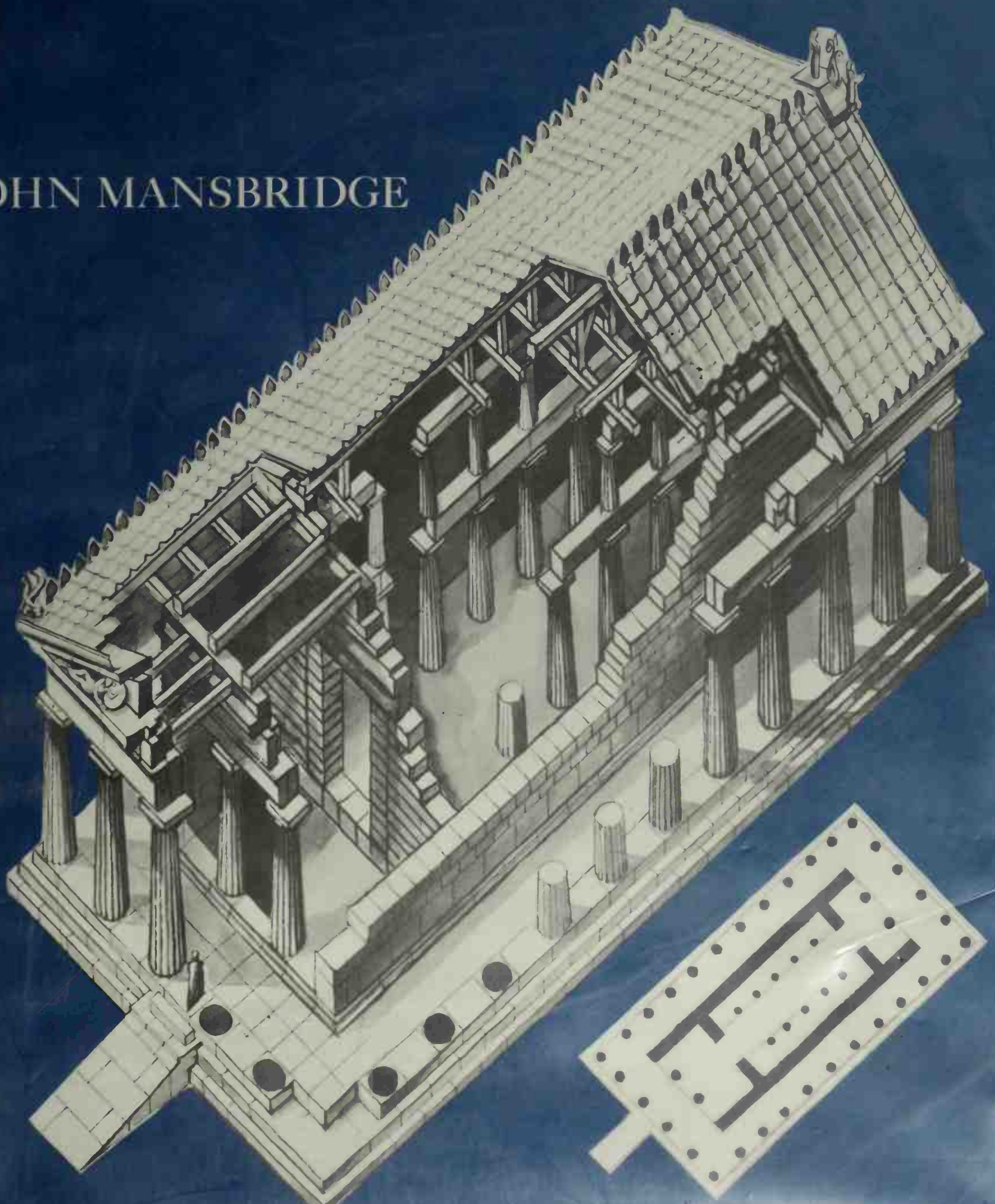
GRAPHIC HISTORY OF ARCHITECTURE

JOHN MANSBRIDGE



$9·95

Graphic History of Architecture

John Mansbridge

John Mansbridge's *Graphic History of Architecture* is a unique work. That a single volume should cover the whole of Western architecture, from its Greek and Roman origins to its present-day development in Europe and the United States, is remarkable enough; but what distinguishes the book from other studies is its uncompromisingly visual approach. The illustrations not only supplement the text, but reveal the changing pattern of European building over the centuries.

