in pencil, water colors, or pen-and-ink can command a good salary.

22. **Submitting Preliminary Sketches.**—When the architect has completed his preliminary sketches, he makes an appointment, either at his office or at the house of the client, to exhibit them. During the conference he points out how he has met the requirements and where he has improved certain arrangements. The client and his wife generally examine every feature of the plan; they see where their furniture and rugs are going to fit in and discuss all the details of the plans or elevations. It frequently happens that the clients desire some changes in the plans and elevations, which the architect carefully notes. His next duty then is to see if he can incorporate the changes in the plans as designed. If this cannot be accomplished, he may be compelled to make new sketches that will include all the points agreed upon. After this, he again confers with the client and once more the sketches are discussed in detail. It may be that slight changes are requested in these sketches, when the architect will be required again to change his sketches. It is much better to make any changes that may be required on the sketches than upon the costly working drawings which will be made later. The sketches are not finished very carefully and are easily changed, whereas changes in working drawings may mean the loss of considerable time and money.

23. It must be understood that when the building is small or unimportant the preliminary studies and sketches will be correspondingly simple. A colored perspective rendering such as the one shown in Fig. 8 would be made only for a client who is ordering a building of some size and for which a full commission is paid the architect. The architect can then afford to pay for high-grade preliminary sketches. Simple drawings such

as the ones shown in Figs. 2, 3, and 4 will be sufficient to show a relatively small house.

24. **Preliminary Estimates.**—Experience has demonstrated that it is advisable before making the working drawings to obtain a preliminary estimate of the cost of the building. If the building, as shown in the preliminary sketches, is too costly, it will be useless to spend time and money in making working drawings that will surely have to be changed. A good contractor can tell, from the preliminary sketches and a brief description of the materials for the building, the approximate cost of the building. The architect can also form a good idea of the cost if he has already designed and erected a similar building. If the cost is greater than the owner will pay, it will be much better to make changes in the preliminary sketch than to change the more expensive working drawings.

WORKING DRAWINGS

PRELIMINARY KNOWLEDGE NECESSARY

25. **Introduction.**—When the client's wishes have been met in the preliminary sketches and in the matter of cost, the architect proceeds to prepare the working drawings, which are the final drawings of the building. The working drawings must be accurately drawn and show the building with all its parts drawn to a given scale, so that the measurements can be taken from it. The method of procedure in getting up a set of working drawings is similar to that described for preliminary sketches. A more intimate knowledge of materials and methods of construction is, however, required for laying out the working drawings than for the sketches.

It will be noted that additional study is recommended at each stage in the progress of the design. The preliminary studies are very rough in character. The preliminary sketches, while showing a satisfactory general solution of the problem, are still in an incomplete form. Further study, especially in matters of construction and fine points of design, is required when making the working drawings. An architect, as he studies the plans in the various stages, finds ways of improving them. He naturally

incorporates these improvements in the plans. This process is kept up until the last drawing is completed. It is this study and improvement that gives an architect's plans their value.

26. In making a set of plans or working drawings the First-Floor Plan is generally drawn first, then the Second-Floor Plan. After these are roughly drawn, the elevations are made. The arrangement of windows, doors, and other openings is best determined on the elevations. When a desirable arrangement of openings is found on the elevations, these openings are drawn on the plans. When so drawn it may be necessary to make corresponding changes in the plans. The plans and elevations should be thoroughly studied and compared until they are all satisfactory, and the best possible results are obtained. This work may require the making of more than one drawing of each plan and elevation, but these study drawings, or studies, need not be made as carefully as the final drawings. The final, careful, and accurate drawings should be made only after all the necessary study and consideration have been given to the design, and there is nothing to be gained by further study. The Basement Plan is made to conform to the First-Floor Plan, and the Attic Plan to the Second-Floor Plan.

In the plates in this lesson are shown finished plans after the proper amount of study has been put on them. They represent the architect's final arrangement and the sizes of the various parts of the building, and can be used as contract drawings.

27. **Familiarity With Construction.**—The architectural draftsman should possess a good knowledge of construction and the application of the numerous materials employed in the erection of buildings, gained as a result of actual work on buildings, or by observation of building operations. A great deal can be learned, however, from the study of books treating of the various materials and methods of construction. Considerable information will also be gained by studying the successive plates in this lesson, while drawing them, until they are thoroughly understood. It should always be remembered that most drawings are made to show how the various building materials are put together harmoniously in order to produce specific results.

The value of reading the most up-to-date books published on all phases of the architect's profession, and the benefits of being a regular reader of one or more architectural magazines, are inestimable. Another fruitful method of obtaining valuable practical information on house planning and house building is to watch a house or other building in the process of construction. There are very few towns or villages, however small, where numerous opportunities to observe buildings being erected do not exist. The aspiring young architect need not go out of his way to find them; all he needs to do is to keep his eyes open and observe, and endeavor to understand what he sees.

28. **Materials Used in Building.**—A number of materials, such as stone, iron, and steel, brick, terra cotta or tile, plain and reinforced concrete, and wood, enter into building construction. Iron, steel, terra cotta, and reinforced concrete enter largely into the construction of large or fireproof buildings. These materials are used only to a limited extent in moderate-size dwellings, which are generally constructed entirely of stone, brick, concrete, and wood. Wood, however, is the predominating material.

29. **Wooden Buildings.**—Wooden buildings are of two classes of construction. One kind is carefully framed together with all the joints fitted like the details of a piece of furniture, and is called braced-frame construction. In this class are structures such as large mills, warehouses, coal pockets, and other buildings that require great strength. The framework of the building itself is made to withstand all strain regardless of covering or finishing material. The other class, called balloon-frame construction, has its framework simply nailed together. The framework in this case is rather flimsy, but when it is covered with sheathing boards laid diagonally, each board acts as a brace and helps to fasten the frame to which it is nailed. When complete, such a building is homogeneous and stiff and capable of resisting all the strain that it is likely to receive. This system of framing is used for residences, stores, and other buildings where great strength is not required. Various modifications of the balloon type of framing are used in different parts

of the country. There are also combinations of all these different methods.

30. **Examples of Framing.**—In Fig. 12 is shown the framing of a balloon-frame type of structure with all the finish-

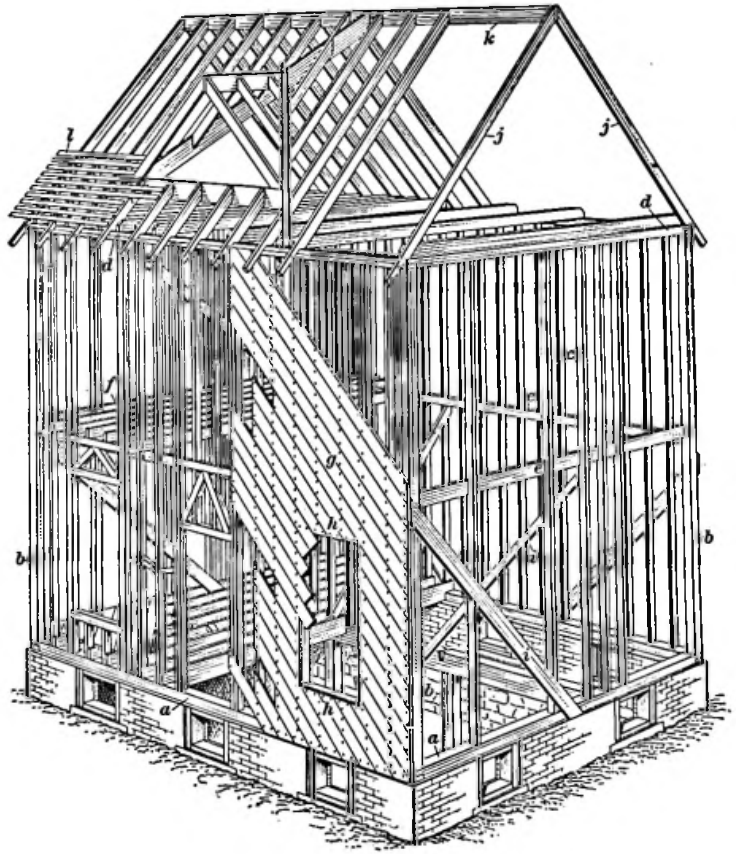


FIG. 12

ing work left off. The sill *a* is set back on the brick foundation wall about 1 inch, so that the sheathing will be flush with the brickwork. The corner posts *b* are simply spiked or nailed in place. Wherever possible the studs *c* are in one piece, extending from the sill to the roof plate *d*, but if the proper length

cannot be obtained, they are spliced. It is customary to use stock lengths of studding in the erection of a balloon-frame building. Studs 20 feet in length are commonly used to provide a building having two stories, the first being 9 ft. 6 in. and the second 9 ft. in height. If studs 18 feet long can be used, 8′ 9″ and 8′ 3″ stories may be used. Story heights such as these are quite satisfactory.

The studs are nailed into position and the ledger boards, or ribbons, *e*, which are about $\frac{7}{8}$ inch in thickness, support the second-story beams *f*, and are let into the faces of the studs and nailed to the studs. The sheathing *g* is securely nailed to each side of the structure in a diagonal position, and serves to brace it thoroughly. In putting on the sheathing, no attempt is made to fit it to the window openings, but these openings are sawed out, as shown at *h*, after the sheathing is placed. Temporary braces, as shown at *i*, are usually employed to hold up the structure until the sheathing is placed and the building made secure. The lower ends of the roof joists, or rafters, *j* rest on the plate *d*, while at the head they rest on the ridge board *k*. The attic-floor beams over the second story are nailed to the rafters wherever practical. In this way they tie the two ends of the rafters together and overcome any tendency they may have to spread out and slide off. In buildings where the ceiling beams are so placed as not to give convenient nailing space for the rafters, a tie is generally carried across the building and nailed to each pair of rafters so as to prevent them from separating. Shingle laths consisting of small strips of wood, as shown at *l*, are sometimes laid over the rafters at intervals equal to the exposure of the shingles. In some cases roofs are covered with wide boards laid close together. This is not as good for a shingle roof as using shingle laths, as it prevents the proper ventilation of the under side of the shingles with which the roof is finally covered. In cold climates, however, it is found necessary to board the roof over so as to conserve warmth, even when shingles are used.

31. Sizes of Building Materials.—The sizes of building materials, such as lumber, glass, brick, etc., have been described

in other lessons. A good knowledge of these materials and the methods in which they are used is indispensable to the architect in making the drawings.

IMPORTANT CONSIDERATIONS

32. Architectural Design.—While an acquaintance with the materials used in buildings and the processes necessary to put them together is essential to the architectural draftsman, a knowledge of the principles of architectural design is of even more importance. It is necessary to know where to put the stone, brick, wood, etc., and this is determined by various considerations, such as beauty, utility, appropriateness, proportion, and scale.

33. In the planning of any dwelling the most important considerations are the comfort and convenience of the occupants. The matter of cost is also important in most operations.

34. Comfort and Convenience.—A man's dwelling should fit the requirements of himself and of every member of his household. To accomplish this end, the architect must, as one of the first considerations, find out his client's mode of life with regard to his domestic habits and necessities. He must also be informed in these matters with regard to the other members of the household, the information extending also to the servants, if there are any. In possession of this information, the architect must proceed to design, so far as he can with the amount of money that the client has to spend, a dwelling that will meet every requirement of comfort and convenience. It must also be satisfying and pleasant to look upon, thereby combining to the maximum degree the elements of utility and beauty.

35. Proper Arrangement of Parts.—Having determined from a discussion of the requirements of the client and his family the approximate number, kind, and size of the rooms required, the next important step is the consideration of the proper arrangement of the different parts with relation to each other. This ordinarily requires a great deal of careful study, arranging and rearranging, tracing and retracing, before a

satisfactory arrangement is finally worked out. The architect generally makes his first studies freehand as described, then he proceeds to the preliminary sketches and lays them out to scale. He then studies the different arrangements of rooms by the simple process of laying pieces of tracing paper over completed layouts and trying different arrangements of different portions until a satisfactory one is secured. In studying the interior arrangement of rooms, the effect on the exterior appearance must also be considered, and, before getting too far in the interior arrangement, the designer must commence his sketches of the exterior so that the study of the exterior may be carried right along at the same time with that of the interior, since the placing of window and door openings, dormers, bay windows, etc. affects not only the convenience of the interior arrangement, but the exterior appearance as well.

36. **Cost Consideration.**—The consideration of cost is of primary importance. It would obviously be a waste of time, for instance, for an architect to design a dwelling for a client that would meet perfectly his requirements as to comfort and convenience, but that would cost $40,000 to build, if the client had only $25,000 to spend. It is, therefore, essential that the architect consider from the very beginning the matter of economy in connection with the design. He should ascertain as nearly as possible just how much money his client will spend for his dwelling and he should keep this in mind in making his design. He should make approximate estimates of the cost of his studies or designs. In order to accomplish this, it is necessary that he should familiarize himself with the cost of the dffierent materials and classes of labor entering into the construction. In addition, he may call upon one of two responsible contracting builders for their approximate estimates of the cost. It is one thing to solve successfully for a client the problem of comfort and convenience in a dwelling without regard to the cost, but it is quite another thing to solve the problem while keeping within a certain stipulated amount, and the architect must not lose sight of this fact. The cases where an architect is permitted to go ahead without regard to expense are extremely rare.

37. **Choice of Materials.**—The matter of choosing materials to be used in the structure may be affected by any or all of a number of considerations. Some of these are cost, proximity to the site, availability at the particular time at which they will be needed, sentiment, etc. Here, again it will be necessary that the architect have a knowledge of the prices of the different materials to guide him in making his decision. The style in which he is designing, the color scheme, etc. will also affect the decision.

38. **Site, Grade, Etc.**—The design of a building may be greatly influenced by the site and the grade, or contour, of the ground at the site of the proposed building. In the problem of designing a dwelling on an ordinary city lot, the architect should obtain from the client the exact size and location of the lot. He should also have the grade or contour of the ground. This will not be needed for the preliminary studies unless the contour is so uneven or diversified as to affect materially the design of the intended structure. It will be necessary to establish on the working drawings the height of the first floor above the ground, the depth of cellar, etc. Elevations should be taken at the sidewalk in front of the dwelling, at the four corners of the dwelling at least; and at as many more points as required by any irregularities of the ground.

39. The architect should obtain from the city engineer or other officials having the matter in charge the location of the sewer and water mains in the street and their depth below the surface of the ground at the points where the house lines will enter these mains. With this knowledge he will be able to allow for the proper fall in the sewer from the house to the mains.

40. **Simplicity in Form.**—Simplicity in form, both with regard to the arrangement of the floor plans and the exterior design, should be the goal of the architect. Simple plans are invariably the most workable, the most convenient, and the best. Complicated arrangements should be avoided; a convenient arrangement of rooms with a minimum of corners, angles, turns, and twists, can generally be obtained by sufficient study of the

problem, and, in addition to giving a better opportunity for treatment of the exterior, the simple plan constitutes much more economical construction than the one having a multiplicity of corners and angles.

41. Beauty.—Every man desires that his dwelling shall possess at least some of the elements of beauty, although very few persons could give an intelligent definition of the term beauty, and no two definitions would be the same. In solving any architectural problem, the elements of both utility and beauty must be considered and so coordinated and combined as to present a harmonious whole. The dwelling under consideration should, when completed, meet every requirement of comfort and convenience of the occupants and present a well-proportioned exterior, and a pleasing example of the particular style of architecture in which it is designed.

MAKING OF WORKING DRAWINGS

PLATE I, TITLE: FIRST-FLOOR PLAN

42. Introduction.—A set of six working drawings of the residence, shown at the scale of $\frac{1}{8}$ inch = 1 foot, is furnished with this text. These drawings are marked as being at the scale of $\frac{1}{4}$ inch = 1 foot, as they represent actual working drawings that would be made at the $\frac{1}{4}$-inch scale. The student should not merely copy the plans, but should endeavor, as far as his knowledge and experience will permit, to study and understand every item shown on the prints. He should assume that he is preparing accurate, dependable working drawings from which estimates will be taken and from which a building is to be erected.

43. The successful completion of the drawings previously required should be sufficient qualification for the execution of the technical part of the drawings called for in this text. Since the actual drawing of the lines and indications should be comparatively easy, greater attention should be given to the ideas that are to be shown by the drawings than to the process of making the lines and indications. The study of the building trades and the processes used in building should be of great

value in laying out the proper sizes and construction on these drawings.

44. Symmetry.—At this point it is advisable to discuss the subject of symmetry as it is used in several instances in drawing the plans and elevations of the building that is being studied. Symmetry is often a very important and desirable feature in good design. In the Front Elevation the arrangement of the various features is symmetrical. If a line is drawn vertically through the center of the doorway, it will divide this elevation into two equal and similar parts, the one to the left of the line being the reverse of the one to the right. The line is called the axis of the elevation.

For each feature on one side of the axis there is a similar one on the other side, equally distant from the axis. These features are said to be symmetrical with reference to this axis. The doorway and the windows above are divided into two equal parts by this axis. The windows of the dining room and the living room which appear in this elevation are symmetrical with reference to this axis. The same is true of the bedroom windows above and the basement windows below.

A slight difference occurs in the details of the porches and the garage on the ends of this elevation, but a symmetrical effect is secured by making the outlines the same, and by keeping the details similar.

The chimneys do not count as part of this elevation, as they are located at different distances back of the building. The Front Elevation may be considered as a symmetrical design.

A façade treated symmetrically generally has a restful, dignified, and elegant effect.

The requirements of a dwelling do not generally allow a symmetrical treatment on all sides, and such a treatment is rarely attempted. Nevertheless, symmetry can be used in the principal parts where a quiet, dignified effect is desired.

45. Symmetry in Plan.—The rooms on the first floor are most important and should be designed with reference to proportion, symmetry, and beauty. In simple homes, well-proportioned and symmetrical plans can be obtained by skilful arrange-

ment of the parts. Good proportions and symmetry are largely conducive to beauty in a room.

46. In the drawing of the First-Floor Plan a general symmetry has been maintained. The walls of the living room and the dining room are symmetrical with regard to the principal axis *AB*; that is, the walls of the hall are equidistant from the axis; and the walls of these rooms opposite the hall are also equidistant from the axis. The main-entrance doors and the vestibule are symmetrical with the same axis, which may be said to cut them into two equal parts.

47. The living room is designed with reference to two axes *EF* and *IJ*. The fireplace is exactly symmetrical with respect to the axis *IJ*, whereas the bay window and the windows in the rear are symmetrical with respect to the axis *EF*.

