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Architectural and Building Student: Second Edition: Volume Two

Walter R. Jaggard and Francis E. Drury

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# ARCHITECTURAL BUILDING CONSTRUCTION

VOLUME TWO

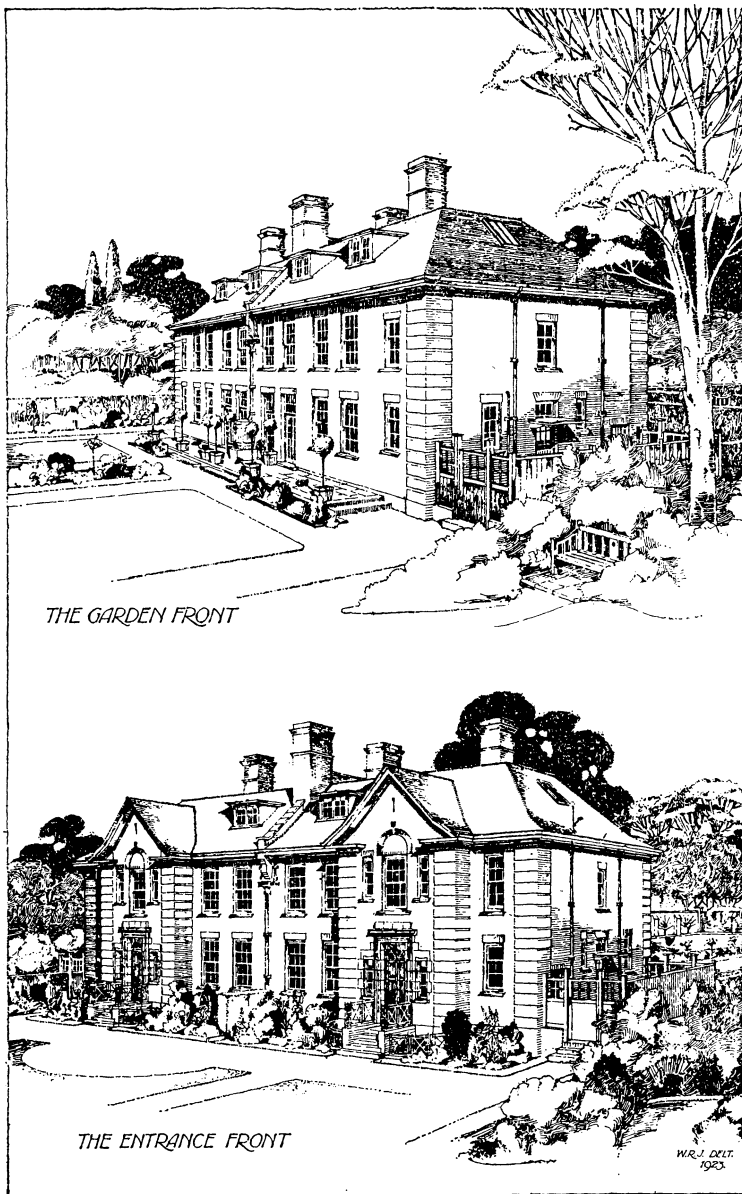
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VIEWS OF THE SEMI-DETACHED HOUSES