The combination of plans and elevations and the use of cutaway and isometric drawings show, in a way that neither words nor even photographs could do, the three-dimensional form and dynamic construction of buildings. In particular the author emphasizes the close interaction, in every age, between technique and style. The book's format is generous and the illustrations are both large and numerous; in all some 2,000 individual drawings—of buildings, ground plans, and architectural details—are included. Equally important, the format provides ample scope for comparative drawings spread across facing pages, which show, at a single glance, the gradual transition from one style to another, as from Romanesque to Perpendicular Gothic or from Renaissance to Baroque. In this way the reader can appreciate both the differences and the continuity between successive periods.

Architecture does not exist in a cultural or social vacuum, and Mr. Mansbridge also explains the historical conditions that called for buildings of a specific type and the economic and artistic forces that influenced their design by means of maps, time charts, and other graphic material, as well as a brief introduction to each main period. But, above all, Mr. Mansbridge stresses the decisive part played by the technical knowledge and the materials available at a particular time and place. The combined effect of new techniques and materials on design is highlighted in the section on contemporary architecture.

Continued on back flap

GRAPHIC HISTORY OF ARCHITECTURE

John Mansbridge

A Studio Book
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Preface

This work is designed as a *visual* textbook for students and as an introduction and guide for the general reader. Certain omissions have necessarily had to be made because of the vastness of the subject, but author, publisher and printer have done everything possible to make both the format and the reproductions clear and vivid.

Drawings and diagrams have been used in preference to photographs in order to give as clear a picture as possible of the three-dimensional form and the construction of buildings. Particular use has been made of drawings spread across facing pages : these double spreads, with comparative plans and elevations (drawn to the same scale whenever possible), show the transition from one style to another, for example from Romanesque to Perpendicular Gothic or from Renaissance to Baroque. (Scales or buildings are given in English feet, e.g. ⊢——————⊣ 20.)

Brief introductions, with maps and time-charts, indicate the historical backgrounds which have generated the need for specific kinds of buildings ; similarly attention is paid to the materials available, which determines the nature and final form of each construction.

In the preparation of this volume I have received assistance of one kind or another from so many people, not least from my students over the years, that it would be invidious, were it not impossible, to attempt to mention them all individually. But I should like to take this opportunity of acknowledging my considerable debt to Choisy, whose magnificent drawings have formed the basis of my own work ; I also want to thank especially Brian Batsford for his initial enthusiasm for the project, Peter Kemmis Betty for his patient editing and many helpful suggestions, and finally Mary Elizabeth Scaping. Not only did she provide great assistance with the lettering of the drawings, but without her constant encouragement the work would never have been completed. To her the book is dedicated.

Forest Hill
January 1967

John Mansbridge

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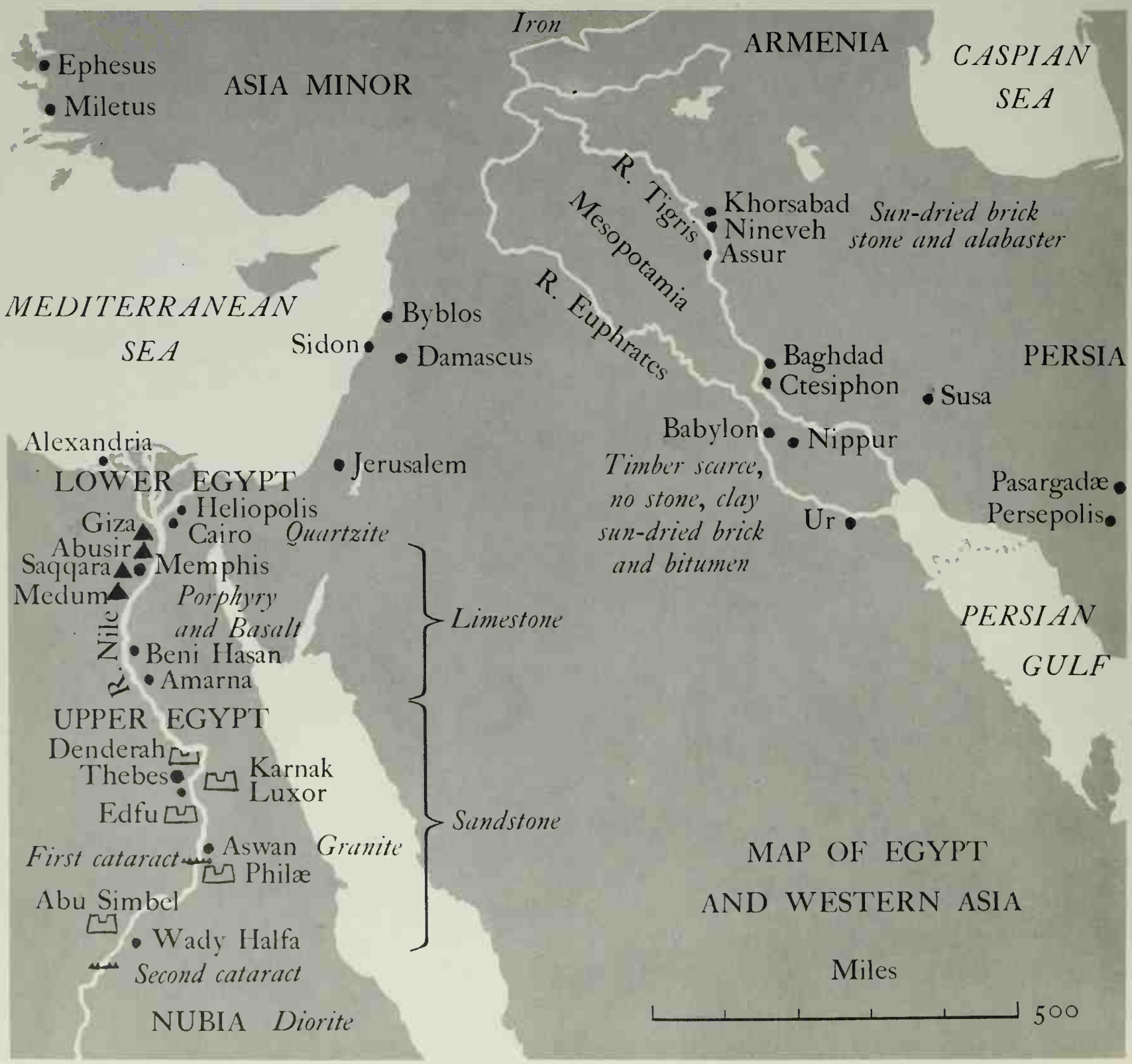
1 Places and Buildings