48. The reason for emphasizing the matter of symmetry at this point is that symmetry can best be introduced into the drawings when starting to lay out the plans of a building. It is also brought out so as to impress the student with the value of drawing axis in certain parts of the plan and working from them in laying out the windows, doors, and other features, especially in the more important rooms of the house.

Axes are used in the elevations in laying out the windows. Thus, in the Front Elevation, the windows of the living room and the dining room are located on this elevation with reference to the axes of these rooms. Axis lines of the four windows should be drawn in faint lines on the elevation and the basement and second-floor windows laid out on the same axes as the first-story windows.

In the other Elevations the axes of the living-room windows should be drawn faintly and the second-story windows laid out on these axes. The same method should be used wherever one window should be directly over the one below.

49. Methods of Procedure.—The drawing board should be covered with a sheet of detail paper or heavy wrapping paper free from wrinkles or creases. A sheet of transparent bond

paper 15 inches × 20 inches should be tacked to the board with the edges of the board and the paper parallel.

The longest dimension of the board and of the paper should extend from left to right; lines in that direction will be referred to as horizontal lines. Lines perpendicular to those lines will be considered as vertical lines.

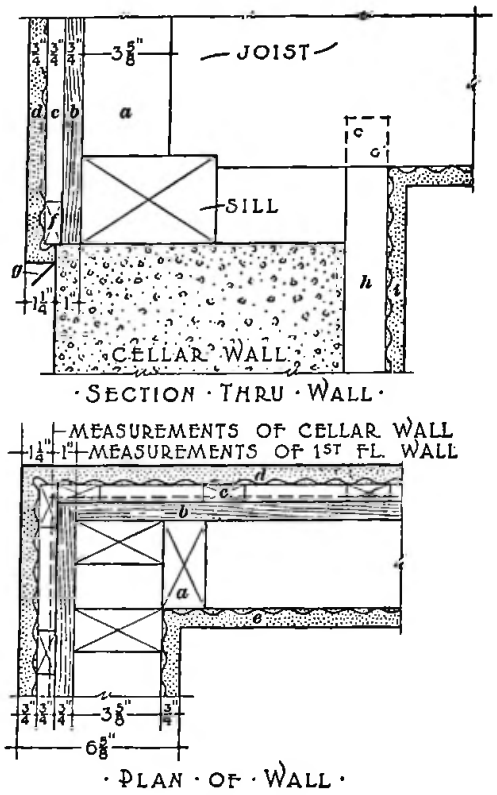


FIG. 13

The drawings are to be made like the drawings accompanying this text. These drawings should not be copied, but the student's drawing should be built up according to the following directions.

50. In drawing the First-Floor Plan draw a faint vertical line *AB* through the middle of the sheet. This line will extend

through the center of the hall in the plan. Draw a horizontal line CD, $1\frac{3}{4}$ inches from the top edge of the paper. This will be the outer face of the rear wall. Draw the vertical line EF parallel with and at a distance of 10 ft. 5 in., on the $\frac{1}{4}''$ scale, from AB. Draw GH parallel with and at a distance of 10 ft. 5 in. from AB. The scale used in laying out this drawing will be $\frac{1}{4}''=1'\,0''$, which is the scale commonly used in laying out working drawings of a residence.

51. Thickness of Outside Wall.—The thickness of the outside wall in this building will now be computed. For this purpose, a section through the wall showing the sill of the building and the top of the cellar wall is shown in Fig. 13. The face of the sill is set back 1 inch from the face of the cellar wall. The studs *a* are set with the outer faces flush with the face of the sill. At *b* is shown sheathing which may be of wood or insulating boards. Vertical furring strips *c* are nailed at 16 inches on centers to the sheathing, which may be covered with paper if desired. Metal lath is fastened to the furring strips and stucco *d* is applied to the lath. Lathing and plastering *e* are shown on the plan of the wall.

52. The dimensions of the parts shown in the illustration are the minimum dimensions. Variations in thicknesses may, however, be expected, but they will not affect the detail seriously. As a rule, the face of the sill is kept 1 inch back of the face of the basement wall.

A strip *f* is nailed horizontally along the bottom of the sheathing to provide nailing for the metal lath. A metal termite shield *g* may be applied if it is considered necessary.

The cellar wall is shown furred with 2 in.$\times$4 in. furring *h*, the tops of which are nailed to the joists. Lath and plaster *i* or wallboard may be applied to the furring.

53. The dimensions on the First-Floor Plan are to the outside of the sill, and the frame will be built to these sizes. The stucco face of the wall will be $2\frac{1}{4}$ inches outside the frame.

The dimensions shown on the Basement Plan are to the outside of the cellar wall.

Thus, the total length of the frame of the building should be 2 inches less than the outside length of the cellar walls. The total thickness of the outside first-story wall will be $6\frac{5}{8}$ inches, and the stucco finish will project about $2\frac{1}{4}$ inches beyond the face of the frame.

54. Draw a horizontal line $6\frac{5}{8}$ inches below the line CD. This will show the rear wall at the proper thickness.

At the ends of the wall, as shown in Fig. 14, draw lines *ab* and *cd* $2\frac{1}{4}$ inches in from the outer faces of the wall. These lines will be the lines of the wood frame and the lines from which the dimensions will be measured. The dimensions to the centers of windows may be laid out on the plan of the first floor as shown in the drawings. Lay off the widths of the windows from the Window Schedule on the First-Floor Plan and indicate the windows as shown.

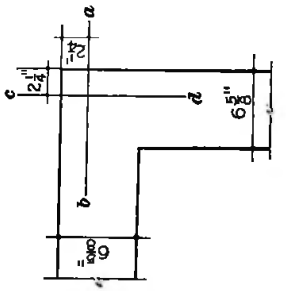


FIG. 14

From CD lay off the distances, 25 ft. 10 in.$+2\frac{1}{4}+2\frac{1}{4}$ in.$=26$ ft. $2\frac{1}{2}$ in., perpendicular to CD, at the right and left ends. These points locate the outside face of the front wall. Make the front walls $6\frac{5}{8}$ inches thick. Project the bay windows 1 ft. 6 in. beyond the face of the wall. On the axes EF and GH lay off the bay windows as shown. On the axis AB lay off the front door as shown in the drawing of the plan.

55. Partitions.—On each side of the axis AB lay off 3 ft. 9 in., which points will locate the centers of the hall partitions. The minimum size of these partitions is $3\frac{5}{8}$ inches for the studs plus $\frac{3}{4}$ inch for the plaster on each side of the partition, which is $5\frac{1}{8}$ inches. The partitions may be shown as 6 inches for this drawing, but should be figured to the centers. These partitions have been made thinner in the coat and toilet rooms so as to gain a few inches of additional inside space. This is done by setting the studs flatwise, thus saving 2 inches in the thickness of each partition.

It will also be noted that the partition between the living room and den and the dining room and garage are $5\frac{1}{8}$ inches minimum size, but they are shown on this drawing as 6 inches.

56. **Windows.**—The windows are laid out with their centers on the axis according to the Window Schedule given on the drawing of the First-Floor Plan. The central windows in the bays are picture windows and do not open. The windows on each side of the picture windows are single casement windows that open sidewise. Most of the windows are double hung. The numbers, sizes, and characters of the various windows are shown in the Window Schedule given on the First-Floor Plan. The sizes given in this schedule are the sizes of the sash openings. The numbers on the plans correspond with the numbers in the schedule.

57. **Doors.**—All the swinging doors are indicated by lines drawn to show the edge on which the door is hung and the direction in which the door swings. In laying out doors it is desirable to try the full swing of the doors by making faint half circles in order to see if the door strikes any obstacles or interferes with other doors. The sizes of the doors are shown in the Door Schedule given on the First-Floor Plan. The letters on the plans correspond with the letters in the schedule.

58. **Swing of Doors.**—In domestic buildings, all outside doors should swing into the building. In schools, churches, and other buildings where numbers of people gather, the outside doors should open outward so as to permit of easy exit in case of an emergency.

59. Doors to the principal rooms of a house generally open into the room. They should, when possible, open against walls, where they will be out of the way. Doors to bathrooms generally open into the bathrooms, and doors to closets open out of the closets into the rooms. Doors to closets should open so that the closets will be as light as possible. Doors to bedrooms should open so that the bed cannot be seen, if this is convenient.

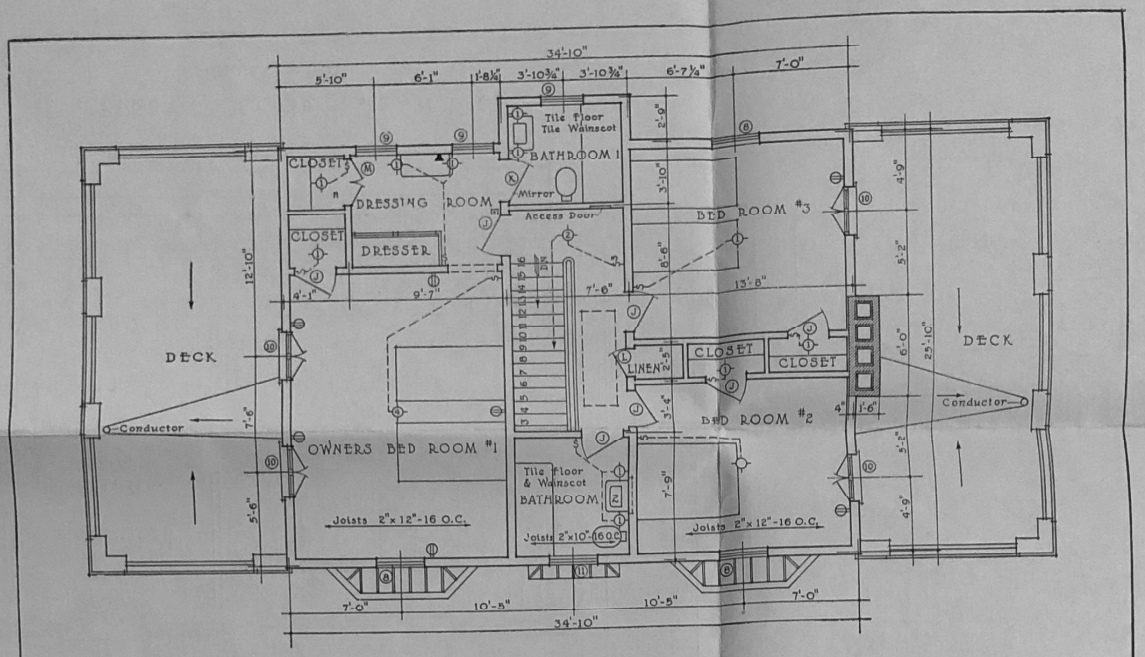
60. **Trim of Doors.**—It should be remembered that the trim of doors, as well as of windows, extends 4 inches or more

on each side of the opening. Consequently, in placing a door that is 3 feet wide, a space 3 ft. 8 in. or more will be required to provide properly for the door and the trim. When locating doors on a plan in the corners of rooms, a space of 4 inches or more should be allowed between the door opening and the adjacent wall. In important rooms it is always safer to allow 10 or 12 inches between the opening and the wall, to provide for more elaborate trim.

61. Where a door is to be fitted with a glass panel, the fact is noted on the plan and on the elevation by the letters *GL.* or the word *glass* marked at the door on the plan. The nature of the glass is stated in the specifications and the sizes and shape are given on scale details and in a Door Schedule, as in the First-Floor Plan of a residence in this lesson.

The doors should be carefully drawn, as shown on the drawing. They may be shown on the plans at an angle of 30 or 45 degrees, as convenient. As a rule, it is best to have them all drawn at the same angle.

62. **Pantry.**—Although the pantry is a useful connecting link between the dining room and the kitchen in large residences where servants are employed, in the modern small house, where the housewife does most of the work connected with the management of the home, the pantry is generally omitted. For this reason and because its omission reduces the cost of the house, a pantry is not shown in this residence. When used, it is a convenient place to keep the china and to wash the china after it has been used. For this latter purpose a pantry sink made of porcelain, galvanized iron, white metal, or copper is provided. The pantry sink is generally provided with a stopper or a standing waste so that glassware can be washed in the sink itself without using the dishpan. If the sinks are of very hard material such as porcelain, china, or heavy cast iron, there is a great risk of breaking glassware and fine china. Pantry sinks are, therefore, often made of thin sheet metal such as copper or white metal, which is more yielding and reduces the risk of breakage. The pantry sink should have an ample drain-board. A pantry should have counter shelves or cabinets with a suitable space



SECOND FLOOR PLAN

SCALE: ¼" = 1'-0"

2ND FL. DOOR SCHEDULE				2ND FL. WINDOW SCHEDULE				
(J)	7	5-Panel	2'-6" x 6'-8" x 1⅜"	–	(8)	3	D.Hung	3'-0" x 4'-4" x 1⅜"	7 LGTS
(K)	1	Mirror	2'-6" x 6'-8" x 1⅜"	GL.	(9)	2	Casem't	2'-6" x 4'-4" x 1⅜"	5 "
(L)	1	5-Panel	1'-8" x 6'-6" x 1⅜"	–	(10)	4	French	3'-0" x 7'-0" x 1¾"	12 "
(M)	2	Smooth	1'-6" x 6'-8" x 1⅜"	–	(11)	2	Fancy	2'-6" x 2'-6" x 1⅜"	9 "
			ATTIC						
					(12)	4	Casem't	2'-0" x 3'-0" x 1⅜"	6 LGTS

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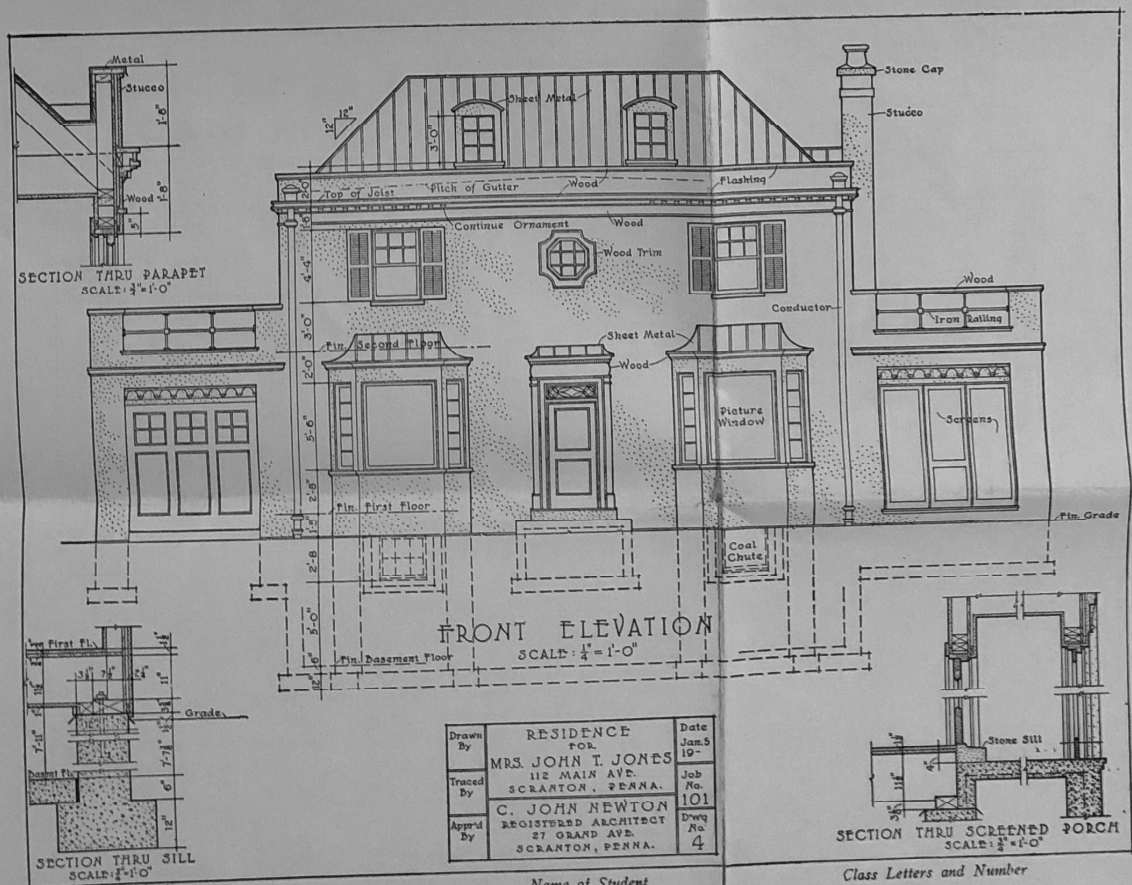

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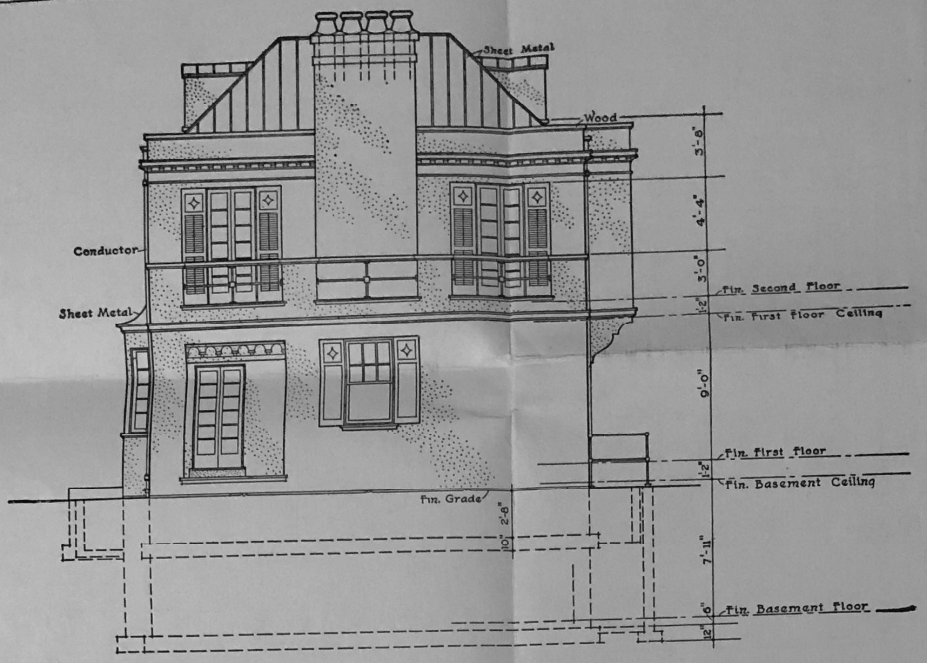