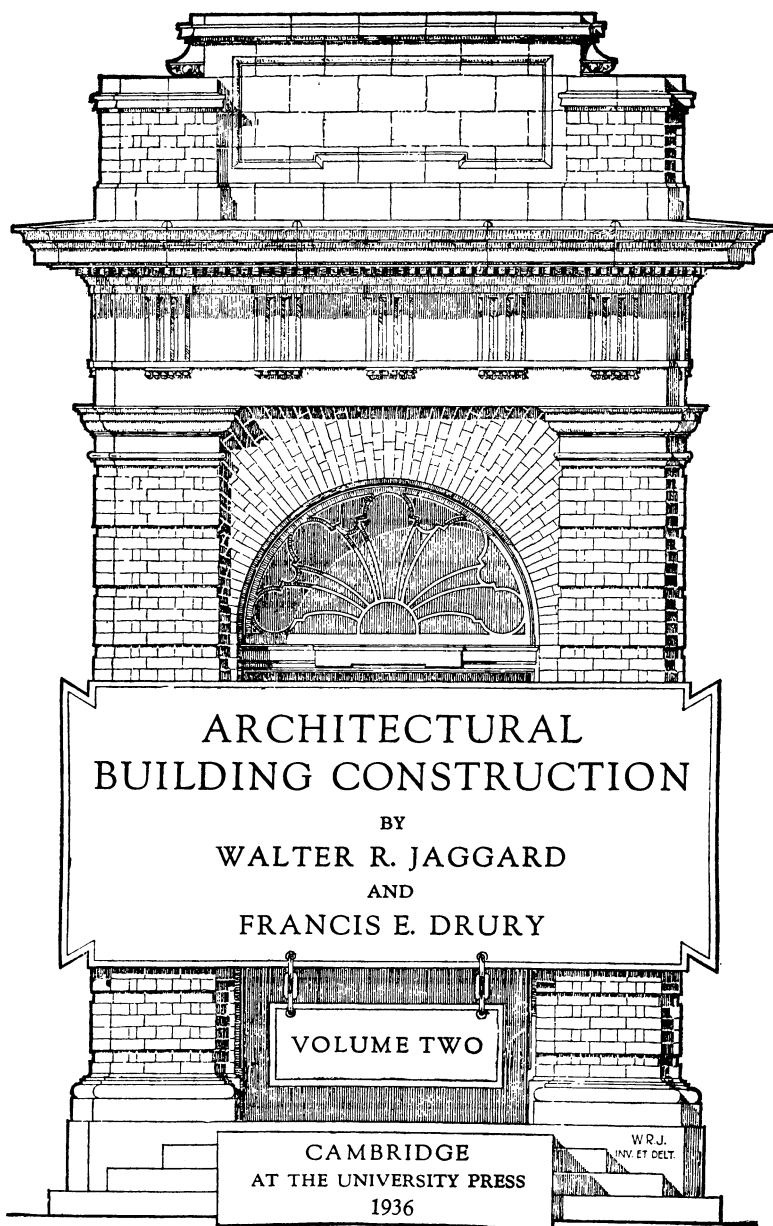
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# ARCHITECTURAL BUILDING CONSTRUCTION

A TEXT BOOK FOR THE ARCHITECTURAL  
AND BUILDING STUDENT

BY

WALTER R. JAGGARD

AND

FRANCIS E. DRURY

M.Sc.Tech., M.I.Struct.E., F.I.San.E.

*Second Edition*

*(Revised and Enlarged by F. E. DRURY)*

VOLUME TWO

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1936

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## GENERAL PREFACE

**I**N writing and illustrating the series of works on Architectural Building Construction of which this is the second volume, the authors have been actuated by the desires and objects which are briefly set out below.

That there are many existing books on Building Construction is a well-recognised fact; that some of them have excellent matter, and others have good illustrations is also duly acknowledged, but from a long experience in the practice of Architecture, both in England and the Colonies, and many years of teaching architectural principles and the science of building construction, the authors have been forced to the conclusion that something more in the way of text books is needed for the following reasons.

1. Building Construction should not be divorced from the Principles of Architectural Design. Although it is sometimes true that we find an Architect who can design pleasing structures with little or no knowledge of building construction, it is an undoubted fact that a fine conception of noble architecture must be based upon an intimate and complete knowledge of the proper use of materials, the scientific and fit assembly of the varying units, and an honest and conscientious co-ordination of the work of Architect, Builder and Craftsman.

It may be argued that with the present day use of steel and reinforced concrete, together with other modern materials and methods, we are able to construct some most extravagant fancies in architectural design, which a few years ago would have been quite impossible. Whilst this is quite true, and illustrates the age in which we live, it is also true that the very great majority of our buildings to-day are still erected with the staple materials, such as concrete, brick, stone and timber.

2. For the creation of good architecture it is necessary to study the work produced by our predecessors, and not only the work of ancient civilisations and mediæval peoples, but the best work of more modern architects must be examined. This study is rendered comparatively easy of acquisition through the rapid and cheap facilities offered for travel, and the many excellent books and illus-

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trations which are constantly being published. Attention might here be drawn to the publication entitled, *The Development of English Building Construction*, written by Mr C. F. Innocent, and forming one of the volumes of The Cambridge Technical Series; a perusal of this book will be found both interesting and helpful. It is possible to apply this method to the study of Building Construction? The authors have been impressed with this idea, and have endeavoured, with some success, to carry it out in their teaching. They have, however, found that in the earlier stages of education this must not be unduly pressed. For elementary students, the teacher should, to some extent, be dictatorial, and whilst selecting a well-proportioned and designed study as an example, should insist upon the construction being shown in a definite manner, although he knows that infinite variety, both in design and construction, is possible. With the more advanced student greater latitude is desirable, and in fact necessary. The authors have, therefore, impressed a certain amount of individuality in the subjects of the first two volumes, but they intend, as far as possible, in the third volume to select examples of established taste and architectural value to illustrate advanced principles of design, maintaining in some cases the constructional details given them by their designer or constructor, but in others, adapting the construction in accordance with modern methods and the more extended use of machinery.