2 *Architects*

3 Architectural Terms, Styles and Materials

EGYPT

THE ARCHAIC PERIOD		THE OLD KINGDOM				First Intermediate Period	THE MIDDLE KINGDOM		Second Intermediate Period
Dynasty I	II	III	IV	V	VI		IX	XII	
*c.*3200 B.C.	2980	2789	2680	2565	2420	2258	2134	1991	1786	1570
Union of Upper and Lower Egypt Capital: Heliopolis		Capital: Memphis The Age of the Pyramids					The Feudal Age Capital: Thebes		Invasion of the Hyksos from Asia



INTRODUCTION

THE NEW KINGDOM — THE LATE PERIOD — THE PTOLEMAIC PERIOD

XVIII XIX XX — XXI - XXXI

1570 1314 1197 1085 — 671-663 525 332 — 30 B.C.

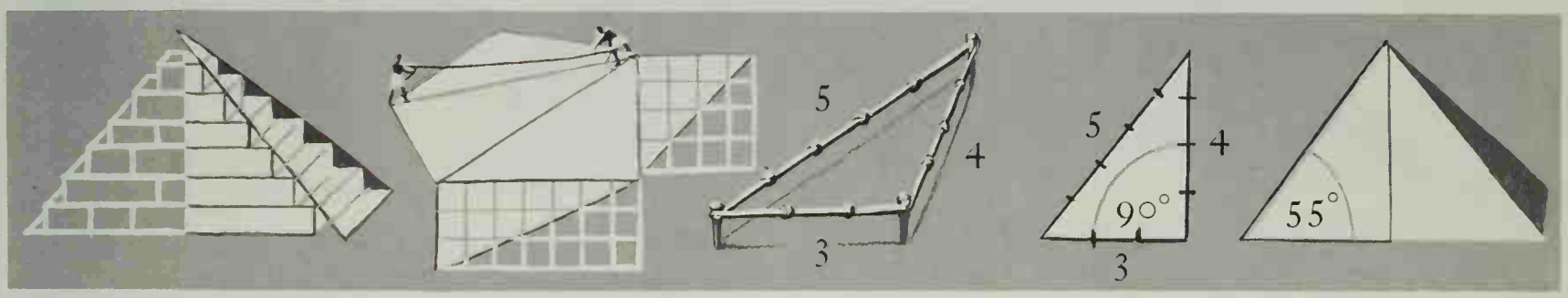
The Egyptian Empire in Asia and Nubia
Capital: Thebes