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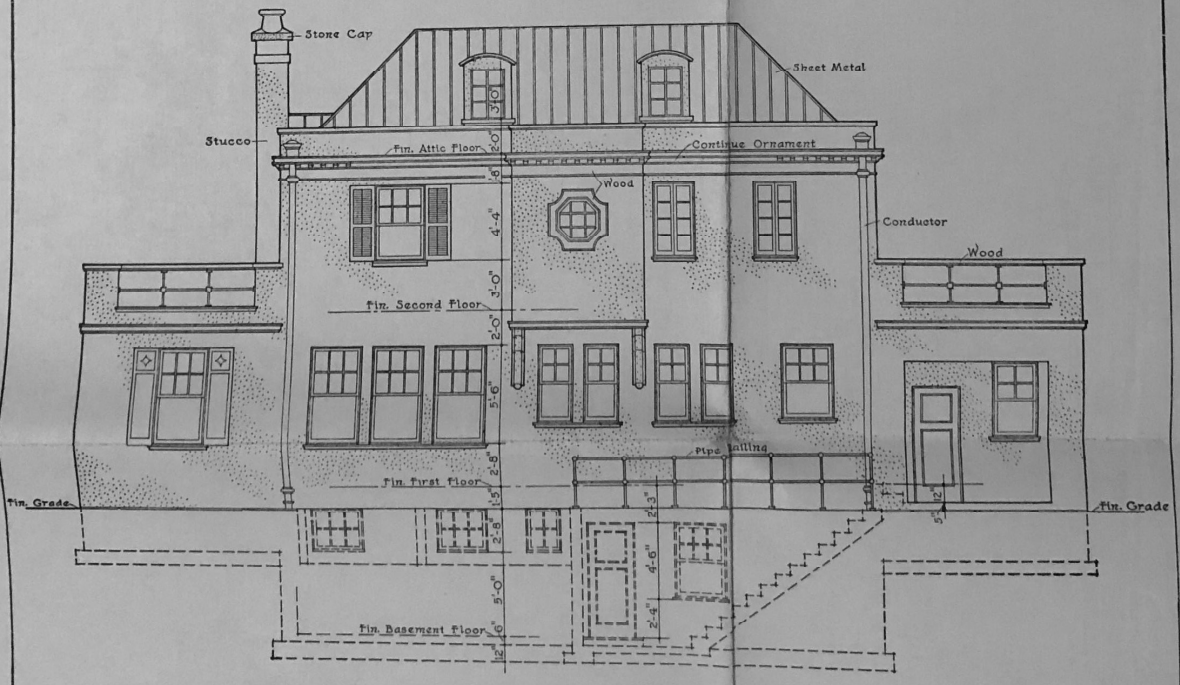
SIDE ELEVATION
SCALE: $\frac{1}{4}$" = 1'-0"

5637B Grade — Name of Student — Class Letters and Number



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REAR ELEVATION
SCALE: $\frac{1}{4}$" = 1'-0"

5637B Grade — Name of Student — Class Letters and Number

Architectural Drawing

Serial 5637B—Edition 3

Basement Plan
First Floor Plan
Second Floor Plan

Front Elevation
Side Elevation
Rear Elevation

Figs. 21—22—31

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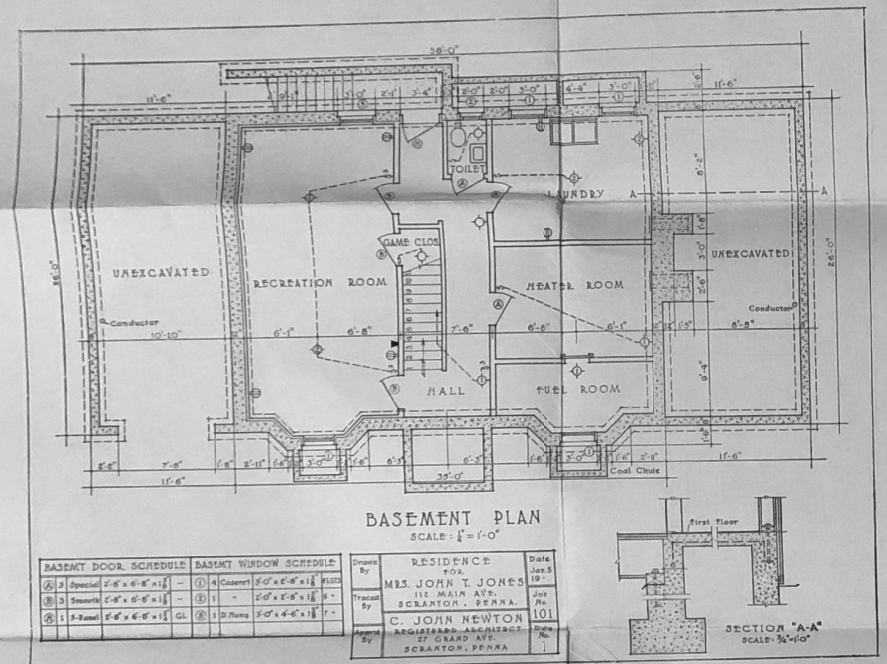

BASEMENT PLAN

SCALE: 1/4" = 1'-0"

BASEMT DOOR SCHEDULE					BASEMT WINDOW SCHEDULE				
(A)	3	Special	2'-8" x 6'-8" x 1 3/8"	—	(1)	4	Casemt	3'-0" x 2'-6" x 1 1/8"	H.G.
(B)	3	Smooth	2'-8" x 6'-8" x 1 3/8"	—	(E)	1	"	2'-0" x 2'-6" x 1 1/8"	9 "
(R)	1	5-Panel	2'-8" x 6'-8" x 1 3/8"	GL	(E)	1	D.Hung	3'-0" x 4'-6" x 1 3/8"	7 "

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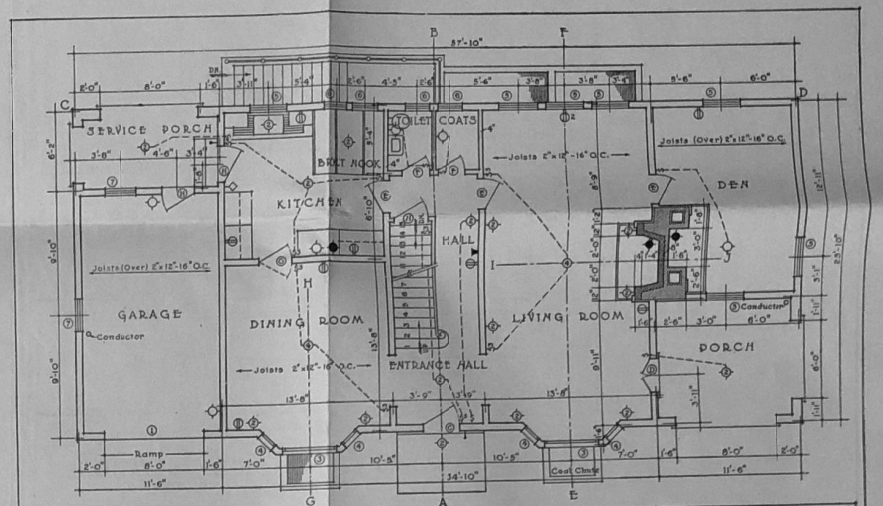
Date	Jan.5 19 -
Job No.	101
Dwg No.	1

SECTION "A-A"
SCALE: 3/4"-1'-0"

5637B Grade *Name of Student* *Class Letters and Number*



1ST FL. DOOR SCHEDULE						1ST FL. WINDOW SCHEDULE					
(C)	1	Special	3'-0" x 6'-8" x 1 3/8"	GL	(3)	2	Single	4'-6" x 5'-6" x 1 3/8"	H.G.
(D)	2	French	1'-4" x 6'-8" x 1 3/8"	GL	(4)	6	Single	1'-6" x 5'-6" x 1 3/8"	5 "
(E)	3	5-Panel	2'-6" x 6'-8" x 1 3/8"	—	(5)	7	D.Hung	3'-0" x 4'-6" x 1 3/8"	
(F)	2	"	2'-2" x 6'-8" x 1 3/8"	GL	(6)	4	"	2'-0" x 4'-6" x 1 3/8"	
(G)	1	"	2'-2" x 6'-0" x 1 3/8"	—	(7)	2	"	2'-6" x 4'-6" x 1 3/8"	
(H)	2	"	2'-8" x 6'-8" x 1 3/8"	—					
(I)	1	Overhead	8'-0" x 8'-0" x 2 1/4"	Gar.					

FIRST FLOOR PLAN

SCALE: 1/8" = 1'-0"

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Traced By	
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Date	Jan.5 19 -
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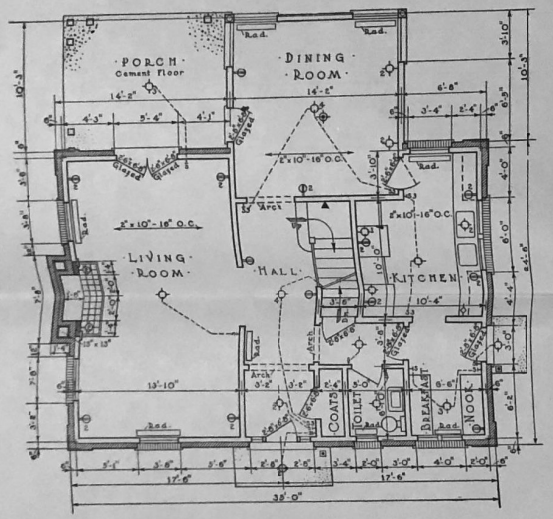
Dwg No.	2

INDICATIONS	SYMBOLS	
Brick	Ceiling Outlet	Wall Outlet
Concrete	Wall Plug	Radio
Wood Wall	Floor Outlet	Telephone
Stucco	Bell	Door Bell Push
Wood	Switch	Annunciator
	3-Way Switch	Gas Outlet
	Door Switch	

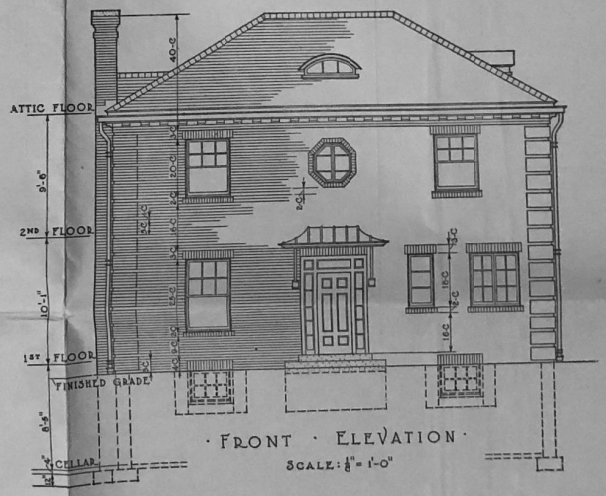
5637B Grade *Name of Student* *Class Letters and Number*

5637B Grade



· FIRST · FLOOR · PLAN ·

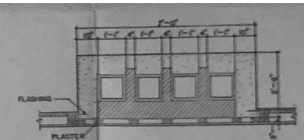
SCALE: $\frac{1}{8}$ = 1'-0"



· FRONT · ELEVATION ·

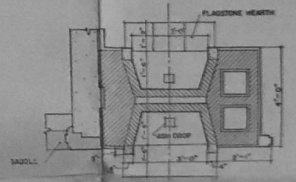
SCALE: $\frac{1}{8}$" = 1'-0"

BUILDING – Residence
LOCATION– 987 Brick St.
OWNER – A.B. Mason
JOB No. 123 DRAWING No. 1
SCALE: $\frac{1}{8}$"=1'-0" DATE: 10-8-33
DRAWN BY A.B.C. TRACED BY D.E.F.
CHECKED BY G.H.I.
JOHN B. SMITH, Architect
1000 Wyoming Ave., Scranton, Pa.



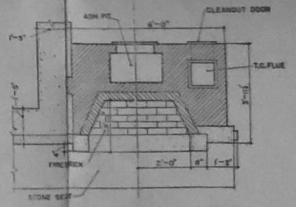
PLAN OF CHIMNEY AT SECOND FLOOR

1"=1'-0"



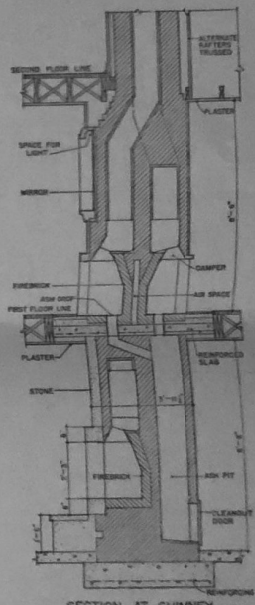
PLAN OF CHIMNEY AT FIRST FLOOR

1"=1'-0"



PLAN OF CHIMNEY AT BASEMENT

1"=1'-0"



SECTION AT CHIMNEY

1"=1'-0"

1637 E

Fig. 21

Fig. 22

Fig. 31

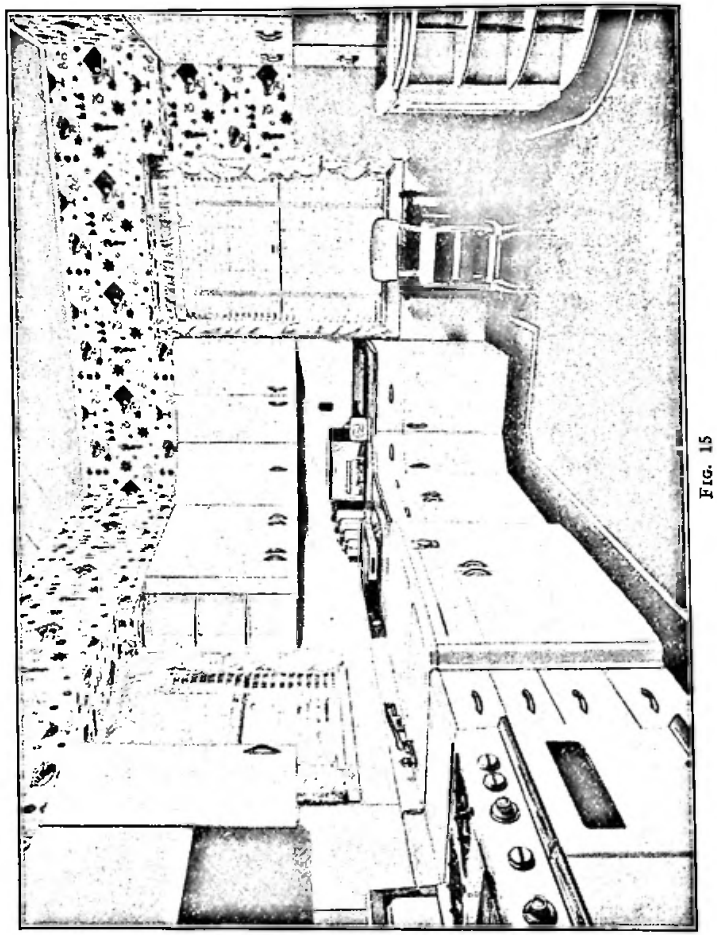


FIG. 15

above. These are used in preparing and serving food, and later on for receiving the soiled dishes from the dining room.

63. Kitchen.—The purpose of a kitchen is for the preparation and cooking of food. It is necessary, therefore, that it contain a stove for cookinng and a sink for washing dishes and cooking utensils. Cabinets or dressers should be provided to contain cooking utensils, kitchen crockery, and some of the less bulky food supplies. A refrigerator should be located so as to be

convenient. All these features should be drawn in place as shown on the drawing of the First-Floor Plan. The kitchen in the modern home is one of the most important rooms in the house and should be most carefully designed.

64. An illustration of a modern kitchen is shown in Fig. 15, in which a sink is shown directly below the window. To the right of the sink is a dishwasher. The counter shelf at the top level of the sink is covered with stainless steel. Beneath the counter shelves are base cabinets with closets and drawers. On the wall above the counter shelves are wall cabinets, having doors and shelves. The purpose of these cabinets is to hold various kitchen utensils and packages of supplies. Between the wall cabinets and the counter shelves is a working space for washing dishes, preparing food, etc. A kitchen such as this is clean, sunny, and a place in which it is a pleasure to work.

65. In the First-Floor Plan, a sink is indicated under the window. A counter shelf, base cabinets, wall cabinets, a refrigerator, and a range, are provided. These items should be indicated as shown in the drawing.

66. A breakfast nook with a double window is shown in the kitchen and should be drawn at the size shown. Although this kitchen is small, it is fairly complete. Each plan presents different opportunities for the arrangement of the various vital parts of a complete kitchen.

67. Service Porch.—A service porch is a necessity in a well-planned house. It affords a place for the servants to sit in pleasant weather. It also gives protection from rain and snow to tradesmen and others who may come to the kitchen entrance. This porch can be enclosed with mosquito screens, including a screen door, if it is found desirable to do so.

68. Dining Room.—The dining room, as shown in the First-Floor Plan, is a simple room and is easily drawn. There is a tendency in modern planning to omit the dining room and to place the dining-room furniture in the living room. The furniture in this case should not include large sideboards or

china-closets, but should be reduced to the minimum quantity possible. A breakfast nook is a pleasant place in which a small family may eat.

69. **Hall.**—The hall should be of ample size so that several visitors can enter at once without being crowded. A coat closet is provided to take care of wraps, umbrellas, overshoes, etc. It is illuminated by a light in the ceiling that is turned on automatically by the opening of the door and extinguished by the closing of the door. To avoid the necessity of people going upstairs, a toilet is also provided. The student should have no difficulty in drawing the indications of the basin, water closet, and light outlet shown here.

The door from the kitchen to the rear hall permits anyone, in answering the door bell, to go from the kitchen to the front door without going through the dining room or the living room, where the family and guests may be assembled.

70. **Stairs.**—More mistakes are made in drawing and arranging stairs than in any other feature of a building. Too much care and study cannot be applied to the design of stairs in order to prevent a faulty arrangement that may spoil the plans.

Because a designer is apt to be careless in indicating the stairs in the preliminary sketches, when the working drawings are laid out from the sketches it is often found that enough space has not been allowed for the stairs. It then becomes necessary to cut the sizes of rooms, to omit closets, and to make other sacrifices in order to make room for the stairs.

71. Conditions that cannot be ignored must be met in designing stairs. The width of the stairs should be at least sufficient to permit two persons to pass. The individual steps should be of a size to form a comfortable step. A standard step should have a rise of from 7 to 7½ inches and a tread of from 10 to 11 inches. Economical working sizes are 7½ and 10 inches.