3. Building Construction has more generally been presented to the student in the form of isolated examples, which have no relation whatever to each other, and thus the knowledge obtained cannot be applied to the actual design of a building, even of the smallest dimensions, until a very much later date. Modern methods of teaching demand a greater cohesion. The authors have endeavoured during their teaching experience to obtain or formulate one building into which all the various items comprehended in each year's work could be fitly placed, but after many attempts it was found to be impracticable, and therefore two buildings were arranged, which embody, with few exceptions, all the items necessary for an elementary knowledge of building construction, thus enabling "teaching from the structure itself to be adopted rather than the selection of isolated examples on account of their simplicity".



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This method has been adopted in the first three volumes, but whilst the authors disclaim any idea of presenting great architecture, they do claim that the buildings designed fitly express their purpose, and enable them in a more or less pleasing manner to assemble the different units of the building, and at the same time to inculcate a sense of completeness in the student's work.

4. The acquisition of a knowledge of Building Construction should rightly be a plant of slow but sturdy growth, and in the majority of Architectural and Building Schools the course of instruction covers a period of from three to five years. The first volume of this series is designed to meet the needs of the first year student, the second volume will provide more than is generally required for a second year course, while the third volume will cover a large field of advanced work.

5. The authors have often felt that the ordinary orthogonal presentation of examples of building construction does not sufficiently convey the solidity of the object to an elementary student, and as it is not possible for each student to have, or to make, models of the different units for himself—although such a course would greatly make for efficiency of study—the illustrations have to a large extent been shown in perspective, isometric or pictorial projection. Photographs might, and in some cases will, be used, but the camera, whilst giving a faithful representation of the object, cannot be used to show the construction of hidden parts. On this account dissociated isometric and oblique sketches have been freely used with some slight shading to indicate differing planes, but cast shadows have generally been avoided as tending to obscure the construction, which it is desired to show in the clearest possible manner.

It is strongly recommended that in all Architectural and Building Schools correct scale models—about half full size—of the different items should be made in such a way that the parts may be disassembled, and that the student should be encouraged and advised to study and measure these carefully, and make the usual orthogonal drawings, which are, after all, the media through which Architect, Builder and Craftsman convey their ideas and wishes to one another.

It is necessary to impress strongly upon a student in the early stages of his work, that his knowledge must be presented in a clear and unmistakable way and with some architectural character and

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students should be encouraged carefully to complete all their drawings with full naming of parts, references, and adequate dimensions, and to ink-in and colour, or otherwise distinguish, the materials of construction. They will thus acquire the habit of thoroughness, which is of inestimable value to both draughtsman and craftsman.

In conclusion, the authors' chief endeavour has been to make these volumes of primary importance to students—architect, builder or craftsman—and since in this study, at least, they all meet upon common ground, although each with different aims and objects in life to accomplish, yet, each finding help and guidance herein, there is an augury of the future happy relations which should exist between those engaged in all the branches of the practice of architectural building.

W. R. J.

F. E. D.

*June 1916*

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## PREFACE TO VOLUME II

**I**N compiling this volume it was necessary for the authors to give careful consideration to the mode of treatment. At least two courses were open to them, viz. the illustration of methods of construction applied to isolated building details, by selecting examples having no definite relation to or embodiment in any one building, or, to continue the method adopted in the first volume of this series, and endeavour to relate all the items of construction which it appeared desirable to illustrate and discuss, and to apply these rationally within the boundaries of one or more buildings of a definite character.

The latter course commended itself to the authors and they decided to proceed on this basis. Two buildings of different character were selected in order to avoid the aggregation of conflicting details and doubtful combinations of materials which would, of necessity, render a single building very elaborate and complicated, if designed to contain them.

This volume contains the treatment of such parts of the two buildings as can reasonably be placed before a good second year student in an average school of building or architecture, and the remaining study, for the complete consideration of the two buildings, is given in Vol. III.

One of the buildings belongs to the class generally known under building regulations as “domestic buildings”, while the other belongs to the division known as “buildings of the warehouse class”.

