VITRUVIUS

THE TEN BOOKS ON ARCHITECTURE

TRANSLATED BY

MORRIS HICKY MORGAN, PH.D., LL.D.

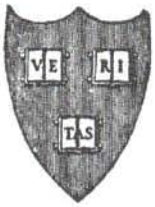
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WITH ILLUSTRATIONS AND ORIGINAL DESIGNS

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CAMBRIDGE
HARVARD UNIVERSITY PRESS
LONDON: HUMPHREY MILFORD
OXFORD UNIVERSITY PRESS
1926

CONTENTS

BOOK I

PREFACE 3

THE EDUCATION OF THE ARCHITECT 5

THE FUNDAMENTAL PRINCIPLES OF ARCHITECTURE 13

THE DEPARTMENTS OF ARCHITECTURE 16

THE SITE OF A CITY 17

THE CITY WALLS 21

THE DIRECTIONS OF THE STREETS; WITH REMARKS ON THE WINDS . 24

THE SITES FOR PUBLIC BUILDINGS 31

BOOK II

INTRODUCTION 35

THE ORIGIN OF THE DWELLING HOUSE 38

ON THE PRIMORDIAL SUBSTANCE ACCORDING TO THE PHYSICISTS . . 42

BRICK 42

SAND 44

LIME 45

POZZOLANA 46

STONE 49

METHODS OF BUILDING WALLS 51

TIMBER 58

HIGHLAND AND LOWLAND FIR 64

BOOK III

INTRODUCTION 69

ON SYMMETRY: IN TEMPLES AND IN THE HUMAN BODY . . . 72

CLASSIFICATION OF TEMPLES 75

THE PROPORTIONS OF INTERCOLUMNIATIONS AND OF COLUMNS . . 78

The Foundations and Substructures of Temples 86

Proportions of the Base, Capitals, and Entablature in the Ionic Order 90

BOOK IV

Introduction 101

The Origins of the Three Orders, and the Proportions of the Corinthian Capital 102

The Ornaments of the Orders 107

Proportions of Doric Temples 109

The Cella and Pronaos 114

How the Temple should face 116

The Doorways of Temples 117

Tuscan Temples 120

Circular Temples and Other Varieties 122

Altars 125

BOOK V

Introduction 129

The Forum and Basilica 131

The Treasury, Prison, and Senate House 137

The Theatre: its Site, Foundations, and Acoustics . . . 137

Harmonics 139

Sounding Vessels in the Theatre 143

Plan of the Theatre 146

Greek Theatres 151

Acoustics of the Site of a Theatre 153

Colonnades and Walks 154

Baths 157

The Palaestra 159

Harbours, Breakwaters, and Shipyards 162

BOOK VI

Introduction 167

On Climate as determining the Style of the House . . . 170

Symmetry, and Modifications in it to suit the Site . . . 174

PROPORTIONS OF THE PRINCIPAL ROOMS 176
THE PROPER EXPOSURES OF THE DIFFERENT ROOMS 180
HOW THE ROOMS SHOULD BE SUITED TO THE STATION OF THE OWNER 181
THE FARMHOUSE 183
THE GREEK HOUSE 185
ON FOUNDATIONS AND SUBSTRUCTURES 189

BOOK VII

INTRODUCTION 195
FLOORS 202
THE SLAKING OF LIME FOR STUCCO 204
VAULTINGS AND STUCCO WORK 205
ON STUCCO WORK IN DAMP PLACES, AND ON THE DECORATION OF DINING ROOMS 208
THE DECADENCE OF FRESCO PAINTING 210
MARBLE FOR USE IN STUCCO 213
NATURAL COLOURS 214
CINNABAR AND QUICKSILVER 215
CINNABAR (*continued*) 216
ARTIFICIAL COLOURS. BLACK 217
BLUE. BURNT OCHRE 218
WHITE LEAD, VERDIGRIS, AND ARTIFICIAL SANDARACH . . . 219
PURPLE 219
SUBSTITUTES FOR PURPLE, YELLOW OCHRE, MALACHITE GREEN, AND INDIGO 220

BOOK VIII

INTRODUCTION 225
HOW TO FIND WATER 227
RAINWATER 229
VARIOUS PROPERTIES OF DIFFERENT WATERS 232
TESTS OF GOOD WATER 242
LEVELLING AND LEVELLING INSTRUMENTS 242
AQUEDUCTS, WELLS, AND CISTERNS 244

BOOK IX

INTRODUCTION 251
THE ZODIAC AND THE PLANETS 257
THE PHASES OF THE MOON 262
THE COURSE OF THE SUN THROUGH THE TWELVE SIGNS . . . 264
THE NORTHERN CONSTELLATIONS 265
THE SOUTHERN CONSTELLATIONS 267
ASTROLOGY AND WEATHER PROGNOSTICS 269
THE ANALEMMA AND ITS APPLICATIONS 270
SUNDIALS AND WATER CLOCKS 273

BOOK X

INTRODUCTION 281
MACHINES AND IMPLEMENTS 283
HOISTING MACHINES 285
THE ELEMENTS OF MOTION 290
ENGINES FOR RAISING WATER 293
WATER WHEELS AND WATER MILLS 294
THE WATER SCREW 295
THE PUMP OF CTESIBIUS 297
THE WATER ORGAN 299
THE HODOMETER 301
CATAPULTS OR SCORPIONES 303
BALLISTAE 305
THE STRINGING AND TUNING OF CATAPULTS 308
SIEGE MACHINES 309
THE TORTOISE 311
HEGETOR'S TORTOISE 312
MEASURES OF DEFENCE 315
NOTE ON SCAMILLI IMPARES 320
INDEX 321