Winders or triangular steps should rarely be used, especially in poorly lighted places.

Sufficient space should always be provided between the steps and any construction above to allow an adult to use the stairs without knocking his head. This space is called headroom.

Dimensions, width of stairs, width and height of steps, and headroom are factors that should never be forgotten in designing stairs.

72. The manner in which headroom should be provided for is illustrated in Fig. 16. In this illustration, the distance

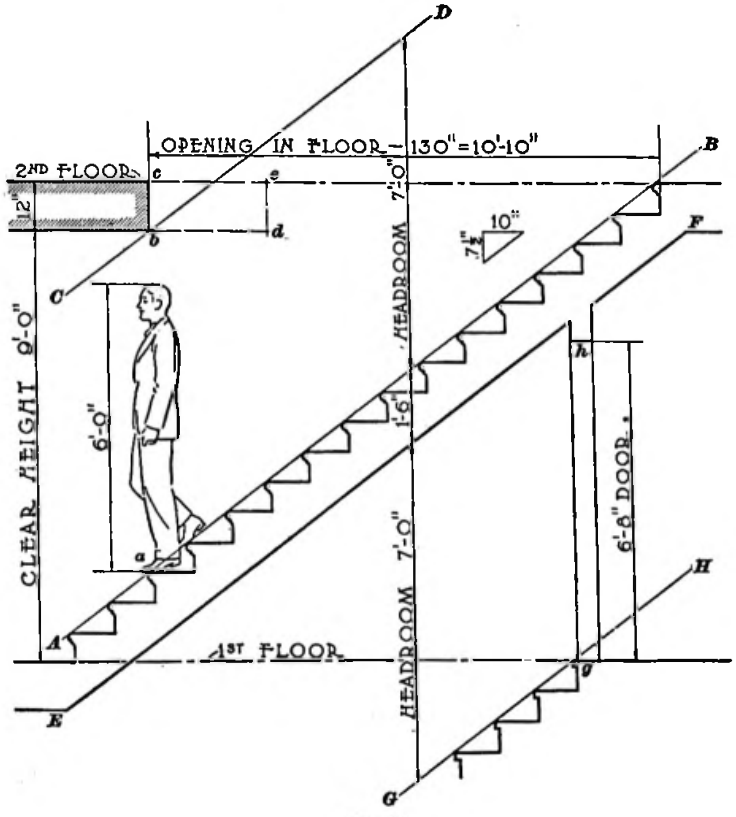


Fig. 16

between the first and second floor is shown as 10 ft. 0 in. Since the thickness of the second-floor construction is shown as 1 ft. 0 in., the clear story height of the first story is 9 ft. 0 in. The steps are shown with risers 7½ inches high and treads 10 inches wide.

A line *AB* is shown tangent to the tops of the nosings of the steps. A line *CD* is drawn parallel with *AB* and 7 ft. 0 in. above it. The space between the lines *AB* and *CD* allows a tall man to walk up or down the stairs without striking his head. The headroom is the distance between the treads and the line *CD*, or 7 ft. 0 in. As seen at *ab*, the height of 7 ft. 0 in. will be that of a man 6 feet tall with 12 inches above his head.

73. It is quite obvious that no construction should be made above the stairs between the lines *AB* and *CD*. The floor construction *bc* can be extended in this case over the first two steps below, but should not be carried beyond the point *b*. If, for example, the floor were extended to *de*, a man 6 feet tall descending the stairs would knock his head against the floor construction.

Stairs could be constructed above the stairs shown provided they do not extend below the line *CD*.

74. The opening in the second floor as shown must be made equal to the width of thirteen steps of 10 inches each, or 130 inches, in order to have proper headroom. In laying out the second-floor plan, therefore, an opening of that size must be provided in the second-floor plan to accommodate the stairs shown in Fig. 16.

In designing a flight of stairs below the one shown in Fig. 16, draw the line *EF* parallel with *AB*. The line *EF* will show the lower limits of the stair construction. Draw the line *GH* 7 feet below *EF*. The stairs should be kept below this line. It will be seen that the top step may begin at *g* if desired. Allowance must be made for the door opening *gh*, as indicated.

75. Of course, there are differences in the heights of stories as well as in the sizes of the individual steps, but these variations are not large. It is safe to say that a floor should not extend over stairs below for more than two treads, and that the opening in the floor above a flight of steps should always be equal to the length of thirteen treads. The safest procedure is to lay out a simple diagram such as Fig. 16 and make sure that proper headroom has been provided.

76. Number of Treads and Risers.—The number of risers for any flight, as well as the height of the riser, is determined in the following manner: Assume that the height of the story from floor to floor is 10 ft. 5 in., and it is desired to have the risers approximately $7\frac{1}{2}$ inches in height. The height of the story, 10 ft. 5 in., or 125 inches, is then divided by $7\frac{1}{2}$ inches and the result is found to be $16\frac{2}{3}$. This would mean that $16\frac{2}{3}$ risers of this height would be required. As it is obviously impossible to use two-thirds of a riser, either 16 or 17 risers of equal height should be used. If the story height, or 125 inches, is divided by 16, the quotient is 7.81. In other words, if 16 risers are used, each riser will be 7.81 inches in height. If it is decided to use 17 risers, the risers must be 7.35 inches in height, since $125 \div 17 = 7.35$.

Stairs are indicated on plans as shown in the drawings of the floor plans.

77. Checking Headroom.—The draftsman should, by simple calculations, check the amount of headroom that occurs beneath a run of stairs at any point. The stairs are generally marked with numbers beginning with 1 at the bottom step. An arrow with the word *Up* or *Down* and the number of risers to the next floor placed at the tops and bottoms of the stairs.

The arrangement and construction of all the staircases available should be examined. By carefully examining and measuring the various parts of staircases that one uses frequently, a person will soon become familiar with their characteristics, and this practice will help immensely in working out the drawing exercises.

78. Living Room.—In the First-Floor Plan the living room is a simple room with a vertical axis *EF*. Except for a fireplace shown on the horizontal axis, it is a plain rectangular room. It has three large windows that admit abundant light and a view of the garden. A bay window is shown in the front wall, and a French window opens on a porch. A den or guest room is connected with the living room.

79. Porch.—The porch, which in the elevation balances the garage, is a simple one intended to be enclosed with screens

or sash. The floor is built at a lower level than the floor of the house so that rain water cannot enter the living room.

80. Fireplace.—The fireplace indicated in the living room should be made wide enough to receive logs 3 feet long. This requirement necessitates a width of 4 feet. It should be about 18 or 20 inches deep and should be lined with firebrick and faced with face brick. The fireplace opening should be about 2 ft.

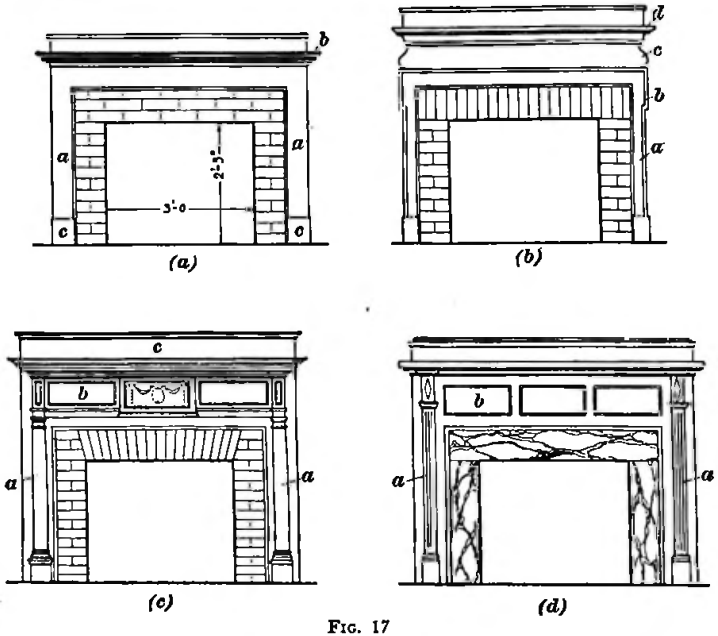


FIG. 17

10 in. high. The area of the opening will thus be $2\frac{1}{12} \times 4 = 11\frac{1}{3}$ sq. ft. For burning wood, the fireplace will require a flue 12 in. $\times$ 12 in. Flue linings should be shown in all flues.

81. Since one flue rises from the laundry and one from the heater room, two flues must be shown on the First-Floor Plan. The brickwork of the lower part of the chimney must be sufficiently strong to support the upper part of the chimney, which must contain four flues. Hearths of tile, marble, or cement should be shown extending in front of the fireplace for a distance equal to the depth of the fireplace. The hearth extends about

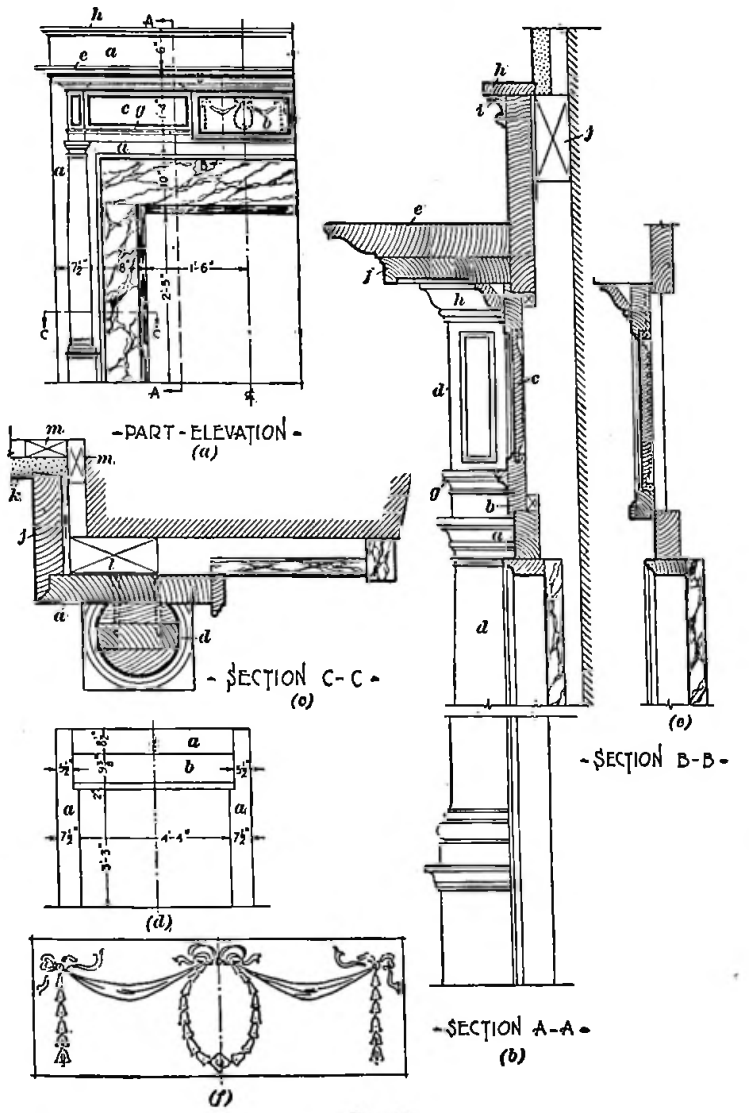


FIG. 18

$\frac{1}{2}$ inch above the floor level and is surrounded, as shown, by hardwood strips. Four designs for fireplaces and mantels are shown in Fig. 17. In Fig. 18 is shown a detail of a fireplace and mantel

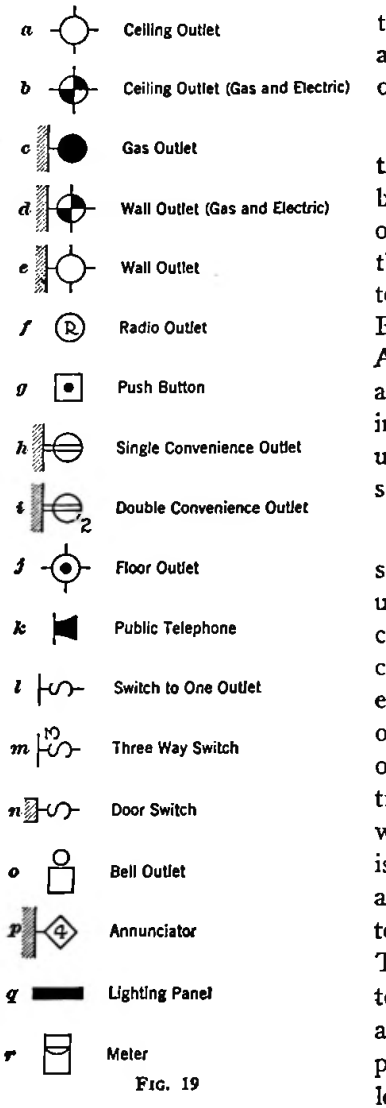


FIG. 19

that would be suitable for use in a room such as the living room or den.

82. Electric-Light Indications.—Certain symbols have been adopted by the Association of Electragists, International, the American Institute of Architects, the American Institute of Electrical Engineers, and the American Engineering Standards Committee. These symbols indicate various devices that are used in wiring for electric service.

83. In Fig. 19 are shown some of the more commonly used symbols. At *a* is an indication of a ceiling outlet, at *b* a ceiling outlet for both gas and electricity, at *c* an outlet for gas only, and at *d* a side, or wall, outlet for both gas and electricity. At *e* is a symbol for a wall outlet for electricity which is generally situated on a wall about 5 or 6 feet above the floor to receive a wall bracket light. The symbol at *f* is for an outlet to supply current for a radio, and at *g* is an indication for a push-button. Convenience outlets *h* and *i* are for use in operating various devices such as vacuum cleaners, dishwashers, refrigerators, egg beaters, percolators, meat choppers, lamps, hair curlers, razors, and the numerous other devices and conveniences that are used in the modern home, which require moderate-sized currents of electricity. A symbol for a floor outlet is shown at *j* and is sometimes used in dining rooms at meal times for calling servants in the kitchen. At *k* is an indication for a public telephone.

84. Switches for manipulating the lights are used in most rooms and are indicated by the letter *S* as illustrated in *l*, *m*, and *n*, Fig. 19. The symbol at *l* is for operating one outlet. The symbol at *m* is for a three-way switch, one of which is shown beside the front door in the First-Floor Plan. This switch controls one light in the entrance hall and one light in the second-floor hall. These two outlets are also controlled through a switch in the second-floor hall. The owner coming home late in the evening can, upon entering the house, push the switch at the front door and light the lower hall and the second-floor hall so that he can see his way to the door of the bedroom. By pushing the second-floor three-way switch he can extinguish the lights in both halls.

85. A switch should be located in every bedroom, immediately inside the door, as shown in the plans of the residence, so that a person entering the room in the dark can turn on the light without having to grope for it.

86. A door switch indicated as at *n*, Fig. 19, is for use in closets. By opening the door the switch turns on the light, which is turned off by the closing of the door.

87. A bell outlet is indicated by the symbol at *o*, Fig. 19. The symbol for an annunciator is shown at *p*. The annunciator should be connected with the front- and the rear door bells, with the floor outlet in the dining room, and with any other call bells that may be installed in the house. A panel board or lighting panel is indicated by the symbol *q*. Switches are located in this fixture by which the current can be cut off from the entire house or from any part of the house desired. Spare fuses should be kept in this fixture to replace fuses that may blow out.

88. The kitchen light is controlled by means of switches in the kitchen. The light for the basement stairs is controlled

by means of two three-way switches, one at the head of the stairs and the other in the basement.

89. **Plumbing.**—Various plumbing indications, which have been studied in a preceding lesson, must be shown in the plans. Toilet rooms containing a water closet and a lavatory are shown in the basement and on the first floor. Both rooms contain a light that is controlled by means of a switch in the wall. A sink must be shown in the kitchen. On the second floor there are two bathrooms, each having a bath, a water closet, a lavatory, and a medicine closet. The medicine closet has a mirror fitted in the door, and vertical fluorescent lamps may be provided for better visuality.

90. **Joist Indications.**—The architect rarely makes framing plans for small buildings, but he should give information regarding the direction in which the floor joists run. As shown on the First-Floor Plan, this is often done by a line with arrowheads indicating the direction in which the joists run. Over this line is marked the sizes of the joists and the distance on centers that they are spaced. The actual working out of the framing plan is left to the carpenter contractor. Nevertheless, the architect should be competent to lay out the framing plan and is responsible to the owner for the proper construction of the building. The indications for the floor joists should be drawn in and neatly lettered.

91. Joists are sold in stock lengths of even feet, such as 12 feet, 14 feet, 16 feet, etc. In laying out a plan it is therefore economical to use stock lengths in framing floors. A room should be made 11, 13, or 15 feet wide so as to use 12, 14, or 16 feet lengths of joists. This practice leaves 6 inches on each end for bearings and avoids waste. The cost of beams increases as they exceed 14 feet in length, a fact that should be considered in the interests of economy.

92. **Dimensions.**—The dimensions should be shown carefully on all drawings, particularly on the Basement Plan. Since the basement of the building is the first part of the building to be built, it will affect the sizes of the upper part of the building.

The dimensions on the Basement Plan should be derived from the First-Floor Plan. The dimensions on both these plans should therefore be carefully compared and checked to make sure that they agree.

93. The dimensions on the Basement Plan are given to the outside faces of the walls and to the masonry openings of the windows as shown on the Basement Plan. The dimensions of the walls and the widths of the window openings are clearly shown. In this plan the footings upon which the walls rest are shown by dotted lines and extend 6 inches on each side of the wall. When the footings, which are the first work to be laid, have been poured. the lines of the finished cellar walls are carefully laid out on them and the forms are set for pouring the concrete cellar walls.

94. In the First-Floor Plan the sill and the studs of the outside frame walls have been set back of the face of the cellar walls for a distance of $1\frac{1}{8}$ inches.

95. In marking the dimensions on the First-Floor Plan two lines of dimensions are given. The outermost lines show the total sizes of the frames measured to the exterior surfaces of the studs. The inner lines show the main divisions or parts of the building and the locations of the windows. The windows and doors in the frame walls are located by their centers from the outsides of the frame of the building. The completed window- and door-frames will be brought to the building and will be set with reference to their centers.

96. Dimensions of all brickwork should be carefully given, as the framing depends upon accurate setting of the brick. The main dimensions of the chimneys are shown on the First-Floor Plan. Details of the chimneys, from which the chimneys and fireplaces are erected, are usually prepared at a large scale.