A certain amount of overlapping in the preparation of details under the conditions of the treatment selected is inevitable, but it was found convenient and practicable to design two structures which are fairly typical of their respective classes, while embodying the features desirable for study.

These buildings are:

- (1) A semi-detached suburban house.
- (2) A town warehouse.

The architectural treatment of these buildings in plan and elevation has been developed with the intention of illustrating as varied

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## PREFACE TO VOLUME II

a range of constructional examples as possible. It cannot be maintained, however, that all the variations of detail suggested could be embodied or economically used in one building, but each example suggested may be fitly employed as an alternative to other forms of construction in a building of the type to which it refers.

The question of cost has not been overlooked by the authors, but they have not allowed this point to interfere with the objects in view, viz. to illustrate and explain a number of sound and standard methods of construction, generally suited to the class of buildings under consideration.

First cost is not the only point to observe, because it frequently happens that an apparently costly structure is so economical in maintenance that it may ultimately become cheaper and more serviceable than a building of a more meretricious character, where a low first cost appeared to ensure economy.

Furthermore, the mere fact that a building has been erected with costly materials and supplied with much added decoration does not necessarily mean the production of a building of architectural value. Many wayside cottages have that elusive charm, which we know as architecture, and which is very often missing in some of the large town buildings. It should be the business of every student to endeavour, for himself, to find that secret by which the smallest building, by correctly expressing its functions, may, equally with the large and noble, take its place as a work of architecture.

The authors desire to record their indebtedness to all who have been kind enough to supply information, and to take an interest in the preparation of this volume.

W. R. J.

F. E. D.

*July 1922*

In the present edition the subjects of study have been rearranged and many revisions and additions to the text have also been made.

It is hoped that this change will be an advantage to teachers and students in meeting the needs of grouped course instruction.

Thanks are hereby accorded to Mr Norman Keep, F.R.I.B.A., and Mr R. A. Bix for their valuable assistance in preparing diagrams for this volume.

F. E. D.

*April 1936*

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## DESCRIPTION OF THE BUILDINGS, THE CONSTRUCTION OF WHICH IS TO BE STUDIED IN VOLUMES TWO AND THREE

### THE HOUSE

**T**HE house designed for the purpose of this volume is the right hand one of a pair of semi-detached suburban houses; it is illustrated in the working drawing supplied in the pocket of the binding.

The plot of land to contain the two houses has a frontage to the street of about 100 ft. and a depth which depends upon the conditions of the locality and the garden space decided upon at the back of the property. The front of the house faces north-east and is intended to be set back about 25 ft. from the roadway.

The house itself has a frontage length of 42' 3" and a depth of 33' 6". There are no out-buildings at the rear. The main entrance is at the front and is emphasised by a gabled feature projecting 3 ft. from the main face.

The house is two storeys in height, the ground floor being 10' 9" high from floor to floor, and the first floor 10' 3", while an attic storey with a height of about 9' 4" is arranged in the roof.

The walls are of brick, built as a cavity wall, with an external thickness of 4½" in Flemish bond and an internal thickness of 9" in English bond, and care has been exercised in arranging the sizes of rooms, door openings and window openings, so that ordinary brick sizes are obtained with little or no special cutting or broken bond. The main quoins of the building are emphasised by the use of pilasters, formed by slightly projecting and recessing certain brick courses.

The window openings have moulded brick cills and joggled brick lintols, and are fitted with wooden cased frames and sliding sashes. The frames are set 3" from the outside face of the wall, the openings being formed with square stopped jambs, and the windows surrounded by moulded wood architraves, abutting upon the oak cill. A tradesmen's entrance doorway at the side is provided with a lead covered projecting hood and a glazed door with a fanlight over.

The main entrance doorway, set in the centre of the front projecting gable, forms a focal point of interest to the building. It is approached by a short flight of steps across an open area, which is formed to obtain light to a small basement room, and is guarded by

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## THE HOUSE

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short wing walls surmounted by wrought iron railings. Similar railings guard the open areas on both sides.

The doorway, which is flanked on either side by small windows, is finished with moulded stone architraves, cornice and blocking course and is fitted with a solid door frame, double margined door and fanlight with bronze grille. The small side windows have oak frames with metal casements.

The garden at the back of the house is approached from the drawing room by means of French casement windows giving access to a small paved terrace.

The main walls are surmounted by a built up wooden eaves cornice finished with half round eaves gutters, connected to down pipes, one of which discharges into a water butt upon the terrace for use in the garden.