LIST OF ILLUSTRATIONS

CARYATIDES FROM TREASURY OF CNIDIANS, DELPHI 6

CARYATIDES OF ERECHTHEUM, ATHENS 6

CARYATID IN VILLA ALBANI, ROME 6

CARYATIDES 7

PERSIANS 9

CONSTRUCTION OF CITY WALLS 23

TOWER OF THE WINDS, ATHENS 26

DIAGRAM OF THE WINDS 29

DIAGRAM OF DIRECTIONS OF STREETS 30

VITRUVIUS' BRICK-BOND 44

TRAVERTINE QUARRIES, ROMAN CAMPAGNA 49

EXAMPLE OF OPUS INCERTUM, CIRCULAR TEMPLE, TIVOLI . . . 51

OPUS RETICULATUM, THERMAE OF HADRIAN'S VILLA, TIVOLI . . 52

EXAMPLE OF OPUS RETICULATUM, DOORWAY OF STOA POECILE, HADRIAN'S VILLA 52

MAUSOLEUM AT HALICARNASSUS, RESTORED 54

CLASSIFICATION OF TEMPLES ACCORDING TO ARRANGEMENTS OF COLONNADES 76

HYPAETHRAL TEMPLE OF VITRUVIUS COMPARED WITH PARTHENON AND TEMPLE OF APOLLO NEAR MILETUS 77

CLASSIFICATION OF TEMPLES ACCORDING TO INTERCOLUMNIATION . . 79

EUSTYLE TEMPLE OF VITRUVIUS COMPARED WITH TEMPLE OF TEOS . 81

VITRUVIUS' RULES FOR DIAMETER AND HEIGHT OF COLUMNS COMPARED WITH ACTUAL EXAMPLES 83

DIMINUTION OF COLUMNS IN RELATION TO DIMENSIONS OF HEIGHT. 85

ENTASIS OF COLUMNS 87

FRA GIOCONDO'S IDEA OF "SCAMILLI IMPARES" 89

IONIC ORDER ACCORDING TO VITRUVIUS COMPARED WITH ORDER OF MAUSOLEUM AT HALICARNASSUS. 91

COMPARISON OF IONIC ORDER ACCORDING TO VITRUVIUS WITH ACTUAL EXAMPLES AND WITH VIGNOLA'S ORDER 95
BASILICA AT POMPEII 104
CORINTHIAN CAPITAL OF VITRUVIUS COMPARED WITH MONUMENTS . 105
VITRUVIUS' DORIC ORDER COMPARED WITH TEMPLE AT CORI AND THEATRE OF MARCELLUS 111
VITRUVIUS' TEMPLE PLAN COMPARED WITH ACTUAL EXAMPLES . . 115
VITRUVIUS' RULE FOR DOORWAYS COMPARED WITH TWO EXAMPLES . 119
TUSCAN TEMPLE ACCORDING TO VITRUVIUS 121
CIRCULAR TEMPLE, TIVOLI 123
MAISON CARRÉE, NÎMES 123
PLAN OF TEMPLE, TIVOLI 123
PLAN OF TEMPLE OF VESTA, ROME 123
PLAN OF CIRCULAR TEMPLE ACCORDING TO VITRUVIUS . . . 124
FORUM, TIMGAD 131
FORUM, POMPEII 133
PLAN OF BASILICA, POMPEII 134
VITRUVIUS' BASILICA, FANO 135
ROMAN THEATRE ACCORDING TO VITRUVIUS 147
THEATRE AT ASPENDUS 149
THEATRE PORTICO ACCORDING TO VITRUVIUS 152
TEPIDARIUM OF STABIAN BATHS, POMPEII 157
APODYTERIUM FOR WOMEN, STABIAN BATHS, POMPEII 157
STABIAN BATHS, POMPEII 158
PALAESTRA, OLYMPIA, AND GREEK PALAESTRA ACCORDING TO VITRUVIUS 161
PLANS OF HOUSES, POMPEII 176
PLAN OF HOUSE OF SILVER WEDDING, POMPEII 177
PLAN OF TYPICAL ROMAN HOUSE 178
PERISTYLE OF HOUSE OF THE VETTII, POMPEII 179
PLAN OF HOUSE OF THE VETTII, POMPEII 179
PLAN OF VILLA RUSTICA, NEAR POMPEII 183
PLAN OF VITRUVIUS' GREEK HOUSE 186
PLAN OF GREEK HOUSE, DELOS 187

PLAN OF GREEK HOUSE DISCOVERED AT PERGAMUM 188
RETAINING WALLS 191
CONSTRUCTION OF THE ANALEMMA 271
CONSTRUCTION OF WATER SCREW 295
WATER SCREW 296
HEGETOR'S RAM AND TORTOISE 312

1. From sixteenth century MS.
2. From model by A. A. Howard.

BOOK I

PREFACE

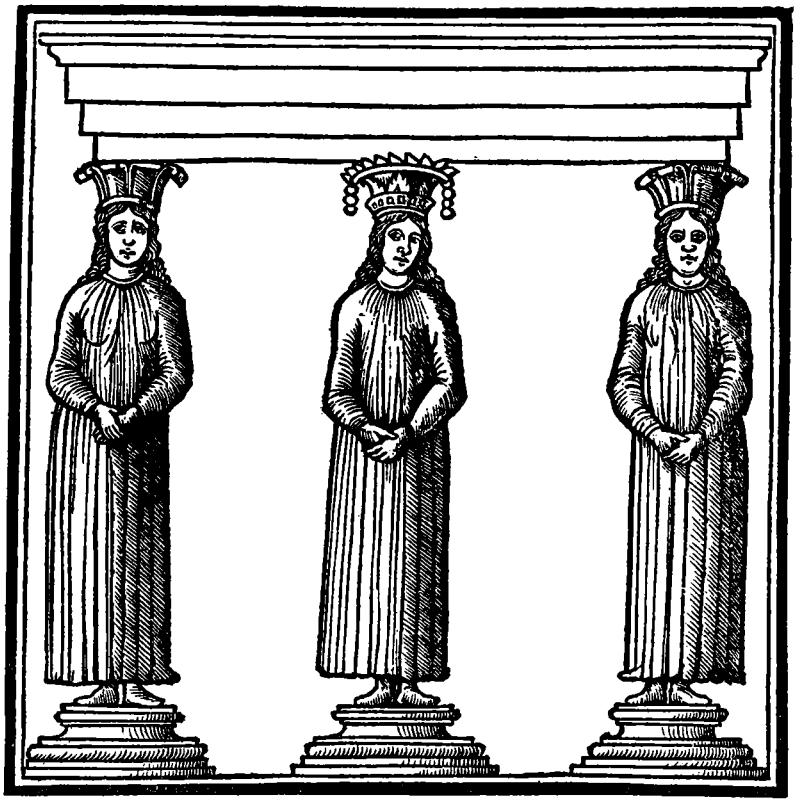
1. WHILE your divine intelligence and will, Imperator Caesar, were engaged in acquiring the right to command the world, and while your fellow citizens, when all their enemies had been laid low by your invincible valour, were glorying in your triumph and victory, — while all foreign nations were in subjection awaiting your beck and call, and the Roman people and senate, released from their alarm, were beginning to be guided by your most noble conceptions and policies, I hardly dared, in view of your serious employments, to publish my writings and long considered ideas on architecture, for fear of subjecting myself to your displeasure by an unseasonable interruption.

2. But when I saw that you were giving your attention not only to the welfare of society in general and to the establishment of public order, but also to the providing of public buildings intended for utilitarian purposes, so that not only should the State have been enriched with provinces by your means, but that the greatness of its power might likewise be attended with distinguished authority in its public buildings, I thought that I ought to take the first opportunity to lay before you my writings on this theme. For in the first place it was this subject which made me known to your father, to whom I was devoted on account of his great qualities. After the council of heaven gave him a place in the dwellings of immortal life and transferred your father's power to your hands, my devotion continuing unchanged as I remembered him inclined me to support you. And so with Marcus Aurelius, Publius Minidius, and Gnaeus Cornelius, I was ready to supply and repair ballistae, scorpiones, and other artillery, and I have received rewards for good service with them. After your first bestowal of these upon me, you continued to renew them on the recommendation of your sister.

3. Owing to this favour I need have no fear of want to the end of my life, and being thus laid under obligation I began to write this work for you, because I saw that you have built and are now building extensively, and that in future also you will take care that our public and private buildings shall be worthy to go down to posterity by the side of your other splendid achievements. I have drawn up definite rules to enable you, by observing them, to have personal knowledge of the quality both of existing buildings and of those which are yet to be constructed. For in the following books I have disclosed all the principles of the art.

carry a load, in order that the sin and the punishment of the people of Caryae might be known and handed down even to posterity.

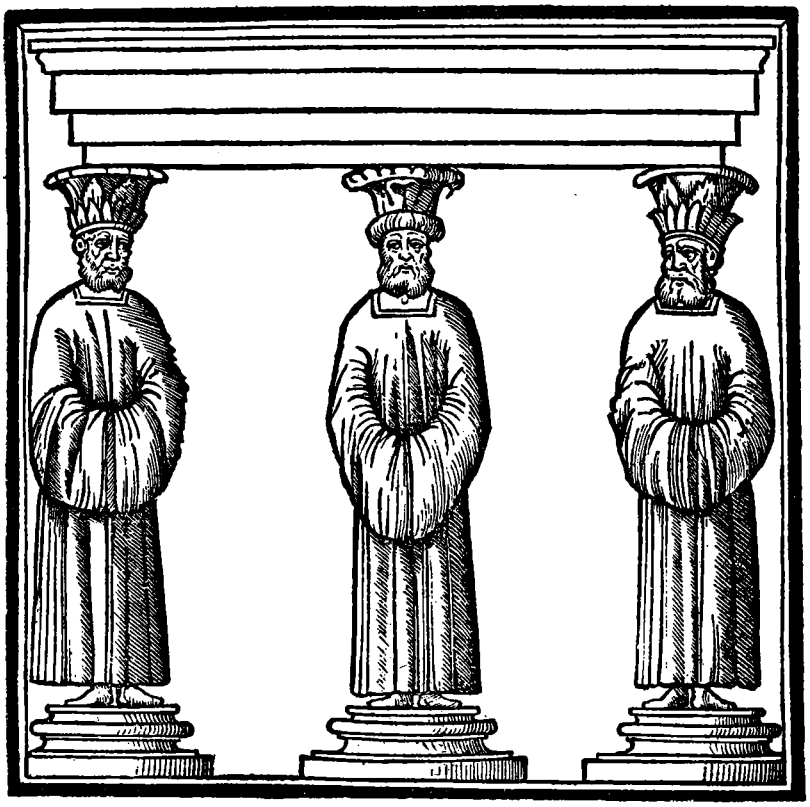
6. Likewise the Lacedaemonians under the leadership of Pausanias, son of Agesipolis, after conquering the Persian