97. Dimensions and dimension lines showing the distance intended to be covered by the dimensions should be drawn as shown. Although dots have been shown at each end of the dimension lines showing the distance covered, arrowheads may be used if preferred. Both methods are in use among archi-

tects. The dimensions should always be clearly lettered on all plans so as to be easily read.

98. **Lettering.**—The plans should be neatly lettered as shown on the drawing. The names of the various rooms should be placed as near the middle of the rooms as possible. The other lettering should be as close as possible to the object referred to. The lettering should be placed so as not to crowd or conceal the figures, or indications, so that it can be easily seen.

99. **Final Tracing.**—The first drawing of the First-Floor Plan will probably not be clean and neat. In this case a neat, clean tracing should be made of it on the new sheet of bond paper. Parts of the first drawing which have not been done satisfactorily may be redrawn carefully on this second sheet; the work that is satisfactory may be traced through very quickly. This will be a valuable exercise and will result in a neat, clean piece of work. When a satisfactory tracing in pencil has been completed, it should be dimensioned and lettered. The drawings accompanying this text will serve as a model for this work.

100. The outlines of the walls, partitions, and other supports should be made in firm, heavy lines; the windows, areas, steps, and other parts in a lighter line. The dimension lines should be made lightest of all. Send your pencil drawing to the Schools for correction.

PLATE II, TITLE: SECOND-FLOOR PLAN

101. **General.**—In order to draw a plan of the second floor a sheet of transparent bond paper can be tacked down over the First-Floor Plan and some of the walls, partitions, and center lines of windows can be traced through directly, thus saving time which might be lost if the Second-Floor Plan had to be drawn upon another board.

The instructions given for drawing this plan are similar to those already given for the First-Floor Plan, and there should

be little or no difficulty in laying out the various parts of this plan.

102. The axes, or center lines, of the various windows should, in most cases, come directly above the axes of the windows below. This can be verified by the figures on both plans or by studying the elevations. In some cases it is impossible to place the windows directly over the ones below, as in the rear wall of this house. In this case, however, the kitchen-window group below is centered between the two windows above. This construction gives a restful and artistic result and shows careful design.

103. **Bedrooms.**—The bedrooms are rectangular, of good size, and well lighted by a sufficient number of windows; each has at least one good closet. The *Owner's Bedroom No. 1* has two closets, a private bath, and a dressing room. In this bedroom the best position for the bed or beds will be shown on the drawing. Convenient wall spaces against which chiffoniers, dressing tables, and chairs can be placed are provided. A base outlet is provided near the place where the bed is to go, so that a light may be available for a table at the head of the bed.

104. **Stairs.**—The main stairs are shown. The floor opening that must be left over them to provide sufficient headroom should be carefully calculated. In this case a person will have descended 13 risers before he will be below the second-floor level. As the risers are about $7\frac{1}{2}$ inches, the distance between the second floor and the thirteenth tread is $13 \times 7\frac{1}{2}$ inches $= 97\frac{1}{2}$ inches. The thickness of the floor construction, about 12 inches, should be deducted from the $97\frac{1}{2}$ inches and the resulting headroom will be $97\frac{1}{2}$ inches $- 12$ inches $= 85\frac{1}{2}$ inches, or 7 ft. $1\frac{1}{2}$ in. The draftsman should be extremely particular about this matter of headroom, as an error in this matter, if not discovered in time, may cause serious difficulty in remedying mistakes after the building is well advanced.

105. **Disappearing Stairs.**—Access to the attic from the second floor is obtained by means of disappearing stairs. When the stairs are not being used they are in the attic and are covered

by a panel in the second-floor ceiling. When this panel is pulled down, the stairs come into position for use. These stairs are indicated by a rectangle drawn with dotted lines and should be described in the specifications.

106. Bathrooms.—The arrangement of the fixtures in bathrooms depends upon the location of the soil pipes. Low fixtures such as water closets should be placed as close to the soil pipe as possible. The piping for these fixtures extends beneath the floor, and if it must be carried for any considerable distance in a longitudinal direction, it will stick out below the ceiling. The bathtubs also have the pipes below the floor, and it is desirable that the wastes from them should be as close to the soil pipe as possible. The waste pipe from the wash basin is higher and can be carried for some distance in a horizontal direction without projecting below the ceiling beneath. In *Bathroom 2* the water closet is close to the soil line and the bathtub waste can be carried across successfully to the soil line beneath the floorbeams. These considerations are not apparent to the novice or layman, but these ideas should be incorporated in every drawing.

107. Chimney.—As there are no fireplaces on the second floor, all that will be necessary is to see that flues of sufficient size are provided to take care of everything below. Thus, a flue must be provided for the laundry, one for the heater room, one for the living room, and one for the den.

In drawing this chimney in the Second-Floor Plan, it should be placed so that it is properly supported on the chimney below, and is located in the center of the gable as shown on the Side Elevation.

108. Decks.—Flat roofs, or decks, which are featured in some modern styles of architecture, are shown in the Second-Floor Plan at each end of the building. Where climatic conditions are favorable, they may be used as places to sit in fine weather. They may be adorned with plants, gardens, awnings, and other accessories to be made as attractive as may be desired.

If the decks shown in the Second-Floor Plan are to be used for walking upon, they may be covered with canvas, or wooden

slats may be placed on a tin roof. A railing such as the one shown in the Front Elevation must be provided when the decks are to be used. The decks must be treated as roofs, and water falling on the roof should be carried to gutters and leaders.

In the Front Elevation railings are shown that may be made of galvanized iron piping.

When this plate is completed in pencil it should be sent to the Schools for examination and correction.

PLATE III, TITLE: FRONT ELEVATION

109. Laying Out of Elevation.—The elevation is drawn on a fresh sheet of transparent bond paper that is tacked over the First- or Second-Floor Plan. The limiting lines of the elevation can be accurately traced through from the plan. The width of the windows will also be easily found.

The vertical line of figures at the side of the drawing of the elevation gives the heights of the floors. The dimensions on the vertical line of figures through the dining-room windows locate the sash openings in all floors.

Having drawn the plans, it should not be difficult to draw the Front Elevation in a satisfactory manner. The large scale details that are shown on the drawing need not be shown, but it will be excellent practice to draw them as shown on the drawing.

110. Story Heights.—On at least one elevation the heights of the stories should be shown, as at the left side of the Front Elevation. The distance of the first-floor joists above the finished basement floor is shown.

111. Windows.—The windows in the Front Elevation must be laid out on the axes of the living room, the hall, and the dining room. The sills of the second-floor windows should be 2 ft. 8 in. or 3 ft. above the floor level, while the tops of the windows should be 8 or 10 inches below the ceiling level.

The top of the sill in the first-floor windows may be 2 ft. 6 in. or 2 ft. 8 in. above the floor, and the top of the window should be within 12 inches of the ceiling. Exact distances for this building are shown on the Front Elevation.

When laying out the sill heights, the method of heating the building should be considered. Care should be taken that radiation selected does not extend above the stools of the various windows.

In the bay windows in the living room and the dining room, the picture window is to be 4 ft. 4 in. in sash width and to have 6-inch outside casings on each side. The width of the front of the bay will then be 4 ft. 4 in. + 6 in. + 6 in. = 5 ft. 4 in.

The width of the slanting side of the bay will be 2 ft. 1½ in., approximately. The casings will be 6 inches and 1½ inches as shown, and the sash opening will be 1 ft. 6 in. in width.

112. Roof.—The roof is made of sheet metal with standing seams. The metal used may be copper, galvanized iron, or tin. The latter two will need painting, whereas the copper may be left to take on a natural green finish. The vertical strips shown in the drawing represent standing seams, which add to the attractiveness of the roof.

Flashing of metal or of tar and felt must be carried over all the gutters and up under the lower parts of the metal roof. Metal flashing must be used around the chimney.

113. Dormer Windows.—Dormer windows will be as shown on the drawings. The walls are stuccoed and the roof is sheet metal with standing seams.

114. Completing Windows.—In drawing the windows shown at the scale of ¼ inch to 1 foot where blinds are used. take one-half of the sash opening on the compasses and lay it off twice on each side of the center line. The inside two parts will be the window opening and the outer two parts will represent the blinds. This should be done with all the windows, after which the sash and the slats in the blinds can be indicated.

115. Porch.—A porch is shown at the right in the Front Elevation. It is convenient to the living room and provides a pleasant place to sit in warm weather. The interior of the walls and the ceiling of this porch will be covered with stucco, and the floor will be formed of cement or tiles. The porch may be enclosed by glass in winter to form a conservatory; in warm weather it may be enclosed with screening.

116. Cornice and Gutter.—Over the tops of the second-floor windows is a cornice shown by the horizontal lines. This cornice is shown in the scale detail to the left of the Front Elevation at the scale of ¾ inch = 1 foot. The cornice proper is formed of wood, as is the coping on top of the wall. The pitch of the metal-lined gutter is shown by the dotted broken line marked *Pitch of Gutter* on the elevation. Jig-sawed brackets are used to decorate the cornice. The cornice should ultimately be studied at full size before being installed.

117. Rain Conductors.—Rain conductors, or leaders, should be shown at each end of the building extending from the gutter to the ground. These conductors are fitted with conductor heads as shown in the drawings. The conductor is fastened to the house by means of metal straps. These gutters, leaders, etc. are shown on the drawings of the elevations.

118. Chimney.—The top of a chimney is generally carried a short distance above the highest point of the roof, so that the roof will not interfere with the draft. The flues in the chimney are shown by dotted lines in the side elevation.

119. The footings are drawn as shown with the top about 6 inches below the finished cellar floor. The footings shown on this elevation are 12 inches thick.

120. Flashings.—Flashings are used where chimneys meet the roof. These flashings are stepped up into the brickwork, that is, the metal is let into the brickwork where the joints occur.

121. Stucco.—Stucco is indicated by the use of dots, which are made over parts of the stucco surface in the elevations.

When this elevation is completed in pencil on transparent bond paper, send it to the Schools for inspection.

122. The remaining drawings of this set include the basement plan and two elevations, which are similar to the three required drawings. Although these drawings are not required, you will obtain valuable practice in making them. It is therefore suggested that they be made, thereby completing the set of drawings for the residence.

BRICK-VENEERED BUILDINGS

123. General.—Methods of preparing working drawings for a wooden-frame residence covered with stucco have already been shown in this lesson. Many of the indications of materials and methods of construction shown in those drawings are applicable to buildings of all kinds, especially where wood construction is used.

Buildings may also have walls of solid brick, concrete, or stone, or of concrete or terra cotta blocks. They may have frames of steel or reinforced concrete with walls of stone, brick, or concrete. Small buildings are frequently built with walls of wood covered with a veneer of brick or stone. Each of the materials and types of construction used must be definitely indicated on the working drawings.

In order to represent these materials properly on drawings it is necessary to have a good knowledge of the sizes and peculiarities of each material and how it can be used in connection with other materials used in the construction.

124. Brick-veneered buildings are those which are built with a standard wood frame enclosed by a 4-inch thickness of brickwork. This coating or veneer must be supported on the foundation walls and anchored to the wooden construction by means of metal ties or anchors. The wooden frame will stand up firmly and support the brick facing in a satisfactory manner.

125. Advantages of Brick-Veneered Construction. The brick-veneered type of building has certain advantages over a wood-frame building covered with siding, wood shingles, or stucco. The veneer, and the air space between the brickwork and the wood sheathing, add to the insulating value of the wall. Also, the brick surface of the wall tends to prevent the building from catching fire from the outside and has the substantial appearance that is characteristic of a brick building. This type of construction is used principally for buildings that are not more than two stories in height.

126. Methods of Construction.—In Fig. 20 are illustrated the methods generally used in the brick-veneered

form of construction. At *a* is the foundation wall, which is commonly built of concrete. This wall should be of the thickness required to support the structure above it, and should be indicated by the symbols for concrete. Upon this foundation wall, the wooden frame of the building and the brick veneering rest.

The sheathing *b* is nailed to the studs *c*, and at *d* is the wooden sill upon which the ends of the wooden floor joists *e* and the studs *c* rest.

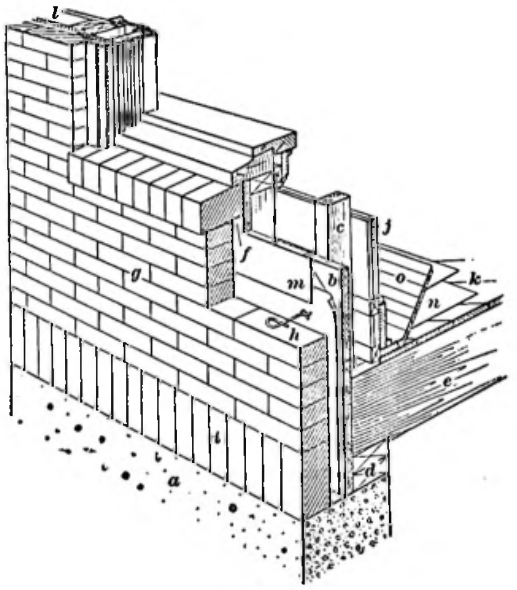


FIG. 20

The air space *f* between the wooden sheathing and the brick veneering *g* allows the bricklayer to handle the bricks properly and helps to insulate the wall against heat, cold, and moisture. The brick veneering is tied to the wooden construction by the anchors *h*.

At *i* is shown a brick soldier course, which is the first course of the brick veneering. The wall studs *c* support the framework of the building, as well as the lathing and plaster *j* on the interior of the wall. The under floor *k* is nailed to the joists *e*. At *l*

is the window frame. Waterproof building paper *m* is shown over the sheathing, and deadening felt or heavy building paper *n* is laid between the under floor *k* and the finish floor *o*.

127. Drawings of Brick-Veneered Building.—In Fig. 21 is shown a plan of a brick-veneered house. In it is indicated a 4-inch wall of brickwork on the outside of the outer wooden walls of the building. The arrangement of the plan enclosed by the brick walls is the same as for a wood-frame building.

In Fig. 22 is shown an elevation of the same house, which has the appearance of a building with solid brick walls. In this elevation the sizes of the brick courses determine the vertical dimensions. The bricks have a fixed size, and the size of the mortar joint is selected. Hence, the thickness of one brick plus the thickness of one mortar joint is taken as a unit of measurement. Thus, if the brick selected is $2\frac{1}{4}$ inches thick and the thickness of the mortar joint is $\frac{1}{2}$ inch, each course of brickwork will be $2\frac{1}{4}+\frac{1}{2}=2\frac{3}{4}$ inches high.

The vertical dimensions of the windows and other vertical distances will also be measured in terms of brick courses. If it is desired to have a window about 5 feet 8 inches high, this distance, 68 inches, is divided by $2\frac{3}{4}$ and its height in brick courses is determined. Thus $68\div2\frac{3}{4}=24.73$ courses. Since full courses must be used, the height must be taken as either 24 or 25 courses.. If 24 courses are used, the height of the masonry opening will be $24\times2.75=66$ inches, or 5 feet 6 inches. If 25 courses are used, the height will be 25×2.75 inches $=68.75$ inches, or 5 feet $8\frac{3}{4}$ inches. The latter height of 5 feet $8\frac{3}{4}$ inches, or 25 courses, has been marked on the drawing for the first-floor window. The height of the window frame will be slightly greater, depending on the design of the masonry sill.

For the second-story window, 20 courses has been selected for the height, which makes the height of the masonry opening $20\times2\frac{3}{4}$ inches $=55$ inches $=4$ feet 7 inches. A similar allowance will need to be made for the design of the masonry sills.

The vertical dimensions of the sills, lintels, and chimneys are given in brick courses.

128. Details of Construction.—In Figs. 23 and 24 are shown detail drawings of the construction employed in this type of building, Fig. 23 being a portion of a plan. The stud wall consists of the studs *a*, sheathing *b*, sheathing paper *c*, and interior plaster *d*; an air space *e* is seen between the sheathing

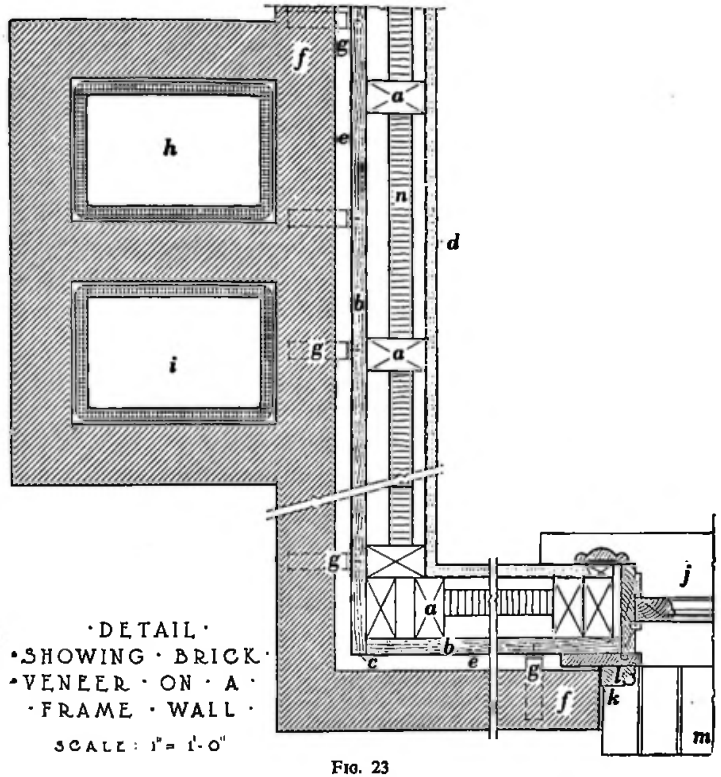


FIG. 23

and the 4-inch brick veneer *f*. Anchors *g* extending into the joints of the brickwork are nailed to the sheathing, and are embedded in the mortar, thus holding the veneer firmly to the wooden building. A chimney is shown that contains two terra cotta flue linings *h* and *i* enclosed by brickwork.