The roof is covered with plain tiles, and is hipped at the external angles, the front projection being finished with a gable. Owing to the width of the building, it is not desirable to carry the roof to a ridge, hence the upper part is kept down and a lead covered flat roof is formed, which affords several opportunities for constructional examples. Three lead covered dormer windows break the roof surface, and for purposes of illustration skylights are shown to the cistern room and to the attic stairs, although the authors deprecate the use of skylights, where vertical windows can and ought to be used.

The chimney stacks are of brick, with oversailing brick and tile courses to provide a capping and necking to the stack.

The internal accommodation of the house is as follows:

On the ground floor. An entrance hall, 17' 6" × 14' 10½", contains an open well stair leading to the upper floor, a straight flight stair with winders to the basement, a recess for the telephone, a small lobby and a lavatory. The hall has a concrete floor surfaced with marble tiles, and the walls are finished in plaster above a panelled teak dado, which is in harmony with the design of the teak mantel surrounding the stone arched fireplace.

The dining room, at the front, is 15' 9" × 14' 0", and the drawing room, at the back, 16' 7" × 15' 9"; the latter overlooks the garden. On the left of the hall two doors provide access to these rooms. The rooms are divided by a trussed timber partition containing a pair of folding doors. The fireplaces and windows of these rooms are subjects of special treatment in the design and construction.

The kitchen is entered from the hall and is 14' 10½" × 12' 0". Its windows overlook the garden and the room contains a kitchen range, a gas cooker and a dresser, this last being illustrated in detail. A scullery, 8' 3" × 7' 11", opens off the kitchen and is fitted with an earthenware sink and teak draining boards. The larder, 8' 3" × 3' 6", is entered from the scullery. A semicircular archway from the hall



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## DESCRIPTION OF BUILDINGS

leads to the tradesmen's entrance, the lobby thus formed giving access to a w.c. and coal store, while a bicycle or tool store entered from the yard at the side of the house completes the accommodation provided on the ground floor.

On the first floor there are two double bedded rooms and two rooms for single beds. They are respectively  $16' 7'' \times 15' 9''$ ;  $15' 9'' \times 14' 0''$ ;  $14' 10\frac{1}{2}'' \times 12' 0''$  and  $14' 0'' \times 8' 3''$ . The three larger rooms each have fireplaces and permanently fitted wardrobes. A lavatory and w.c. and a linen store are entered from the landing, and a bathroom and store cupboard are placed over the scullery and tradesmen's entrance.

The attic floor contains three bedrooms, one of which is sufficiently large to accommodate twin bedsteads, while a large box room and a cistern room are also provided.

Hot and cold water services are provided to the bathroom, lavatories and scullery sink, the hot water storage cylinder being placed in a cupboard entered from the bathroom on the first floor.

The basement consists of one room under the entrance hall and affords a number of examples in the construction of basement walls. It is lighted from the areas alongside the front entrance steps.

## THE WAREHOUSE

The warehouse building is intended to occupy a site between other buildings on each side of it. It has a frontage to the main street of  $54' 6''$ , a depth of  $64' 6''$  and a frontage to the back street of about  $69' 6''$ . Access is obtainable from both streets, but no side lights are possible except by the formation of open areas.

The accommodation required is provided on three floors, while about half the area is slightly excavated in the front for a basement. This is rendered economically possible by a fall of  $4' 0''$  in the original surface of the ground from back to front of the site.

The main building consists of a large room, about  $60' 9''$  long by  $36' 9''$  wide, on each of the three main floors. A series of six steel stanchions or cast iron columns on the ground and first floors divide the floor area into twelve bays, each about  $15' 0'' \times 12' 0''$ , and various alternative methods of dealing with the construction and calculations necessary for these floors are illustrated and discussed. The second floor has no intermediate supports, but is covered by a slated roof supported on queen-post trusses.

Assuming that it may be desirable under some conditions to have the first floor free from intermediate supports, it would be necessary to introduce large main girders across the full breadth of the building. Built-up plate girders have therefore been included in the scheme for the consideration of the student.

In order to gain access to the rooms at the various floor levels a separate staircase wing is arranged alongside of the main building.



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## THE WAREHOUSE

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The principal entrance is placed on the ground level of this building and a tiled vestibule and entrance hall lead to a stone stair which is carried to the top of the building. The large rooms of the main building are entered through slightly recessed doorways, fitted with teak fire-resisting doors, opening outwards.

Lavatories are arranged upon the main and intermediate landings, providing two w.c.'s and two lavatory basins on each level. Accessible from the landings, and behind the stairs, a space is provided for a lift or hoist, although the construction of this feature does not form a part of our study.