CARYATIDES
(From the edition of Vitruvius by Fra Giocondo, Venice, 1511)

armies, infinite in number, with a small force at the battle of Plataea, celebrated a glorious triumph with the spoils and booty, and with the money obtained from the sale thereof built the Persian Porch, to be a monument to the renown and valour of the people and a trophy of victory for posterity. And there they set effigies of the prisoners arrayed in barbarian costume and holding up the roof, their pride punished by this deserved affront, that

through those stretched strings must, on being let go, strike their blow together at the same moment; but if they are not in unison, they will prevent the course of projectiles from being straight.

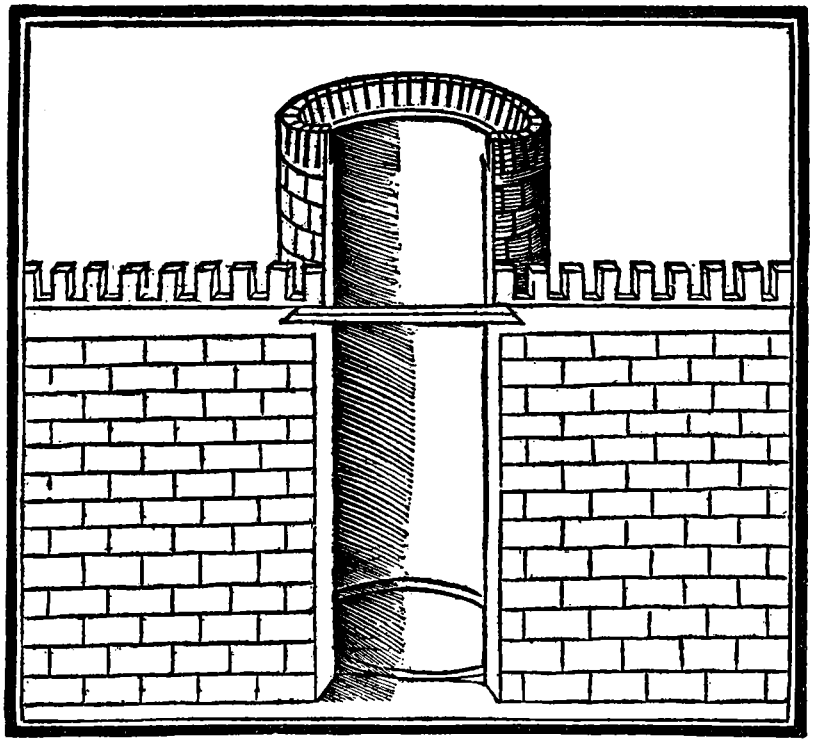


PERSIANS
(From the edition of Vitruvius by Fra Giocondo, Venice, 1511)

9. In theatres, likewise, there are the bronze vessels (in Greek ἠχεῖα) which are placed in niches under the seats in accordance with the musical intervals on mathematical principles. These vessels are arranged with a view to musical concords or harmony, and apportioned in the compass of the fourth, the fifth, and the octave, and so on up to the double octave, in such a way that when the voice of an actor falls in unison with any of them its power is increased, and it reaches the ears of the audience with

done, the enemy will not be able to make his way to the other towers and the rest of the wall unless he is ready to face a fall.

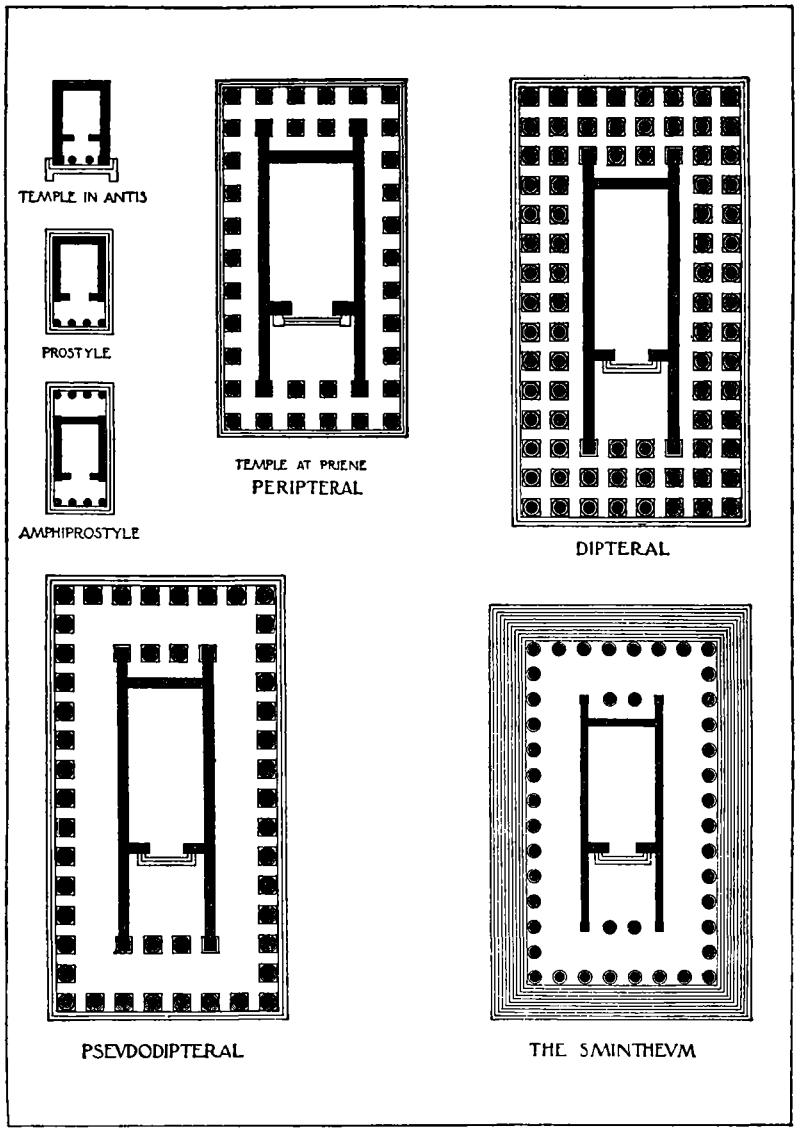
5. The towers themselves must be either round or polygonal. Square towers are sooner shattered by military engines, for the



CONSTRUCTION OF CITY WALLS
(From the edition of Vitruvius by Fra Giocondo, Venice, 1511)

battering rams pound their angles to pieces; but in the case of round towers they can do no harm, being engaged, as it were, in driving wedges to their centre. The system of fortification by wall and towers may be made safest by the addition of earthen ramparts, for neither rams, nor mining, nor other engineering devices can do them any harm.