A double-hung wndow *j* is indicated and is fitted to the wooden wall in the usual manner. The brickwork is laid up in front of the window frame and anchored as shown. The space

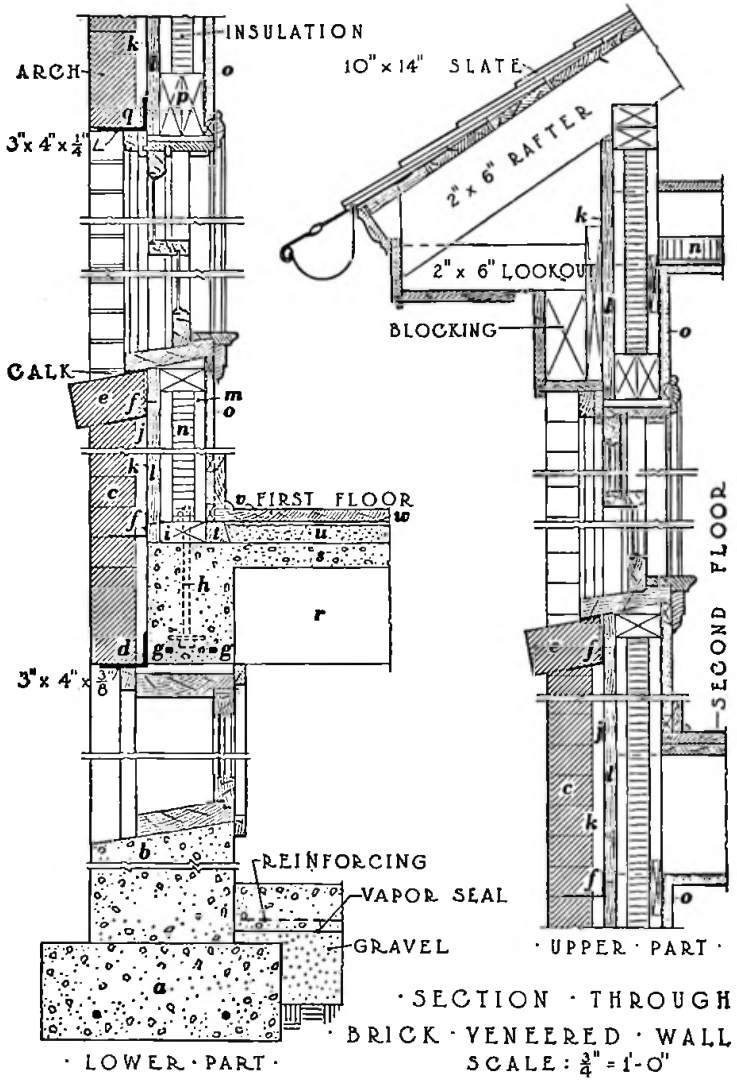


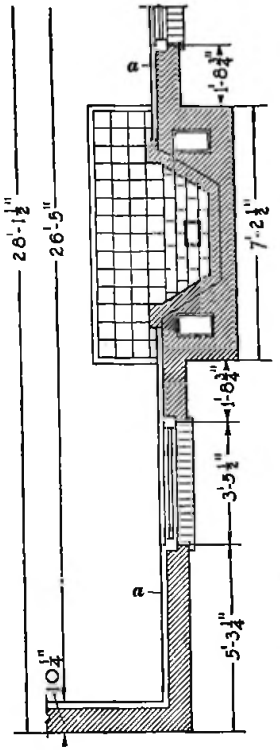
Fig. 24

k between the brickwork and the outside casing of the window frame is calked or stuffed with oakum, and the staff bead *l* is nailed tightly in the corner formed by the frame and the brick reveal. A brick sill is indicated at *m*. Insulation *n* is

indicated between the studs, and consists of 2-inch insulation bats with a vapor seal. The vapor seal should always be on the interior surface of the insulation.

In Fig. 24 is shown a vertical section through a brick-veneered wall, the lower part of the wall being shown in the left-hand of the illustration, and the upper part in the right-hand side. At *a* is a concrete footing, at *b* a 12-inch concrete foundation wall, and at *c* the brick veneering. This veneering is supported over the basement window opening by means of a steel angle *d*. Brick window sills are shown at *e*, and anchors holding the brickwork to the wooden frame are indicated at *f*.

Concrete lintels reinforced by rods *g* are formed over the basement window openings. Iron bolts *h* are set in the concrete wall and anchor the wooden sill *i* to the foundation wall. At *j* is the air space between the brick veneering and the sheathing, at *k* is waterproof building paper, at *l* is the sheathing, at *m* the studding, at *n* insulation, at *o* the inside plastering, and at *p* wooden lintels are shown. The angle-iron lintel *q* is bolted to the wooden lintel over the first-floor window and extends into the jambs to support the brickwork over the window opening.



SOLID BRICK-FURRED

Fig. 25

The construction of the first floor consists of reinforced concrete beams *r* and concrete slabs *s*. Upon the slabs are laid sleepers *t*, between which cinder concrete *u* is poured. The floor *v* is nailed to the sleepers after a layer of building paper *w* is first placed over them. The second and attic floors are constructed of wooden beams and flooring in the usual manner.

The window and cornice details are similar to those already shown and described. The joints between the window frames and the brickwork should be thoroughly calked so as to prevent the entrance of water.

Drawings such as Figs. 23 and 24 illustrate details that are typical of brick veneer construction.

129. Building With Solid Brick Walls.—The method of indicating a plan of building having solid brick walls is shown in Fig. 25. The wall in this case is 8 inches thick. Furring of $1'' \times 2''$ wood strips is attached to the interior of the brick wall, and to this the lathing is nailed. In this plan, which is drawn to a $\frac{1}{4}$-inch scale, a single line *a* is drawn about 2 inches from the wall to indicate both furring and plastering. If no furring is used, this line is not shown. For the part of the building enclosed by the brick walls the plan may be shown in the same manner as that for any wooden-frame building.

130. Building With Stone-Veneered Walls.—Walls of buildings not exceeding two stories in height may be veneered with 4 inches of cut stone in the same manner as in brick-veneered houses. The plans and the sections through the walls are drawn in exactly the same manner as for brick-veneered walls, except that the stone work is indicated by dots instead of by hatching.

The stone is secured to the wooden-frame construction by means of anchors. Stone sills and lintels may be used, the lintels being supported on steel angles that are bolted to the wooden frame and extend into the brick jambs. The methods are exactly the same as those used in the brick-veneered construction.

BLOCK CONSTRUCTION

131. Kinds of Blocks.—Blocks used for buiding may be made of terra cotta, concrete, or other materials. They are generally made with holes or voids in them for the sake of lightness and to provide an air space in the block that will contribute to the insulating quality of the wall. The material

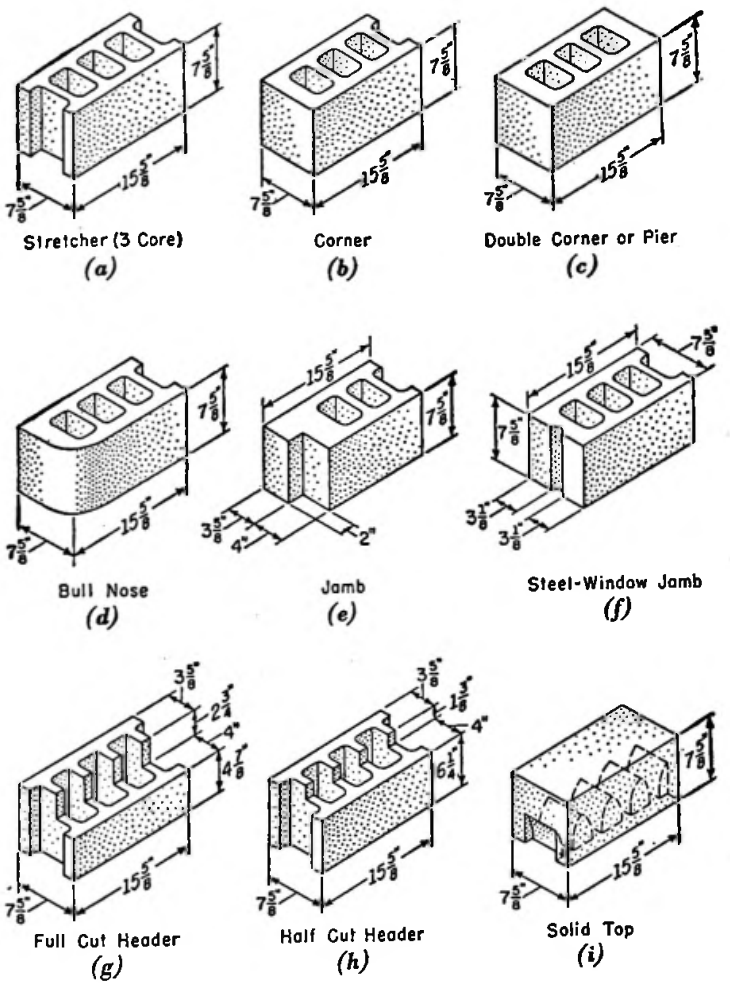


FIG. 26

is sometimes of a porous character, which adds still more to the lightness of the blocks and to their insulating value. Blocks are frequently used for backing a brick-faced wall and should be of heights that will permit of brick headers extending into the backing to form a bond with the face brick.

In drawing for walls made of blocks, the full widths of the

walls are indicated and the surfaces are marked with the symbol or indication of the material of which the blocks are made. Concrete blocks are indicated in the same way as is concrete, and terra cotta blocks as shown for terra cotta on Plate I, Exercise I, *Architectural Drawing*, Part 1. The walls at a small scale, such as $\frac{1}{4}$ inch = 1 foot, are shown exactly like the solid brick wall in Fig. 25, with the proper indication instead of the hatching.

132. Block Sizes.—Figure 26 shows the common types of units. These blocks are all $7\frac{5}{8}$ inches thick and are used to build 8-inch walls. The units are $7\frac{5}{8}$ inches high and $15\frac{5}{8}$ inches long; each unit with a $\frac{3}{8}$-inch mortar joint, fills an $8'' \times 16''$ space. The units are described as $8'' \times 8'' \times 16''$ blocks. Similar units are made for 10-inch and 12-inch walls.

133. Forms of Concrete Blocks.—In Fig. 26 are shown nine forms of concrete blocks. A typical stretcher is shown at (*a*); a corner block with a closed end at (*b*); at (*c*) is shown a block with two closed ends that could be used to advantage in building up piers that are 16″ wide; at (*d*) is a corner block with a rounded end or bull nose; at (*e*) is a jamb block that is notched to receive a door or window frame. At (*f*) is a jamb block that is notched to receive a steel window frame, at (*g*) and (*h*) are blocks that are notched to receive brick header courses, at (*i*) stretcher course with a closed top which can be used for such locations as sills and copings.

134. Finish of Blocks.—Concrete, terra cotta, and other blocks are generally finished so as to receive a coating of stucco on the exterior faces of the walls. Terra cotta blocks are sometimes made with a special face that is exposed and has an effect like brickwork.

135. Details of Construction of Block Wall.—If possible, it is advisable to use blocks without cutting them. In laying out a wall in a drawing, the dimensions of the wall should be

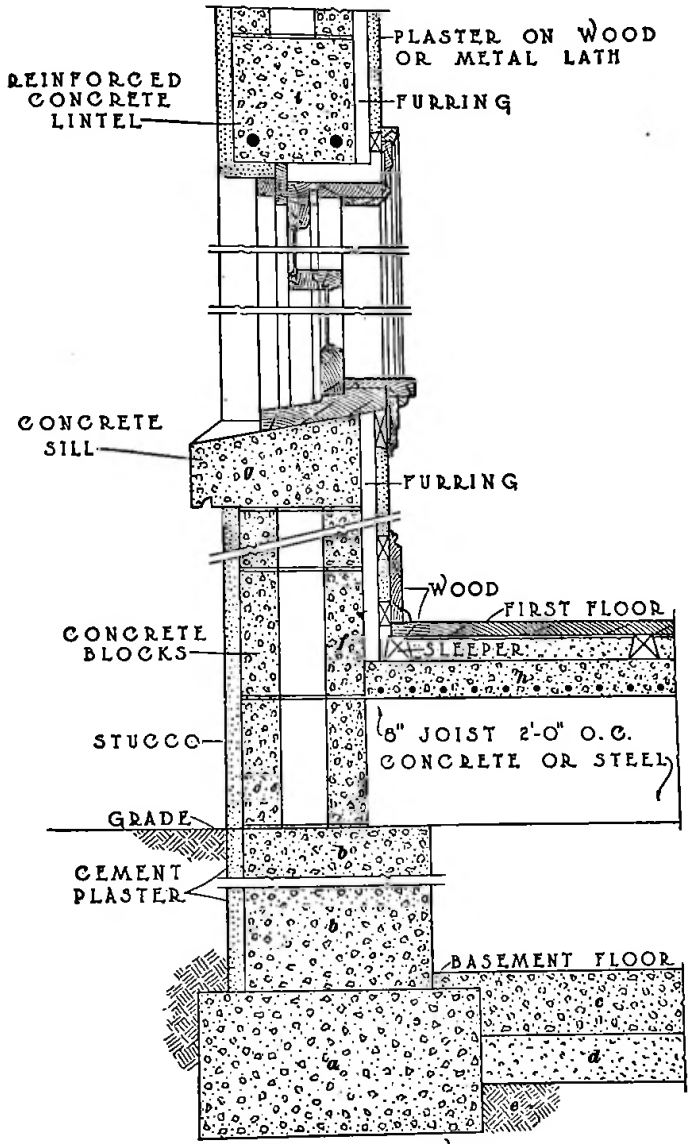


Fig. 27

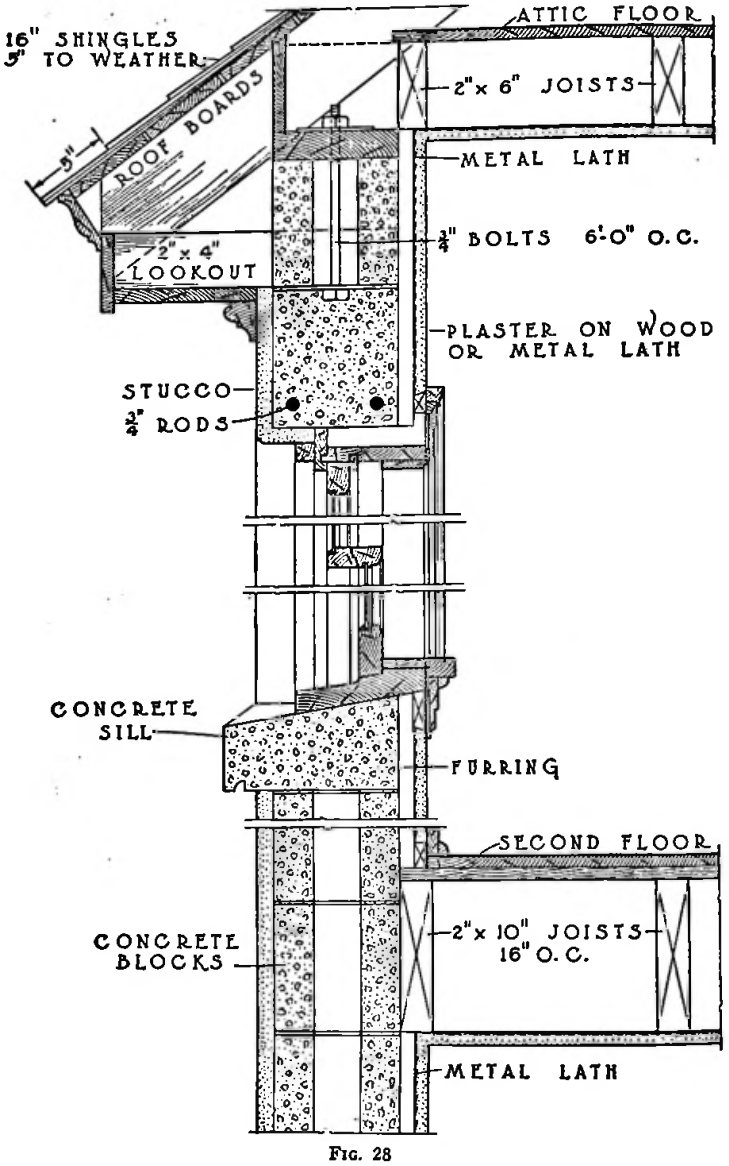


FIG. 28

drawn in units of block sizes and joints. The same should be done in laying out walls between window openings, and between openings and corners. Jamb blocks should be used at the sides of windows, and square-end units for corner construction. The various standard forms and sizes of the blocks should be obtained from manufacturers' catalogs, and the blocks should be used as shown in the catalog, with as little cutting as possible.

Lintels are generally made of reinforced concrete, the reinforcing rods being placed in the lower parts of the lintels. Stone, brick, or concrete sills may be used, and brick arches may be used over the openings, if desired.

136. Detail Drawings of Concrete-Block Wall.—In Fig. 27 is a drawing of a section through the lower part of the wall of a building, to show how the methods of construction and materials are represented on a detail drawing. At *a* is a footing of poured concrete and at *b* a concrete wall, both of which are shown by the customary indications. The basement floor *c* is of concrete and rests upon a bed of cinders *d*, which is placed on the tamped earth *e*. A wall *f*, of concrete blocks, is supported on the concrete wall *b*. The blocks when shown in section have the same indications as for poured concrete. A concrete sill is shown at *g* and a floor slab at *h*. The black dots near the bottom of the first floor slab indicate steel reinforcement of the mesh type. The indications of windows and interior trim are as shown in the illustration. A reinforced concrete lintel is shown at *i* and the reinforcement, consisting of two steel rods, is indicated by two black circles.

The upper part of the wall shown in Fig. 27 appears in Fig. 28 and shows the construction at the second floor, the cornice, and the second floor windows. The indications here will be readily understood after careful study of Fig. 27 and previous drawings.

In Fig. 29 is shown a cornice for a flat roof. This cornice is formed by a continuation of the roof rafters. The grilles in the soffit of the cornice permit the air to circulate above the hung ceiling. In northern climates, the grilles may be closed during the winter months. An insulation blanket is shown over the

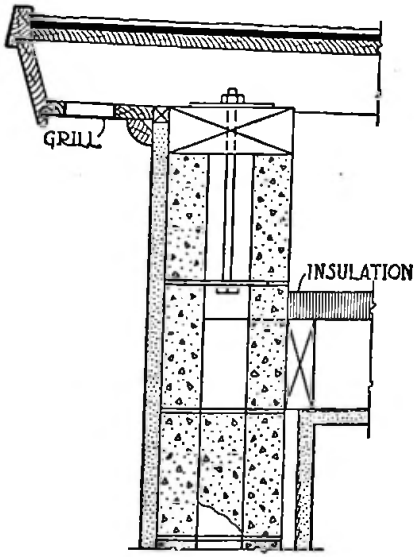


FIG. 29

ceiling joists. This type of cornice, as used with the flat roof, is much more economical than the parapet wall.