Entered from the back street and occupying the remainder of the back portion of the site a loading and packing shed is provided about 32' × 25'. This contains a sunk loading dock for carts to back into at the level of the street, and a back entrance for employees and a timekeeper's office are also provided.

The loading shed is roofed with corrugated galvanized iron or pantiles supported on open steel trusses, and contains a fixed skylight. A doorway at the back of the loading shed leads, by way of a flight of stone steps, to a small open yard which has an exit to the front street.

Communication between the loading shed and main ground floor room is obtained by means of a large opening spanned by a bressummer, several alternatives for which are illustrated, and by a doorway fitted with a sliding fire-resisting door. The larger opening would be closed by fitting a steel revolving shutter under the bressummer.

Only a portion of the basement is excavated, but the room so obtained is 36' 0" × 29' 3" and is lighted by windows from the main street.

The stone stairs, already mentioned, are carried to the level of the main roof, and a portion of the staircase wing is carried to a higher level, in order to provide adequate headroom for the lift gear. This part of the building is enclosed by a lead covered flat roof.

Externally, the main front of the building, including the staircase or lavatory wing, is to be carried out in stone. The design of this façade has been allowed to express the plan of the building, and provides suitable masonry examples for the student.

The main façade consists of a basement and ground storey, with strongly marked and channelled horizontal joints; the basement windows are protected with wrought metal grilles, while the ground floor windows are surmounted with segmental arches with channel jointed voussoirs and triple key blocks, and are fitted with wrought metal window frames. A slightly projecting string course at the first floor level forms a base upon which a simple application of one of the Orders of Architecture is erected. This consists of Doric pilasters carried through the height of the two upper floors and finished with

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an entablature consisting of architrave, frieze and cornice. The windows of the first and second floors are placed between the pilasters, surrounded with moulded stone architraves and fitted with wrought metal window frames, similar to those on the ground floor. Amongst the subsequent illustrations in this volume an alternative design is given, showing the space between the pilasters filled in with cast iron panels in lieu of stonework. Above the main cornice the façade is completed by a broken parapet, which serves to cover the end of the main roof. A masonry chimney stack in the party wall contains the flues from the basement and ground floor fireplaces.

The front of the staircase wing is kept quite distinct from the main façade. The main entrance doorway at the ground level is surrounded with a sunk panelled architrave and finished with a small frieze, tablet panel, cornice and blocking course. The lavatory windows are grouped together vertically in pairs and the channel jointed ground storey and string course are carried through this side wing and serve to bind it to the main building. Chamfered projecting quoins accentuate the angle and are returned along the side wall and enable a finish to be made to the stonework of the front.

The side wall of the staircase wing is built in brickwork in English bond, and although irregularly broken up by the staircase and lavatory windows is bound together and strengthened by the horizontal line of the cornice.

The elevation of the main building to the back street is intended to be of brickwork in English bond, with the large window openings finished with ashlar stone quoins, although an equally satisfactory finish would be obtained with plain brick quoins, as suggested for the side windows overlooking the roof of the loading shed, on the first and second floors of the main building. The ground floor windows are spanned by segmental stone arches with stepped extrados and key blocks, whilst sunk panelled cast iron lintols are used for the upper floor windows. Lok'd bar metal frames with ventilating lights are fitted to the openings, but alternative treatments are suggested elsewhere.

The back entrance is shown with a plain flat stone architrave and moulded cornice, and the doorway is fitted with double folding doors and glazed fanlight, while the entrance to the loading dock is spanned by a semi-elliptical gauged brick arch and closed with collapsible steel gates.

So far as applicable or expedient for the authors' purpose the provisions and regulations of the London Building Acts have been adhered to, but these have not been allowed to interfere with the proper elucidation or development of the scheme of constructive examples embodied in the building.

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## THE WAREHOUSE

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### *Alternative Brick Façade*

The main façade of the warehouse might appropriately be constructed of brick in lieu of stone. A suggestion for a brick façade is given in the frontispiece of this book for the consideration of students and teachers.

The development of this brick façade might be treated as a problem in design for students specially interested in brickwork.

The suggested design—or the student's own production—would make a useful feature for individual study. For the designer the selection and use of multi-coloured bricks or selected and grouped bricks of varying colour may be introduced. For the constructor the planning of voids and solids to allow of unbroken bond, and for the craftsman in brick the actual detailing of the bonds for practical purposes.

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Frontmatter

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