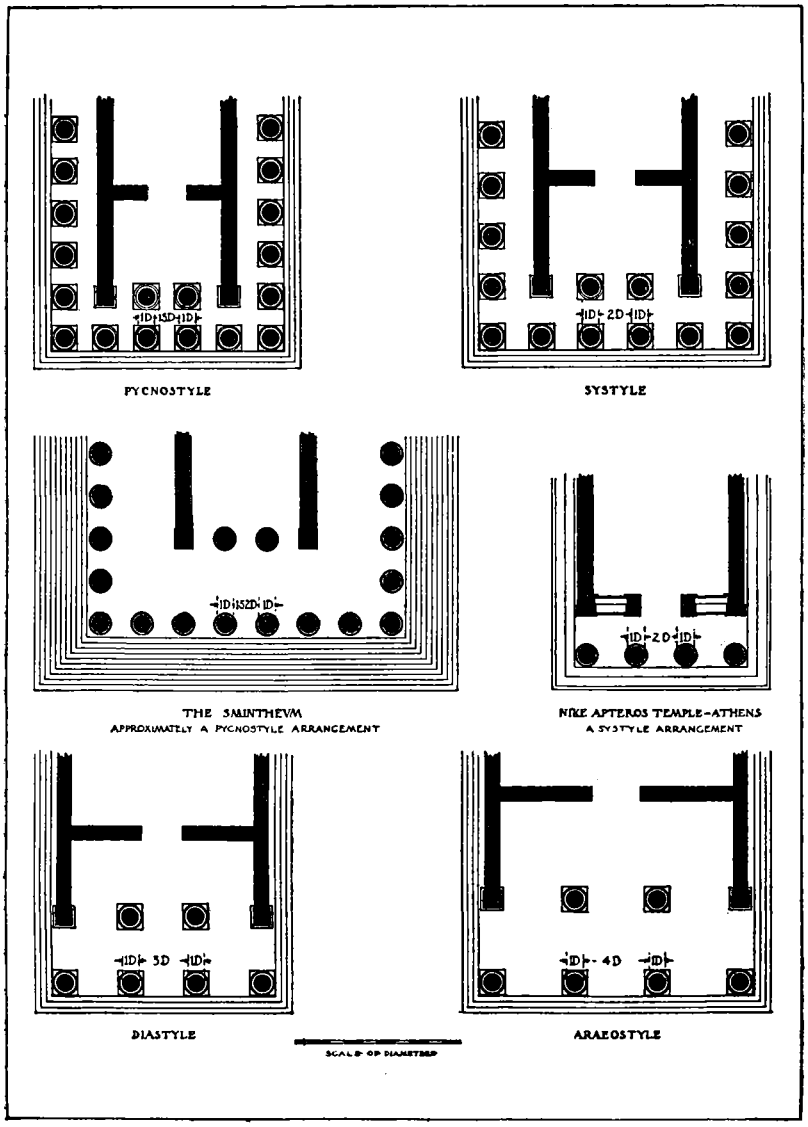
6. The rampart form of defence, however, is not required in all places, but only where outside the wall there is high ground from



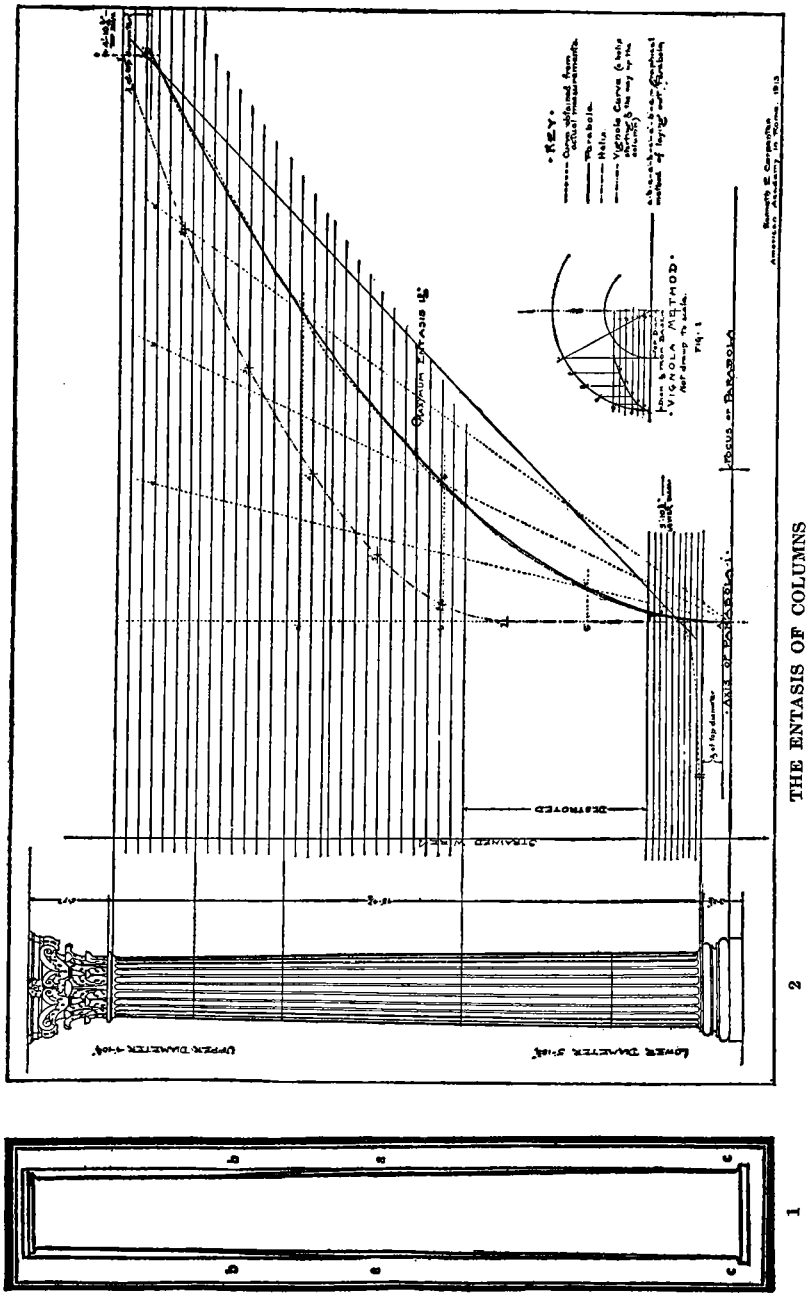
THE CLASSIFICATION OF TEMPLES ACCORDING TO THE ARRANGEMENTS OF THE COLONNADES

umns. Let the columns be so placed as to leave a space, the width of an intercolumniation, all round between the walls and the rows of columns on the outside, thus forming a walk round the cella of

2. The pycnostyle is a temple in an intercolumniation of which the thickness of a column and a half can be inserted: for example, the temple of the Divine Caesar, that of Venus in Caesar's forum, and others constructed like them. The systyle is a temple in which



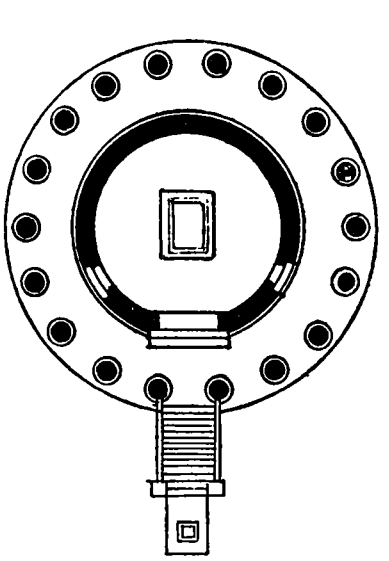
THE CLASSIFICATION OF TEMPLES ACCORDING TO INTERCOLUMNIATION



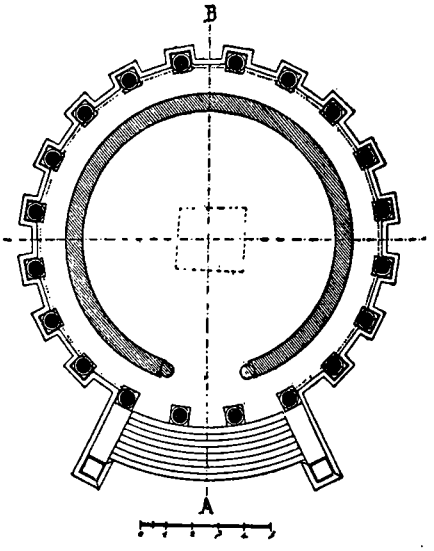
THE ENTASIS OF COLUMNS

1. The entasis as given by Fra Giocondo in the edition of 1511.
2. The entasis from the temple of Mars Ultor in Rome compared with Vignola's rule for entasis.