In Fig. 30 a plan of a fireplace in connection with a block wall is shown. The ovals *a* show the cells in the blocks, which are set in a vertical position. A terra cotta flue lining is shown at *b*. In the fireplace, the walls *c* and the floor *e* are formed of firebrick and the facing *d* is of face brick. The flue lining shown here is to accommodate the boiler in the basement.

A horizontal section through a wood mantel is shown at *f*, and a tile hearth at *g*. A concrete jamb block is shown at *h* with the window frame *i* set against it.

137. Facing of Walls.—Walls are generally built of combinations of materials. They are faced with a more costly material, which is bonded into or secured to a less expensive material that forms the supporting body of the wall. Thus, face brick, stone, and architectural terra cotta may be backed or bonded to substantial walls of brickwork or blocks.

These combinations should be indicated on the drawings

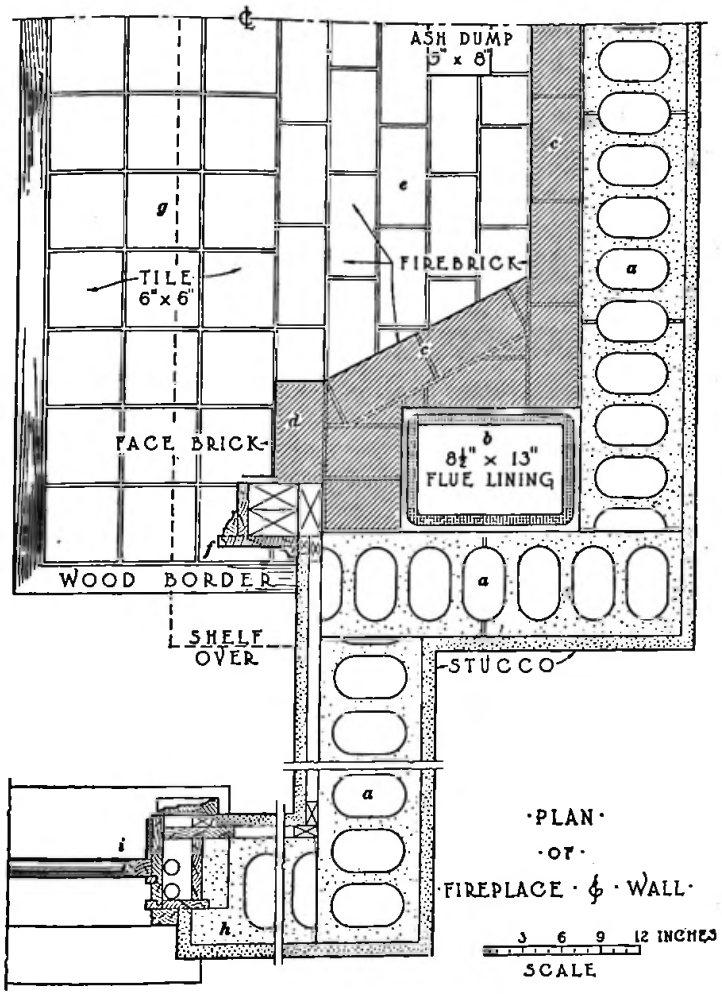


FIG. 30

and described in the specifications. The different materials should be indicated definitely in the plans, elevations, and sections. It is always desirable to draw small rectangles on the drawing with samples of these indications properly labeled so that there will be no misunderstandings regarding the matter.

Walls made of plain substantial materials that do not present a pleasing color or texture are frequently covered with stucco.

138. Furring.—It is generally necessary to fur the interiors of masonry and concrete walls. This may be done with terra cotta furring, with ribbed lathing, or with wood strips. The furring should be clearly indicated on the drawings, as in Figs. 25 and 29, and described in the specifications.

PLATE IV, TITLE: CHIMNEY AND FIREPLACE DETAILS

139. Scale Drawings of Details.—The architectural draftsman is required to make scale and full-size details of various parts of the building. In *Architectural Drawing*, Part 1, examples of such details as windows and window frames, doors and frames, cornices, entrance doorways, porches, stairs, dressers, door and window trim, and base are shown. It is to you advantage to lay out some of these details at full size.

In *Architectural Drawing*, Part 1, some space was devoted to the explanation of chimney and fireplace details. Plate IV of this text consists in drawing in pencil on a sheet of transparent bond paper the chimney and fireplace details shown in Fig. 31 at the scale of $\frac{1}{2}'' = 1'\text{-}0''$. This is twice the scale shown in Fig. 31. It is suggested that you proceed by first drawing the plans, then the section. Leave enough space between the plan and section to draw the elevation which is not shown in Fig. 31, but which is to be shown on your drawing. Your elevation should be taken from the side that will show the basement fireplace. Show the various flues by dotted lines. The doors to the right of the fireplace may be shown as 2′-8″ x 6′-8″.

STEEL-SKELETON BUILDING

140. General.—The next subject to be discussed is the preparation of drawings for an apartment house built with a steel-skeleton frame that supports the weight of the structure. The ideas involved in the preparation of the plans will be discussed and the drawings illustrated by means of a set of five blueprints of actual working drawings. *The student will not be expected to send in any drawings for this building.*

141. Laying Out Drawings.—The floor plans are first drawn approximately by the architect or designer. In fact, several trial plans may be drawn in a sketchy manner in order to note the advantages of several different schemes, and to help in determining the best arrangement of the parts of the building. Trial sketches of elevations are made to fit the sketch plans. The sketches that show the most satisfactory results in both plan and elevation are adopted and are submitted to a structural engineer who will examine them to find whether they are adapted to an economical arrangement of supporting columns, beams, and girders. The engineer may make suggestions in the interests of better construction and economy, but the architect may adopt the suggested changes. In any case the architect and the engineer finally agree as to what will be the most feasible plan, and the architect proceeds to lay out, accurately, the final drawings. The columns, which will be designed by the engineer, are indicated by spaces that will be large enough to accommodate the columns, and the spaces are numbered as shown on the accompanying blueprints. The services of the structural engineer are generally obtained for the owner by the architect, and the engineer draws the steel framing plans and steel details to fit the architect's plans.

142. Building and Lot Lines.—The building and lot lines are obtained from a survey of the lot on which the building is to be erected. The survey consists of a plan of the lot, on which are shown the outlines of the lot, the building lines, curb lines, location of the sewer, its depth below the street, and the

direction in which it pitches, and the position of any structures that may exist on the property. It should also give the levels of the curb, especially at the middle of the lot.

The building lines are the boundary lines of the building lot on the streets, beyond which the City laws restrict the construction of any part of the building. Under certain restrictions, the space under the sidewalk may be used by the owner of the building. But the owner, when using it, must provide suitable support for the part of the sidewalk over it. Parts of this space are used, as shown, in the cellar plan of the apartment house under consideration.

The lot lines are the inner boundaries of the building lot that separate different properties. The architect should be particularly careful to avoid having his building extend over into an adjacent lot, or he will make the owner subject to suits for damages.

The curb line is the line between the sidewalk and the roadway for vehicles.

143. Characteristics of Plans of Tall Buildings.—In the usual type of office building many of the floors are similar in plan, and it is therefore unnecessary to show all the plans. The same thing is true of some apartment-house plans; hence the plans of several floors can be shown in one drawing. The only variations in these plans are the slight differences in the sizes of the steel columns, which naturally diminish in size toward the top of the building. Details of the steel frame are shown on the engineer's drawings.

144. Blueprints of an Apartment House.—The blueprints given with this text are part of a set of drawings of an apartment house erected in New York City, in accordance with the Multiple Dwelling Law and the Building Code of that City. The blueprints are of the following drawings:

1. Cellar Plan
2. First-Floor Plan
3. Second- or Typical Floor Plan
4. Roof Plan

5. Two Elevations of Fronts, and Details of Exterior Walls

A student who understands and can make drawings of these plans will have no difficulty with the other plans of the building.

The most important drawings in the case of the Apartment House are those of the First-Floor and of the Second- or Typical Floor. The First-Floor Plan shows the arrangement of the stores, which should be designed so as to earn a considerable rental. The Second- or Typical Floor Plan will show the arrangement of the apartments on most of the floors, which should be designed to earn the best rental possible.

FIRST FLOOR PLAN

145. Laying Out Lot.—The first step to take in laying out a plan of the first floor is to draw the building lines, curb lines, and lot lines. The necessary information is obtained from the survey of the lot. As shown on the blueprint, there is a building line on Madison Avenue and one on 73rd Street. Curb lines are shown on both streets. They are 13 feet $1\frac{1}{2}$ inches in front of the building line on Madison Avenue, and 15 feet 2 inches in front of the 73rd Street building line. These widths establish the widths of the two sidewalks.

The lot lines are shown on the inner corners of the plot. The main lot is about 58 feet by 100 feet with a rectangular projection 19 feet by 20 feet 3 inches in size. As a matter of fact, the Madison Avenue length of the plot is 99 feet 11 inches, or 1 inch less than the 100-foot lot line opposite it. On the first floor, the building must be kept within the building and lot lines.

146. Light.—In designing a building on a lot such as the one just considered, it is not advisable to place windows in a wall that is built with its face against the lot line. The owner of the adjacent lot may build a wall that would block out all light to such windows. If windows are needed in interior walls, as in the janitor's apartment, a court or yard should be provided on the owner's property so as to secure light. This has been done in the apartment house under consideration.

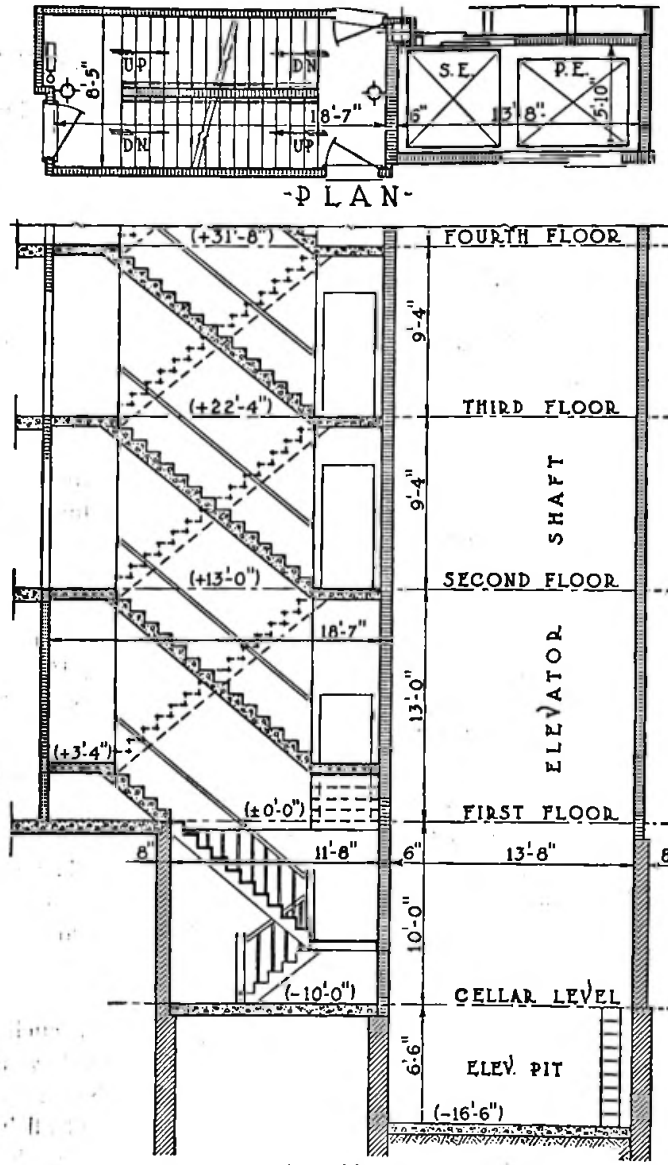


FIG. 32

There are some cases where an owner may safely place windows in a lot-line wall. When there is no likelihood of an adjacent building covering his windows, he may enjoy the use of the windows for many years.

Light courts and yards are demanded by the city laws. They must be provided by the owner on his own property and must be of the prescribed sizes.

In the apartment house now being considered the Multiple Dwelling Law demands a yard 10 feet in width across the back of the lot. This yard must start at the second-floor level and be open for the full height of the building. It will serve as a light shaft and will afford light to rooms opening on it. It may be carried down below the second-floor level if desired, and in this case it is carried down through part of the first story to provide light for the janitor's apartment.

147. Laying Out Columns.—The location and sizes of the columns have been decided upon and are next indicated on the plans. The actual sizes and details of the columns are not shown, but a sufficient space, about 12 inches square, is allowed for each column. The columns are numbered and each column location bears the same number as the corresponding column in the framing plans. Thus, between Stores #5 and #6, column #62 is shown.

Around each column 2 or more inches of fireproofing must be constructed and is indicated in the blueprints. This fireproofing may be of brickwork or terra cotta as shown on the drawing. Practically all of the columns run perpendicularly throughout the height of the building. The indications of columns will be seen in all the floor plans.

148. Stairs.—The law requires that a fireproof stairway be installed that will extend through the entire height of the building. These stairs must not only be fireproof in construction but must be enclosed with fireproof walls and doors as is indicated on the plan. This staircase encloses a double stair as is indicated in Fig. 32. The floor and other levels are shown by datum numbers. The first-floor level is marked (±0′-0″).

The second floor is (+13′-0″) and the third floor is (+22′-4″). The cellar floor is marked (−10′-0″), and the floor of the elevator pit is marked (−16′-6″).

This drawing is a partial section through the stair and elevator shaft taken parallel with Madison Avenue. The full width of the stair shaft is shown from the first floor up, the shaft being 8 feet 5 inches by 18 feet 7 inches, with a slight extension. The shaft must be finished 4 inches away from column #44. The final location of the stair shaft cannot be determined until all the other parts of the building have been studied.

149. Stairs to Street.—A separate stairway must be provided from the cellar to the street according to the law, and is shown at columns #1 and #2. It must be fireproof in construction and enclosed in fireproof walls as indicated in the plan. The cellar plan includes the lower part of this stairway, which is cut off from the open cellar by means of fireproof self-closing doors. A red light above the doors shows that this is an exit door.

150. Elevator Shafts.—In a building of this type a service elevator and a passenger elevator must be provided. In this case both are approached from the main entrance through the Vestibule and Lobby. From the lobby, the passenger elevator is reached through the Elevator Vestibule. The service elevator is reached through a door in the back of the lobby, as shown on the plan.

The elevator shaft, which contains two elevators, extends from below the cellar floor up to the roof and serves all floors. It is 5 feet 10 inches by 13 feet 8 inches in size. Spaces must be provided in the shaft for counterweights that balance the weights of the elevators. The shaft is enclosed in fireproof walls as indicated in Fig. 32, and the sides of the shaft must be perfectly plumb. The doors are fireproof and are marked F. P. on the plans.

The positions of the elevator shaft and the stair shaft cannot be determined from the first-floor plan alone, but studies must be made of the upper floors before deciding as to the exact locations of these shafts.

151. Smoke Stacks.—Another important feature that extends up through the entire building is the stack containing the boiler flue and the shaft to the incinerator, both of which are built of brick. The stack is 3 feet 4 inches by 6 feet in size. The boiler flue is lined with terra cotta. It is carried down to the boiler-room floor, where a cleanout door is installed at the floor level. The flue of the incinerator shaft is lined with a 4-inch thickness of firebrick for a distance of 30 feet above the combustion chamber, as noted on the first-floor plan.

152. Vertical Features.—The principal vertical features, such as the columns, stairs, elevator shafts, and flues have been shown and discussed. The positions of these features as shown on the blueprints have been fixed with relation to the remainder of the building after considerable study.

153. Datum and Grades.—The datum, or datum point, is a point from which vertical distances up and down in the building and at the sidewalks are measured. The top of the curb at the center of the Madison Avenue front of the building is taken as the datum point and is marked (±0′-0″). Distances below that point or level are marked with a minus sign, as (−10′-0″). Distances above are marked with the plus sign, as (+13′-0″). The floor of the lobby and vestibule are marked (±0′-0″) which indicates that they are neither above nor below datum.

The levels of the curbs are fixed by the city and cannot be changed. They are marked at various points on the blueprint, showing their relation to the datum point on the Madison Avenue curb. On 73rd Street the top of the curb is (−3¾″) or 3¾″ below the datum point, (−8¼″) at the middle of the building, and (−1′-1″) at the Madison Avenue building line. The curb line thus drops from (−3¾″) to (−1′-1″), or 9¼ inches, along the 73rd Street front of the building.

On Madison Avenue at the left end the level is (+1′-0″). At

the middle of the building the level is (±0′-0″) and at the 73rd Street building line is (−10″). The drop is therefore 1′-10″, and the point (−1′-1″) is the low point of the curb.

The sidewalks must have a pitch from the curb up to the building line of about ¼ inch per foot of width. The elevations of the sidewalks with relation to datum are marked in front of the door of each store, and the levels of the store floors are marked accordingly. Thus, the sidewalk at the building line in front of Store #1 is (+11¾″) and the floor level of the store is made (+1′-0″) or ¼ inch above the sidewalk level. The level of the floor of the janitor's apartment is (+0′-0″) as marked in the floor of the foyer. The platforms of the stairs are marked (+3′-3″) in both cases. At other points in the plans similar figures in parentheses show the levels at those points.

154. Stores.—The principal features on the First-Floor Plan are the stores. The owner builds a building such as this one as a source of profit, and the architect should endeavor to make the rentable units as attractive and remunerative as possible.

In the First-Floor Plan, six good-sized stores, the corner store being the largest, have been designed, and face on the most desirable street. The columns have been designed to divide the store fronts without sacrificing show-window space. It is probable that stores are not permitted on 73rd Street, hence the store wall on that street has been made a blank wall.

Each store is provided with an entrance door and two show windows with bulkheads beneath, a water-closet compartment, electric light outlets, and a panel board. Each store has a room in the cellar. Although provision is made in the framing plans for future stairs from each store to its corresponding cellar compartment, these stairways are not indicated in the blueprint.

There is no means of communication shown between the stores and the cellars except by leaving the stores and going into the main entrance to reach the elevators or stairs, or by using the cellar entrance at column #1.

The rear walls of the store are formed of terra cotta blocks, as are also the walls around the water-closet compartments. The walls between the stores are made of gypsum blocks and are plastered on both sides.

The variations shown in the levels of the floors of the different stores are due to the pitch of the sidewalk.