a cella, while others are termed peripteral. Those that are without a cella have a raised platform and a flight of steps leading to it, one third of the diameter of the temple. The columns upon the stylobates are constructed of a height equivalent to the diameter taken between the outer edges of the stylobate walls, and of a



TEMPLE AT TIVOLI



From Durm

PLAN OF THE TEMPLE OF VESTA AT ROME

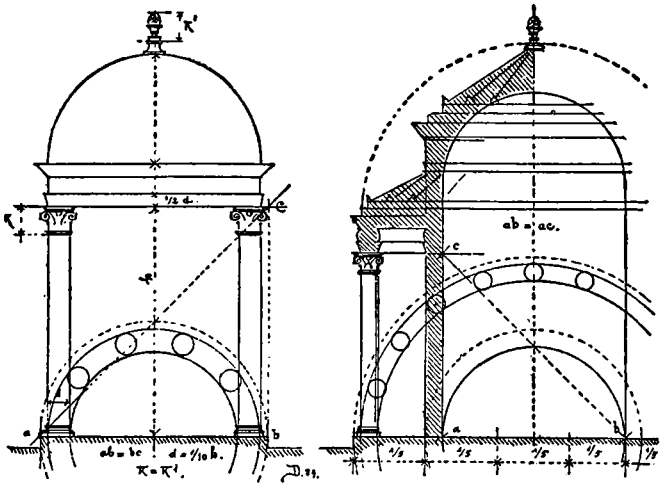
thickness equivalent to one tenth of their height including the capitals and bases. The architrave has the height of one half of the thickness of a column. The frieze and the other parts placed above it are such as I have described in the third[1] book, on the subject of symmetrical proportions.

2. But if such a temple is to be constructed in peripteral form, let two steps and then the stylobate be constructed below. Next, let the cella wall be set up, recessed within the stylobate about one fifth of the breadth thereof, and let a place for folding doors be left in the middle to afford entrance. This cella, excluding its walls and the passage round the outside, should have a diameter equivalent to the height of a column above the stylobate. Let

[1] Codd. *quarto.*

the columns round the cella be arranged in the symmetrical proportions just given.

3. The proportions of the roof in the centre should be such that the height of the rotunda, excluding the finial, is equivalent to one half the diameter of the whole work. The finial, excluding



From Durm

THE CIRCULAR TEMPLE ACCORDING TO VITRUVIUS

its pyramidal base, should have the dimensions of the capital of a column. All the rest must be built in the symmetrical proportions described above.

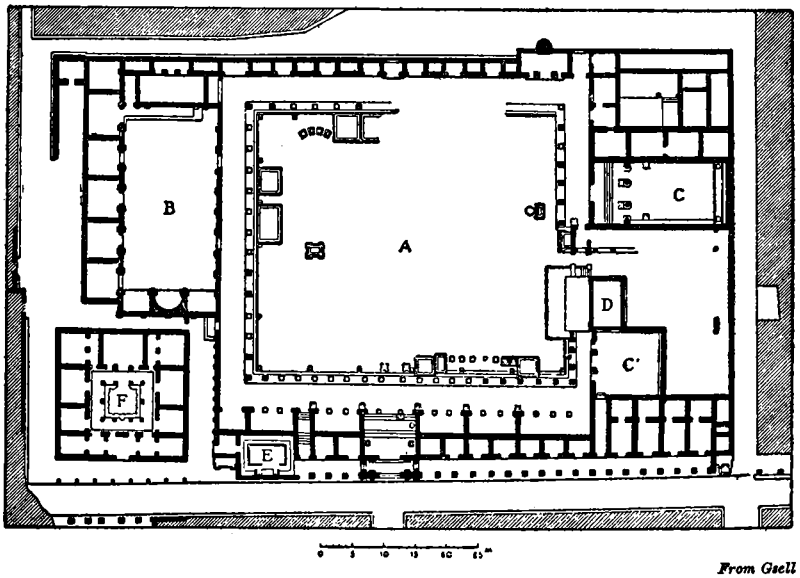
4. There are also other kinds of temples, constructed in the same symmetrical proportions and yet with a different kind of plan: for example, the temple of Castor in the district of the Circus Flaminius, that of Vejovis between the two groves, and still more ingeniously the temple of Diana in her sacred grove, with columns added on the right and left at the flanks of the pronaos. Temples of this kind, like that of Castor in the Circus, were first built in Athens on the Acropolis, and in Attica at Sunium to Pallas Minerva. The proportions of them are not different, but the same as usual. For the length of their cellae is twice the width, as in other temples; but all that we regularly find in the fronts of others is in these transferred to the sides.

CHAPTER I

THE FORUM AND BASILICA

1. THE Greeks lay out their forums in the form of a square surrounded by very spacious double colonnades, adorn them with columns set rather closely together, and with entablatures of stone or marble, and construct walks above in the upper story. But in the cities of Italy the same method cannot be followed, for the reason that it is a custom handed down from our ancestors that gladiatorial shows should be given in the forum.

2. Therefore let the intercolumniations round the show place be pretty wide; round about in the colonnades put the bankers' offices; and have balconies on the upper floor properly arranged so as to be convenient, and to bring in some public revenue.



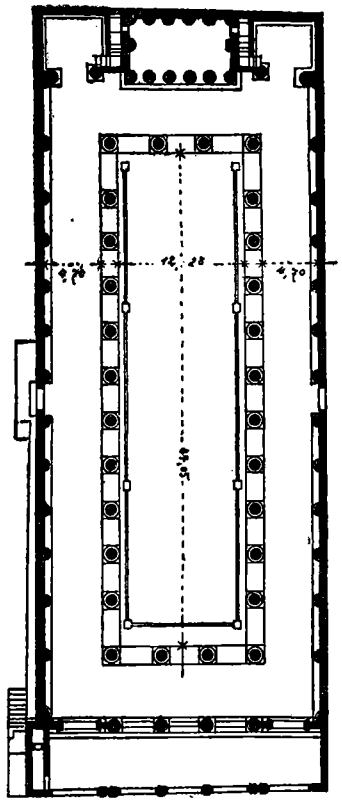
From Gsell

FORUM AT TIMGAD

A, Forum. B, Basilica. C, Curia. C', Official Building. D, Small Temple. E, Latrina. F, Atrium.

be adjusted to the proportions of the columns, as we have stated in the third book.

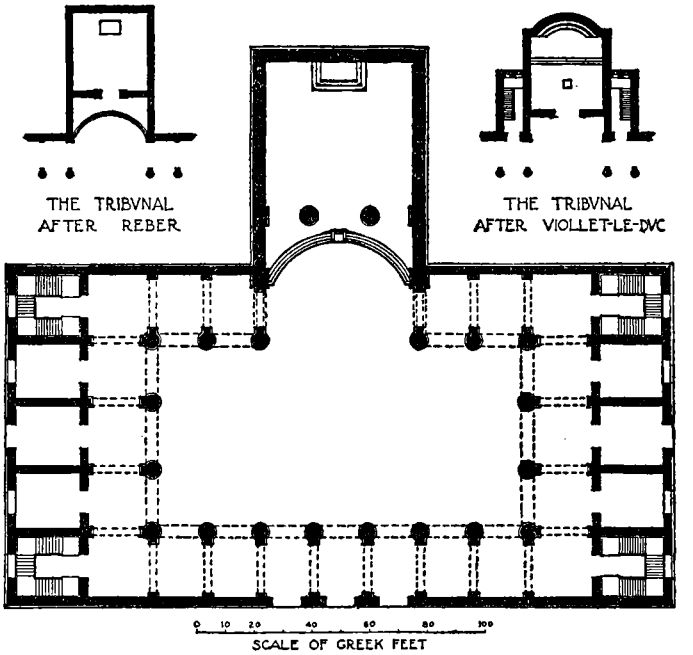
6. But basilicas of the greatest dignity and beauty may also be constructed in the style of that one which I erected, and the building of which I superintended at Fano. Its proportions and symmetrical relations were established as follows. In the middle, the main roof between the columns is 120 feet long and sixty feet wide. Its aisle round the space beneath the main roof and between the walls and the columns is twenty feet broad. The columns, of unbroken height, measuring with their capitals fifty feet, and being each five feet thick, have behind them pilasters, twenty feet high, two and one half feet broad, and one and one half feet thick, which support the beams on which is carried the upper flooring of the aisles. Above them are other pilasters, eighteen feet high, two feet broad, and a foot thick, which carry the beams supporting the principal raftering and the roof of the aisles, which is brought down lower than the main roof.



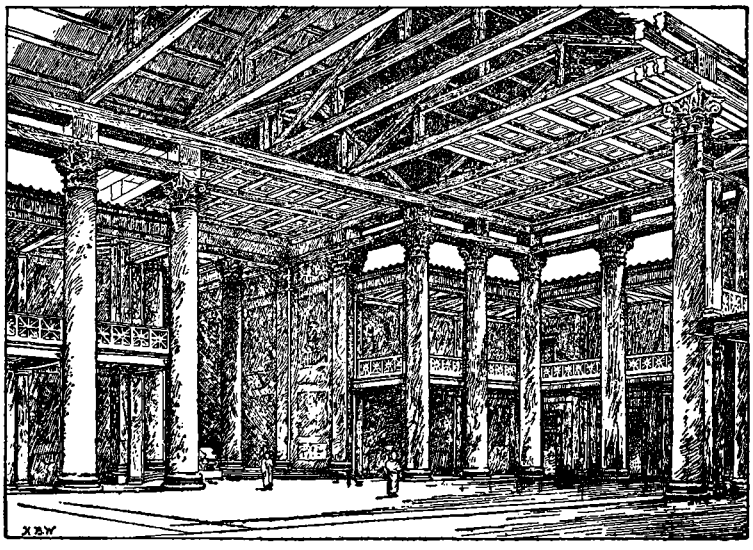
From Durm

PLAN OF THE BASILICA AT POMPEII

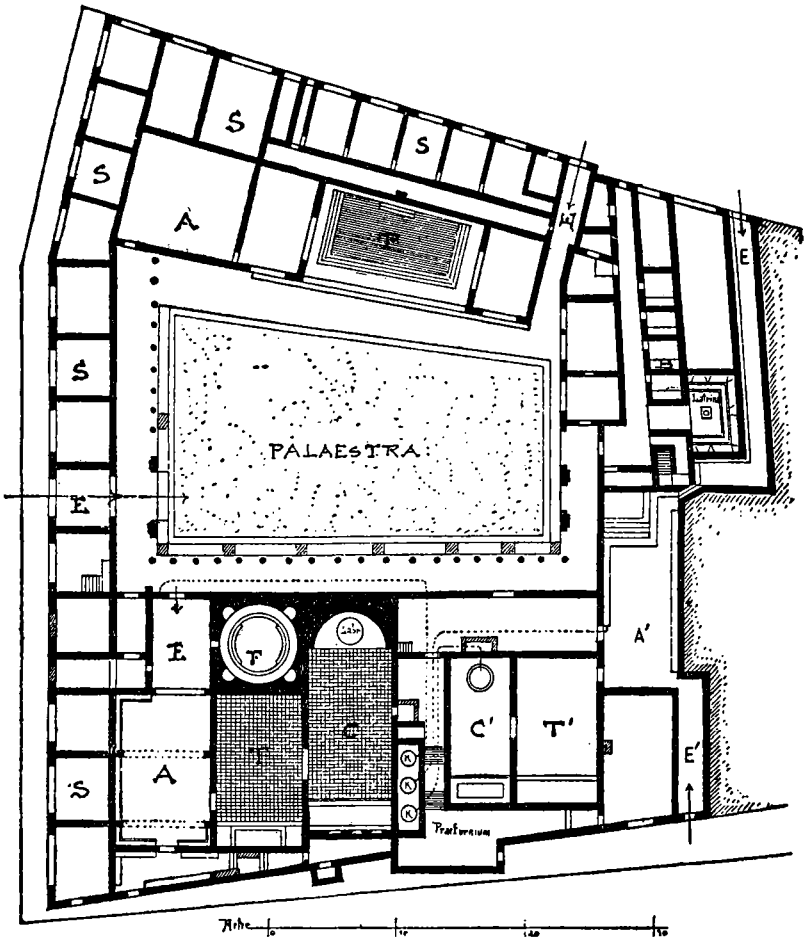
7. The spaces remaining between the beams supported by the pilasters and the columns, are left for windows between the intercolumniations. The columns are: on the breadth of the main roof at each end, four, including the corner columns at right and left; on the long side which is next to the forum, eight, including the same corner columns; on the other side, six, including the corner columns. This is because the



VITRVVIVS' BASILICA AT FANO



3. The vaulted ceilings will be more serviceable if built of masonry; but if they are of framework, they should have tile work on the under side, to be constructed as follows. Let iron bars or arcs be made, and hang them to the framework by means of iron hooks set as close together as possible; and let these bars or arcs be placed at such distances apart that each pair of them may support and carry an unflanged tile. Thus the entire vaulting will be



THE STABIAN BATHS AT POMPEII

S,S. Shops. B. Private Baths. A–T. Men's Bath. A′–T′. Women's Baths. E,E′. Entrances. A,A′. Apodyteria. F. Frigidarium. T,T′. Tepidarium. C,C′. Caldarium. K,K,K. Kettles in furnace room. P. Piscina.

CHAPTER III

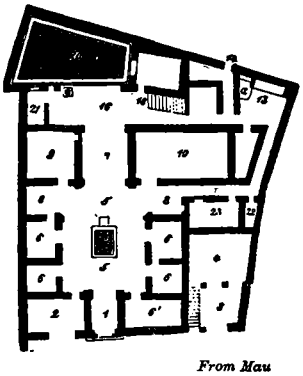
PROPORTIONS OF THE PRINCIPAL ROOMS

1. There are five different styles of cavaedium, termed according to their construction as follows: Tuscan, Corinthian, tetrastyle, displuviate, and testudinate.

In the Tuscan, the girders that cross the breadth of the atrium have crossbeams on them, and valleys sloping in and running from the angles of the walls to the angles formed by the beams, and the rainwater falls down along the rafters to the roof-opening (compluvium) in the middle.

In the Corinthian, the girders and roof-opening are constructed on these same principles, but the girders run in from the side walls, and are supported all round on columns.

In the tetrastyle, the girders are supported at the angles by columns, an arrangement which relieves and strengthens the girders; for thus they have themselves no great span to support, and they are not loaded down by the crossbeams.

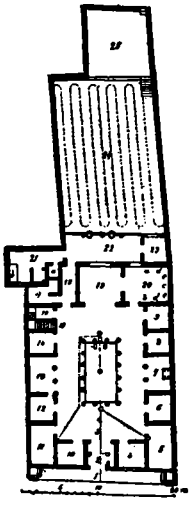


From Mau

THE HOUSE OF THE SURGEON, POMPEII

Illustrating the Tuscan Atrium

1. Fauces
2, 3. Shops
4. Storage
5. Atrium
6. Chambers
7. Tablinum
8. Alae
9, 10. Dining Rooms
13. Kitchen, *a*, hearth
14. Rear Entrance
16. Portico
18. Stairs to rooms over the rear of the house
20. Garden

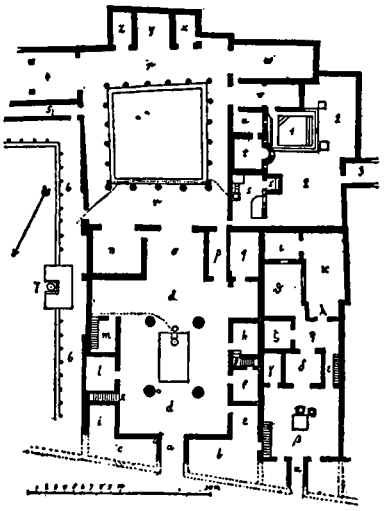


From Mau

HOUSE OF EPIDIUS RUFUS AT POMPEII

Illustrating Corinthian Atrium

2. In the displuviate, there are beams which slope outwards, supporting the roof and throwing the rainwater off. This style is suitable chiefly in winter residences, for its roof-opening, being high up, is not an obstruction to the light of the dining rooms. It is, however, very troublesome to keep in repair, because the pipes, which are intended to hold the water that comes dripping down the walls all round, cannot take it quickly enough as it runs down from the channels, but get too full and run over, thus spoiling the woodwork and the walls of houses of this style.