155. Entrance to Apartments.—The entrance to the apartments is through the vestibule and Lobby, which are designed to be attractive to the tenants and to visitors. The vestibule may be finished with marble wainscotings and floors, and the doors with metal or hard woods.

The plan of the lobby indicates an elaborate treatment. The end walls are shown as being curved and the walls are lined with a plaster finish. The floors may be finished in marble or terrazzo. A note on the blueprint refers to a special detail that the architect has made for the finish of the lobby and the elevator vestibule.

156. Janitor's Apartment.—A door at the back of the lobby opens into a small entry from which the service elevator, the main stairs, and the entrance to the janitor's apartment are reached. The janitor's apartment consists of a living room L R, a chamber C H, a foyer, and a bathroom B, also four closets and an entry. In the foyer is a cooking recess. The living room and chamber have large windows on the yard. There are no outside windows in the other room. The apartment is surrounded with terra cotta walls and the rooms, closets, etc., are separated by solid plaster partitions. The drawing required to show the various parts of this apartment is similar to that previously shown on other drawings. The swing of doors is shown in the customary manner, and the sizes of the doors are given. The door at the entrance to the apartment is marked *F. P. S. C.*, which signifies a fireproof self-closing door. The sill is marked M. S., which means marble or metal saddle. A saddle of these materials is used when the floors on opposite sides of the sill are of different materials. Here the floor in the entry is of wood and on the other side is marble or terrazzo. The saddle under

the bathroom door is used because the floor of the hall is of wood and the floor of the bathroom is of terrazoo or mosaic.

In the living room, chamber, and foyer, the ceilings are furred down, as the height between the first and second floors is 13 feet, and the desired height of ceiling in these rooms is about 9 feet. Plaster arches, marked *P. A.*, are indicated by dotted lines in the partitions.

The bathroom contains four fixtures: a bath, shower bath, water closet, and lavatory.

The cooking recess *C. R.* is of the size prescribed by law. It is surrounded on three sides by fireproof walls and is enclosed on the front by metal Venetian blinds. In it are a refrigerator, a sink, a range, and a high closet *H. C.* A vent register into the ceiling of the recess ventilates it.

157. Heating.—The building is heated by steam supplied by the boiler that is indicated in the Cellar Plan. The various risers are run up through the building, generally in the outside walls, and the radiators are located at the windows. The small pipes that are enclosed in the fireproofing surrounding the columns are all that is shown. The radiators are not indicated in the plans. In fact, the arrangement of the boiler pipes, valves, and radiators is designed by an engineer or by the heating contractor of the building. The pipes are generally concealed as indicated by the letters *s* and *r* at the columns.

158. Dimensions.—All the necessary dimensions must be given on the plans, as is illustrated in the blueprints. The main dimensions of the lot and of the building are generally shown outside the boundaries of the lot. Thus, the main dimensions of the lot are shown as 99′-11″, 58′-0″, 100′-0″. Next are shown dimensions of the building itself and its main divisions. The dimension on Madison Avenue is divided into 10′-0″ for the yard and two dimensions 44′-11½″ that locate the center of the lot. The dimension 100′-0″ on the lot line is divided into 89′-11″ for the building and 10′-1″ for the yard. The 58′-0″ dimension of the rear lot line is divided into 34′-4″ for the building and 23′-8″ for the yard. These dimensions locate the

building accurately, but additional dimensions are necessary to locate the windows in the walls around the yard. These dimensions are given in the First-Floor Plan.

The interior dimensions are laid out from the building and lot lines, and in this set of prints, these dimensions extend to the rough walls and block partitions. Lines of dimensions are shown running parallel with Madison Avenue and 73rd Street, and it will be found, upon adding up these dimensions, that the totals equal the length and the width of the lot.

For example, the line showing the widths of the stores will include the figures 12″, 4′-0″, 8″, 13′-5″, 3″, 14′-0″, 3″, 14′-2″, 3″, 14′-0″, 3″, 14′-2″, 3″, 22′-3″, and 12″. The sum of these figures is 99′-11″, which is the length of the lot on Madison Avenue. A check of the lines of figures through the elevator shaft and through the lobby should show the same totals. It will be good practice for the student to add up the lines of dimensions across the plan parallel with 73rd Street. These lines of dimensions should add up to 58′-0″ in each case.

At the columns are shown dimensions to the center lines of the columns from the rear 58′-0″ lot line and from the Madison Avenue building line. Thus, the center lines of column #64 are 81 feet 6 inches from the rear lot line and 42 feet 6 inches from the Madison Avenue building line.

Similar dimensions are shown to the rough faces of the interior walls. These dimensions are taken from the rear 58′-0″ lot line and the Madison Avenue building line as in the cases of the columns. The wall or partition between stores #5 and #6 is marked as 76′-5″ from the rear lot line and the face of the wall back of store #6 is marked 42′-10″ from the Madison Avenue building line. The faces of these walls can be located and checked with the positions of the columns which are already in place.

It will be excellent practice to lay out a drawing of the First-Floor Plan by using the dimensions as shown on the plans.

Dimensions of individual doors and windows are shown. For individual windows, two dimensions are given, the first showing the width and the other giving the height. Giving both dimensions facilitates the calculation of the lighting area of the window,

which must be in proportion to the area of the room lighted. In general, the glass area of the window must be at least 10 per cent of the floor area of the room. Thus, in the chamber in the janitor's apartment the window is shown 6 ft. 2¼ in. by 5 ft. 6⅛ in. The area of the room is 11 feet by 17 feet, or 187 square feet. This shows that the window area is well above 10 per cent of the area of the room, and complies with the legal requirements.

159. Fire Lines.—Fire lines that deliver water to hose connections at various points in the building are very important and are required by law. In this apartment house a line of 4-inch pipe is carried up through the stair shaft and at each story has a 75-foot length of hose attached. At the corner of the streets on the face of the building a Siamese connection is indicated. This connection is provided so that fire engines may pump water into it and thus supply water to all the hose connections. The standpipe is also connected with a tank on the roof so that water can be furnished to the hose connections from the tank. The tank is kept full at all times by means of a pump.

SECOND — OR TYPICAL FLOOR PLAN

160. General.—The First-Floor Plan shows the indications of the stores. The Second- or Typical Floor Plan shows the methods of indicating the arrangements of the apartments and may be considered as a typical floor representing the arrangements of all the apartment floors up to the roof.

The building lines and the lot lines are similar to those on the other plans. The columns are shown above the ones below and with the same numbers. The grade of the floor is obtained from dimensions given on the elevation and proves to be 13 feet above the grade of the first floor, or (+13′-0″).

In the drawing the Second- or Typical Floor Plan, a sheet of tracing paper would be placed over the First-Floor Plan and all the vertical features such as columns, stairs, elevator shafts, flues, ducts, windows, etc. would be traced directly through from the lower plan.

161. Stairways.—A fireproof concrete stairway is directly above the one in the first-floor plan. It should be enclosed by fireproof walls and should have fireproof self-closing doors. The proper number of treads and risers should be shown. Electric outlets should be provided over the outside of the doors to the stair enclosure and an outlet should be shown in each story for each flight of stairs. The standpipe is shown in the elevator shaft in all the plans. The stairway must open into the public hall so that it can be reached from all apartments on each floor.

162. Pubic Hall.—The pubic hall may be entered from all apartments and a push button for a bell is indicated at the entrance to each apartment. The floor of the public hall is formed of concrete, mosaic, or tile, and metal or marble saddles are indicated under the doors to the apartments. The entrance doors to all apartments are fireproof and self-closing.

163. Apartments A and F.—There are six living rooms (L.R.) in the second floor, one for each apartment. Apartment A consists of an entry, a living room, a foyer, a bathroom, a cooking recess, and three closets. The living room is entered from the foyer through a plaster arch (P.A.). In the foyer is located the cooking recess or closet, containing a set of fixtures consisting of a range, a sink, a refrigerator, and a wall cabinet. The floor of this closet is of concrete and the walls are of terra cotta, brick, or plaster. The recess is closed by shutting the doors, thus concealing the fixtures.

The bathroom is of good size and contains a bathtub, a shower, a toilet, a lavatory, and a medicine closet. In the entry between the public hall and the foyer is a closet and a bookcase. The above description applies also to Apartment F.

164. Apartments C and D.—Apartment C is similar to Apartment A except that it has no chamber and has a cooking space (C.S.) instead of a cooking recess. The cooking space is a small room limited in size by law and has an outside window. This space must be enclosed by fireproof ceilings, walls, and

floors. The cooking space is fitted with a refrigerator, a dresser, a high closet, and a set of three fixtures including a base cabinet, a sink, a laundry tray, and a range. Apartment D is very similar to Apartment C.

165. Apartments B and E.—Apartments B and E have much the same arrangement as the other apartments. In fact, the same elements are used in all these apartments.

BASEMENT PLAN

166. General.—The cellar or basement plan contains no apartments or living quarters, but shows the cellars for the stores, the boiler room, the elevator pits, etc. A cellar or storage space is shown for each of the stores on the first-floor plan. Each of these six cellars contains a water-closet compartment, also a wash basin, and is vented through bulkheads beneath the store windows. The approach to the store cellars is from the open cellar, which is reached from the elevator, from the stairway from the street to the open cellar, or from the main stairway. A storage room and workshop for the service of the building is provided, and is ventilated by the ducts shown on each side of the workroom, which open into the street wall of the building.

Two meter rooms are included, which are ventilated as shown. These two rooms are designed to contain the meters for all apartments, so that the company's representatives can inspect them without going through the building.

The boiler room contains the boilers, pumps, and other apparatus for serving the building. It is ventilated through a duct on the ceiling that leads out into the open cellar as shown.

An incinerator room is provided to burn the garbage that is dropped into the shaft from all the floors.

The elevators are used from this floor up, but can be dropped into the pit when necessary. The concrete stairs also reach the cellar as indicated in the cellar plan in Fig. 48.

In the open cellar are shown standpipes and hose; this cellar is ventilated through a duct on the ceiling.

Doors marked *F.P.S.C.* are fireproof and self-closing.

The oil-storage compartment contains an oil-storage tank for fuel for the boilers. The tank is entirely enclosed in fireproof construction.

167. Columns.—The columns extend through the cellar with the same numbers as in the first-floor plan.

168. Walls and Partitions.—There were on the lot existing walls of older buildings that were in good condition and were consequently incorporated into the new building. They are marked *Existing Brick Walls* and do not show the indications of the materials of which they are composed. They extend along the lot lines as shown. Existing vault walls are indicated under the sidewalks and are pieced out where necessary on the Madison Avenue front as shown by the indication for brick. New brick walls are at the inner corner of the lot.

New brick walls are shown on the interior of the building by the hatching. They enclose the boiler room, part of the elevator shaft, the incinerator room, and the stairs. Brick partitions 4 inches thick are shown by hatching. Gypsum-block partitions are indicated between the store cellars and around the toilets.

169. Grades.—The first-floor level has been taken as datum and marked (±0′-0″). All the grades in the cellar will therefore be marked by a minus sign and will show their depths below the first floor. The open cellar is marked (−10′-0″), which shows that the floor is 10′-0″ below the first-floor level. The locker room, store cellars, storage, workshop and meter rooms are all at the level (−10′-0″). The boiler room is marked (−17′-0″) and is reached from the 10-foot level by a flight of steps.

The floor of the tank space is (−18′-8″) and has another floor over the tank at (−10′-0″).

The bottom of the elevator pit is at the grade (−16′-6″).

170. Building, Curb, and Lot Lines.—The building lines

and lot lines are plainly marked; also, the curb lines are shown. These lines have been explained in the description of the first-floor plan.

171. **Plumbing Indications.**—The plumbing stacks, marked by circles, empty into the house drains beneath the floor, and there are two drains emptying into the house traps. These drains run underground between the bases of the stack to the house traps as shown. One drain takes care of the water-closet compartments of Stores #4 and #5, and of plumbing stacks #5, #6, and #8. The other takes care of the water closets to Stores #1, #2, and #3, and also to the locker-room toilet, and the pipe stacks #1, #2, #9, #10, and #4. This drain also receives the discharge from the sump pit in the boiler room, which is pumped up into the drain as indicated.

The water from leader #2(4″ *L* #2) is taken care of by the drain leading to the 73rd Street sewer.

Each store cellar is provided with an enclosed water closet as well as a wash basin.

172. **Sump.**—A pit extending 4 feet below the boiler-room floor receives the drainage from this floor. It is formed of 8-inch brick walls and covered by a cast-iron cover in a cast-iron frame. In this pit is located a sump pump that raises the waste material and discharges it into a 3-inch pipe that leads to the house drain near column #51.

173. **House Traps.**—The house traps are located near columns #51 and #83, and are enclosed by 8-inch brick walls and covered by cast-iron covers. Fresh-air inlets rise to the face of the building above the sidewalk levels. The house traps are connected with the street sewers by means of 6-inch house sewers as indicated.

174. **Toilet Floors.**—The floors of all toilet or water-closet compartments are covered with tiles, and are to have 6-inch tile bases, as noted on the store cellars.

175. **Fire Line.**—A 4-inch fire line enters the building near column #81 and runs to the standpipe near the stairway.

176. **Miscellaneous.**—Access doors are provided for entering the space containing the oil-storage tank as indicated, and an iron ladder from the boiler-room floor to the top of the floor over the tank is indicated. Iron stairs are supplied to reach the open cellar from the boiler room, and also from the cellar to the first-floor level. Concrete stairs are shown leading from the open cellar to Madison Avenue.

Light outlets are shown at the floor of the elevator pit, also exit lights at the door from the open cellar to Madison Avenue. Vent ducts are shown on the ceiling of the open cellar, providing ventilation for toilets, hall, boiler room, etc. The store cellars are vented through galvanized iron ducts leading to bulkheads under the store windows.

The sidewalk covers the distance between the curb lines and the building lines. The portions over the vaults must be supported by means of iron beams and concrete resting on the existing vault walls and the framework of the building.

ELEVATION OF MADISON AVENUE FRONT

177. **General Description.**—The elevation on Madison Avenue shows the fronts of the stores indicated on the first-floor plan. Each store has an entrance door with a show window on each side. Beneath the show windows are the bulkheads, each containing a ventilating window for the store cellar. A fresh-air inlet for the house trap is shown in the bulkhead of Store #4. The door to the cellar is shown at the extreme left. Careful study of the first-floor plan will show how the plan is expressed in the elevation.

A frieze or fascia of black glass is shown over the doors to the stores, and above this is a band of limestone consisting of a flat frieze with an ornamental band above and below it. Details of this frieze are shown at a large scale at the left in the detail of the Main Entrance. This method of supporting the stone band and string courses is illustrated in the section

at the left of the drawing, where angle irons and plates are shown under the lower band course. Above the band courses are two stories of plain brick walls pierced by groups of three windows that indicate the living rooms of the apartments, and single windows that indicate cooking spaces. The Second- or Typical Floor Plan should be studied in connection with the elevation of these floors.

Between the fourth and fifth floors the surface of the wall is ornamented by a fret ornament and a stone band or belt course above and below. A detail of this ornament is given above the detail of the Main Entrance. The ornament consists of strips of limestone about three brick courses wide and let into the brick wall. A slab of limestone 4 inches thick forms the central feature of the ornament and is carved with a leaf ornament.

Above this story are eight stories treated uniformly with face brickwork. Over the twelfth-story windows is a simple cornice consisting of two flat bands of limestone with brick courses between. A wrought-iron railing is let into the top stone course, which is the coping of the walls.

The fourteenth floor is shown in the Roof Plan, and is treated simply in face brickwork.

ELEVATION OF EAST 73RD STREET FRONT

178. General Description.—The elevation on East 73rd Street is similar to the Madison Avenue elevation. The side wall of Store #6 is shown finished solid with limestone, and the entrance doorway to the apartments is shown at the right-hand end. The limestone extends from the sidewalk to the tops of the window sills of the second story. The stone panel above the main entrance is ornamented with a fret-and-leaf ornament.

179. Detail of Entrance Doorway.—A detail of the entrance doorway at a large scale is shown at the left of the elevations. The entrance is formed of metal and glass and consists of two doors with sidelights and transoms. Metal grilles cover the ends of the vent ducts that ventilate the cellar rooms.

KEY TO CRITICISM

The following symbols are used to indicate criticisms and suggestions on the student's drawings in Elementary Architectural Drawing, Freehand and Ornamental Drawing and Architectural Drawing. When a letter is placed on the corrected plate the meaning of this letter can be found in the following list.

a. Inclination of letters not uniform.
b. Letters not well formed. Study Arts. 2 to 10, 5893B.
c. Letters not uniformly spaced.
d. Practice lettering frequently.
e. Sizes of spaces unequal. Read Arts. 21 and 22, 5893B.
f. Compare your work with model in text.
g. Height of letters irregular. Use guide lines.
h. Letters too large.
i. Letters too small.
j. Use vertical guide lines for your letters. Guide lines should be drawn at random.
k. Numerals should be printed not written.
l. Numerals not well formed.
m. Foot and inch marks not well formed.
n. Line too heavy.
o. Line too light.
p. Line uneven.
q. Line not black enough.
r. Line should be drawn with instruments.
s. Line should be dotted.
t. Line should be broken.
u. Broken or dotted lines uneven.
v. Should be full line not broken.
w. Freehand curved lines not well drawn.
x. Arrow heads not well formed. Use closed type arrow heads.
y. Lines are to be drawn freehand, without the use of instruments.
z. Compare your work with attached drawing.

(1) You can do better work.
(2) All sides of figure should be equal.
(3) Not required.
(4) Erase blots.
(5) Practice use of French curve.
(6) Use black drawing ink.
(7) Not enough contrast in weight of line.
(8) This is good work but you can do better if you take more time.
(9) Excellent work.
(10) Facility in freehand drawing comes with practice.

A. Dimension lines omitted.
B. Dimensions incorrect.
C. Dimension arrows incorrectly placed.
D. Lines not parallel.
E. Intersections poor.
F. Compass work poor.
G. Line should be dotted, as it represents a part not seen.
H. Line should be dotted, as it represents a part cut off.
I. Wrong symbol used.
J. Carelessly drawn.
K. Size too large.
L. Size too small.
M. Not projected properly.
N. Section lines omitted.
O. Section lines not evenly spaced.
P. Lines omitted.
Q. Dimensions omitted.
R. Incomplete
S. Drawing not to scale.
T. Similar lines should have the same thickness.
U. Symbol omitted.
V. Lettering omitted.
W. Use single line.
X. Avoid flat spots when drawing curves.
Y. Avoid angles when drawing curves.
Z. Quality of line should be clean, crisp and uniform.

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