From Mau

HOUSE OF THE SILVER WEDDING AT POMPEII

Illustrating the Tetrastyle Atrium

a. fauces
d. tetrastyle atrium
n. dining room
o. tablinum
p. audron
r. peristyle
w. summer dining room

The testudinate is employed where the span is not great, and where large rooms are provided in upper stories.

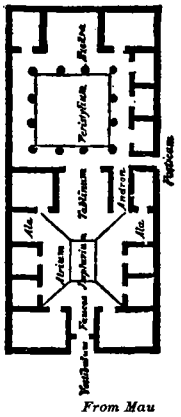
3. In width and length, atriums are designed according to three classes. The first is laid out by dividing the length into five parts and giving three parts to the width; the second, by dividing it into three parts and assigning two parts to the width; the third, by using the width to describe a square figure with equal sides, drawing a diagonal line in this square, and giving the atrium the length of this diagonal line.

4. Their height up to the girders should be one fourth less than their width, the rest being the proportion assigned to the ceiling and the roof above the girders.

The alae, to the right and left, should have a width equal to one third of the length of the atrium, when that is from thirty to forty feet long. From forty to fifty feet, divide the length by

three and one half, and give the alae the result. When it is from fifty to sixty feet in length, devote one fourth of the length to the alae. From sixty to eighty feet, divide the length by four and one half and let the result be the width of the alae. From eighty feet to one hundred feet, the length divided into five parts will produce the right width for the alae. Their lintel beams should be placed high enough to make the height of the alae equal to their width.

5. The tablinum should be given two thirds of the width of the atrium when the latter is twenty feet wide. If it is from thirty to forty feet, let half the width of the atrium be devoted to the tablinum. When it is from forty to sixty feet, divide the width into five parts and let two of these be set apart for the tablinum. In the case of smaller atriums, the symmetrical proportions cannot be the same as in larger. For if, in the case of the smaller, we employ the proportion that belong to the larger, both tablina and alae must be unserviceable, while if, in the case of the larger, we employ the proportions of the smaller, the rooms mentioned will be huge monstrosities. Hence, I have thought it best to describe exactly their respective proportionate sizes, with a view both to convenience and to beauty.



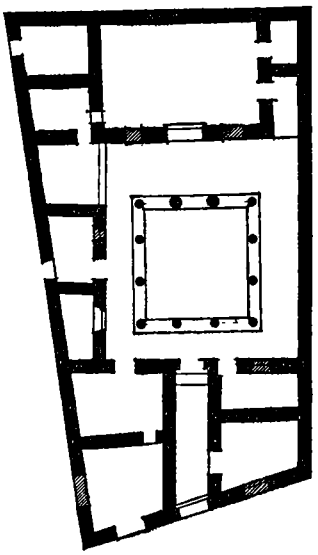
From Mau

PLAN OF A TYPICAL ROMAN HOUSE

6. The height of the tablinum at the lintel should be one eighth more than its width. Its ceiling should exceed this height by one third of the width. The fauces in the case of smaller atriums should be two thirds, and in the case of larger one half the width of the tablinum. Let the busts of ancestors with their ornaments be set up at a height corresponding to the width of the alae. The proportionate width and height of doors may be settled, if they are Doric, in the Doric manner, and if Ionic, in the Ionic manner, according to the rules of symmetry which have been given about portals in the fourth book. In the roof-opening let

west; and to the south, large square rooms of such generous dimensions that four sets of dining couches can easily be arranged in them, with plenty of room for serving and for the amusements.

4. Men's dinner parties are held in these large rooms; for it was not the practice, according to Greek custom, for the mistress of the house to be present. On the contrary, such peristyles are called the men's apartments, since in them the men can stay without interruption from the women. Furthermore, small sets of apartments are built to the right and left, with front doors of their own and suitable dining rooms and chambers, so that guests from abroad need not be shown into the peristyles, but rather into such guests' apartments. For when the Greeks became more luxurious, and their circumstances more opulent, they began to provide dining rooms, chambers, and store-rooms of provisions for their guests from abroad, and on the first day they would invite them to dinner, sending them on the next chickens, eggs, vegetables, fruits, and other country produce. This is why artists called pictures representing the things which were sent to guests "xenia." Thus, too, the heads of families, while being entertained abroad, had the feeling that they were not away from home, since they enjoyed privacy and freedom in such guests' apartments.



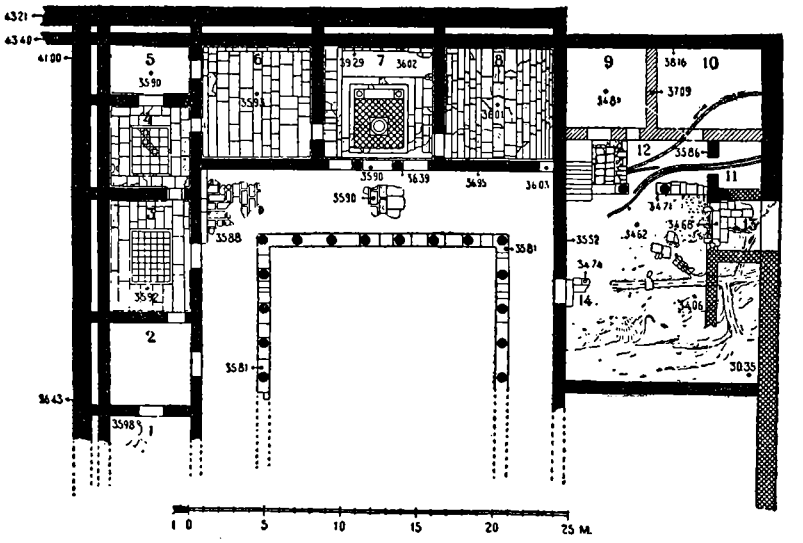
From Bull. de. Corr. Hell. 1895

GREEK HOUSE AT DELOS

5. Between the two peristyles and the guests' apartments are the passage-ways called "mesauloe," because they are situated midway between two courts; but our people called them "androne s."

This, however, is a very strange fact, for the term does not fit either the Greek or the Latin use of it. The Greeks call the large

rooms in which men's dinner parties are usually held *ἀνδρῶνες*, because women do not go there. There are other similar instances as in the case of "xystus," "prothyrum," "telamones," and some others of the sort. As a Greek term, *ξυστός* means a colonnade of large dimensions in which athletes exercise in the winter time. But our people apply the term "xysta" to uncovered walks,



From Mitt. d. Deutsch. Arch. Inst.

GREEK HOUSE DISCOVERED AT PERGAMUM IN 1903

13. Prothyron. 7. Tablinum.

which the Greeks call *παραδρομίδες*. Again, *πρόθυρα* means in Greek the entrance courts before the front doors; we, however, use the term "prothyra" in the sense of the Greek *διάθυρα*.

6. Again, figures in the form of men supporting mutules or coronae, we term "telamones" — the reasons why or wherefore they are so called are not found in any story — but the Greeks name them *ἄτλαντες*. For Atlas is described in story as holding up the firmament because, through his vigorous intelligence and ingenuity, he was the first to cause men to be taught about the courses of the sun and moon, and the laws governing the revolutions of all the constellations. Consequently, in recognition of

CHAPTER II

HOISTING MACHINES

1. FIRST we shall treat of those machines which are of necessity made ready when temples and public buildings are to be constructed. Two timbers are provided, strong enough for the weight of the load. They are fastened together at the upper end by a bolt, then spread apart at the bottom, and so set up, being kept upright by ropes attached at the upper ends and fixed at intervals all round. At the top is fastened a block, which some call a "rechamus." In the block two sheaves are enclosed, turning on axles. The traction rope is carried over the sheave at the top, then let fall and passed round a sheave in a block below. Then it is brought back to a sheave at the bottom of the upper block, and so it goes down to the lower block, where it is fastened through a hole in that block. The other end of the rope is brought back and down between the legs of the machine.

2. Socket-pieces are nailed to the hinder faces of the squared timbers at the point where they are spread apart, and the ends of the windlass are inserted into them so that the axles may turn freely. Close to each end of the windlass are two holes, so adjusted that handspikes can be fitted into them. To the bottom of the lower block are fastened shears made of iron, whose prongs are brought to bear upon the stones, which have holes bored in them. When one end of the rope is fastened to the windlass, and the latter is turned round by working the handspikes, the rope winds round the windlass, gets taut, and thus it raises the load to the proper height and to its place in the work.

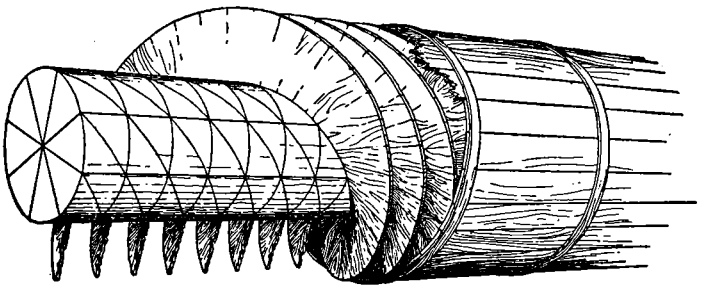
3. This kind of machinery, revolving with three sheaves, is called a trispast. When there are two sheaves turning in the block beneath and three in the upper, the machine is termed a pentaspast. But if we have to furnish machines for heavier loads, we must use timbers of greater length and thickness, providing them with correspondingly large bolts at the top, and windlasses

attached (to the millstone). Thus the teeth of the drum which is fixed to the axle make the teeth of the horizontal drum move, and cause the mill to turn. A hopper, hanging over this contrivance, supplies the mill with corn, and meal is produced by the same revolution.

CHAPTER VI

THE WATER SCREW

1. THERE is also the method of the screw, which raises a great quantity of water, but does not carry it as high as does the wheel. The method of constructing it is as follows. A beam is selected, the thickness of which in digits is equivalent to its length in feet.



CONSTRUCTION OF THE WATER SCREW

This is made perfectly round. The ends are to be divided off on their circumference with the compass into eight parts, by quadrants and octants, and let the lines be so placed that, if the beam is laid in a horizontal position, the lines on the two ends may perfectly correspond with each other, and intervals of the size of one eighth part of the circumference of the beam may be laid off on the length of it. Then, placing the beam in a horizontal position, let perfectly straight lines be drawn from one end to the other. So the intervals will be equal in the directions both of the periphery and of the length. Where the lines are drawn along the length, the cutting circles will make intersections, and definite points at the intersections.

Circumference of earth, 27 *f.*
Circumsonant sites of theatres (περιηχοῦντες), 153.
Circus, Flaminius, 124, 273; Maximus, 80.
Cisterns, 244 *ff.*
City, site of, 17 *ff.*; walls, 21 *f.*
Classification of temples, 75 *ff.*, 78 *ff.*
Clazomenae, 103, 269.
Clearstock of fir, 60.
Climate determines the style of houses, 170.
Clitor, spring at, 239.
Colchis, 231.
Colline Gate, 75.
Colonnades, 131, 154, 155, 156 *f.*, 160 *f.*
Colophon, 103, 269.
Colours, 214 *ff.*; natural, 214 *f.*; artificial, 217; manufactured from flowers, 220; how applied to stucco, 207.
Columbaria (ὁπαί), 108.
Columns, proportions of, in colonnades, 154; in forums, 132; in basilicas, 132; Corinthian, 102; diminution in top of, 84 *f.*; Ionic order, 90 *ff.*; arrangement of, 114.
Conarachne (sun dial), 273.
Concords in music, 142.
Concrete floors, 202.
Cone (sun dial), 273.
Conical Plinthium (sun dial), 273.
Consonancies in music, 142.
Consonant sites of theatres (συνηχοῦντες), 153.
Constellations, northern, 265 *ff.*; Southern, 267 *ff.*
Consumptives, resin of larch good for, 63.
Corinth, 145.
Corinthian cavaedium, 176.
Corinthian order, 15; origin of, 102 *f.*; proportions of, 106 *f.*; treatise on, by Arcesius, 198.
Cornelius, Gnaeus, 3.
Corona, 102, 107, 112.
Cos, island of, 269.
Cossutius, 200.
Courage dependent on climate, 173.
Counterforts, 190.
Courtyards, 183.
Crab (constellation), 268.
Crathis (river), 237.
Crete, 20, 62.
Creusa, 103.
Croesus, 195; house of, at Sardis, 53.
Cross-aisles in theatre, 138, 146; in Greek theatre, 151.
Crown (constellation), 266.
Ctesibius, 8, 199, 273 *f.*; pump of, 297 *f.*
Cube, properties of, 130.
Cubit equals six palms or twenty-four fingers, 74.
Cumae, 162.
Cunei in theatre, 146.
Cutiliae, 234.
Cyclades, 214.
Cydnus, 234.
Cymatium, 94, 110; Doric, 112.
Cypress, 59, 61.
Cyrene, 27, 237, 255.

Daphnis of Miletus, 200.
Darius, 195.
Decorations of walls, 209 *f.*
Defence, measures for, 315 *ff.*
Delos, problem enjoined upon, by Apollo, 255.
Delphi, Round Building at, 198.
Demetrius of Phalerum, 200.
Demetrius Poliorcetes, 316.
Demetrius (slave of Diana), 200.
Democles, 199.
Democritus, 42, 195, 251, 255, 269; his study of perspective, 198.
Demophilus, 199.
Denarius, 74.
Dentils, 94, 102, 108.
Departments of architecture, 16*f.*
Diades, 199; inventor of siege machines, 310.
Dials arranged to show hours of varying length, 274 *ff.*
Diana, temple of Ionic order, 15, 78; temple of, at Ephesus, 78, 103, 198, 200, 288 *f.*; at Rome, 80, 124; at Magnesia, 78, 198; statue of, 62.
Diatonic mode, 140.
Diastyle temples, 78, 80; proportions of columns in, 84; Doric, 113.
Διάθυρα, 188.
Dichalca, 74.
Diesis, 140.
Diminution in top of column, 84, 110.
Dining rooms, proportions of, 179, 181. 186; Cyzicene, 186; winter, 209 *f.*
Dinocrates, 35 *f.*
Diognetus, Rhodian architect, 315 *ff.*
Diomede, 21.
Dionysodorus, 273.
Dioptra, 242.
Diphilus, 199.
Dipteral temple, 75, 78.
Displuviate cavaedium, 177.
Dissonant sites of theatres (κατηχοῦντες), 153.
Dnieper, 231.
Dog (constellation), 268.
Dolphin (constellation), 266.
Don (river), 231.
Doors, of temples, 118 *f.*; of dwellings, 178; in theatres, 146.
Doorways of temples, proportions of, 117 *ff.*
Doric order, 15; proportions of, 109 *ff.*; doorways, 117; temples of, 198.