Assyrian invasion

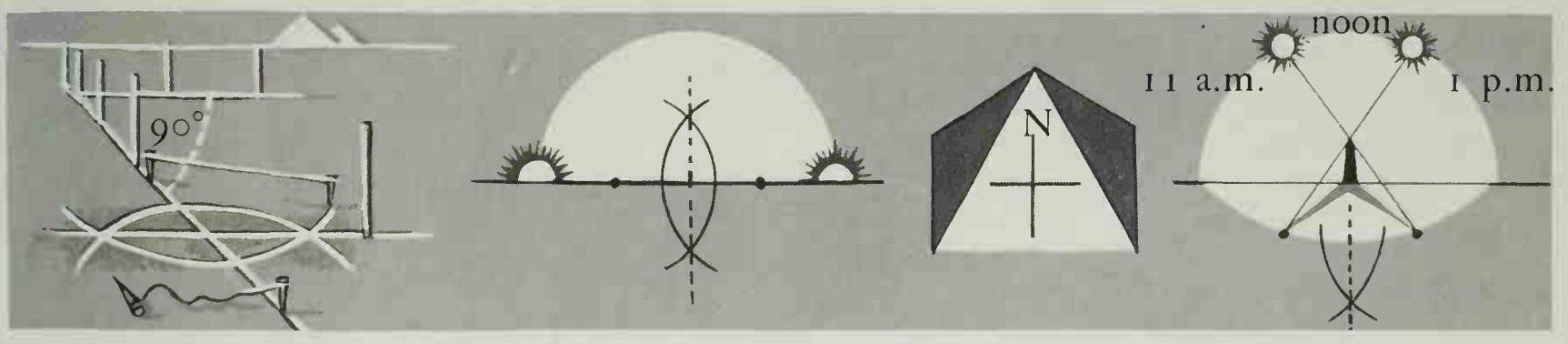
Domination of Persia

Egypt a Roman province

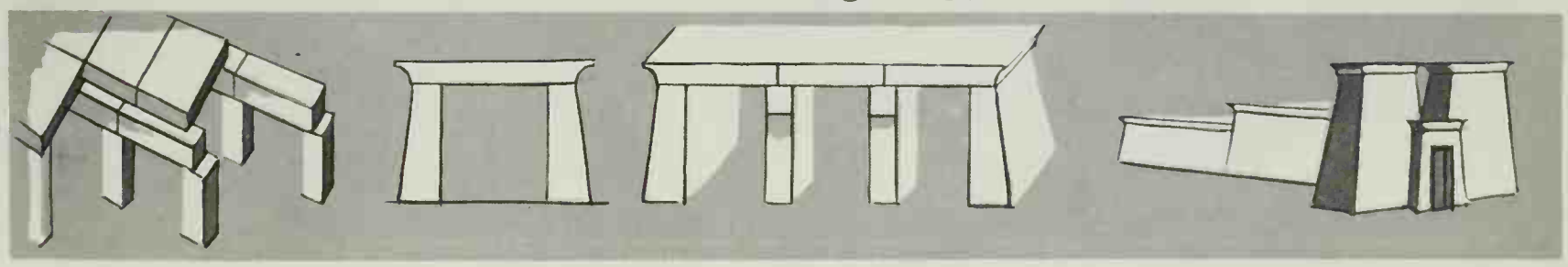
Egypt was a narrow strip of highly productive soil, 8 to 12 miles wide, along the banks of the Nile, about one-fifth of the area of England and Wales. From pre-dynastic times sun-dried mud bricks were used for houses, but these have not survived: timber was scarce and hence arches were built without centering. There was however an abundance of limestone, sandstone and granite. The planning of irrigation canals and fields, necessitated by the annual inundations of the Nile, demanded a system of geometry (Gk land measuring). Believing in a life after death, the Egyptians thought that the body should be preserved in a lasting tomb; this became a geometric construction of great solidity and permanence.



Measurement — The Right Angle — The 'Egyptian Triangle'



Method of orientating the pyramids



Temples constructed with columns, beams and massive, battered external walls

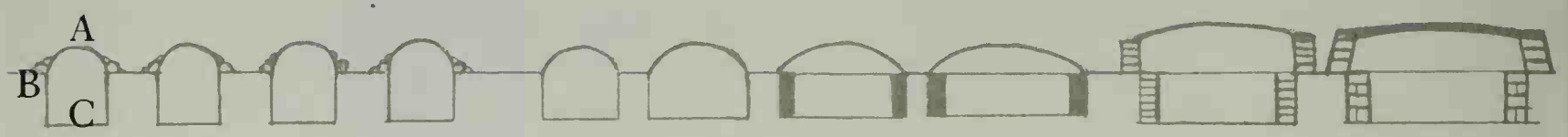
EGYPT

Pit graves in desert cemetries: sand heap A surrounded by circle of stones B over grave C

Pit graves transformed into tombs by brick lining and flat wooden or arched brick roofs

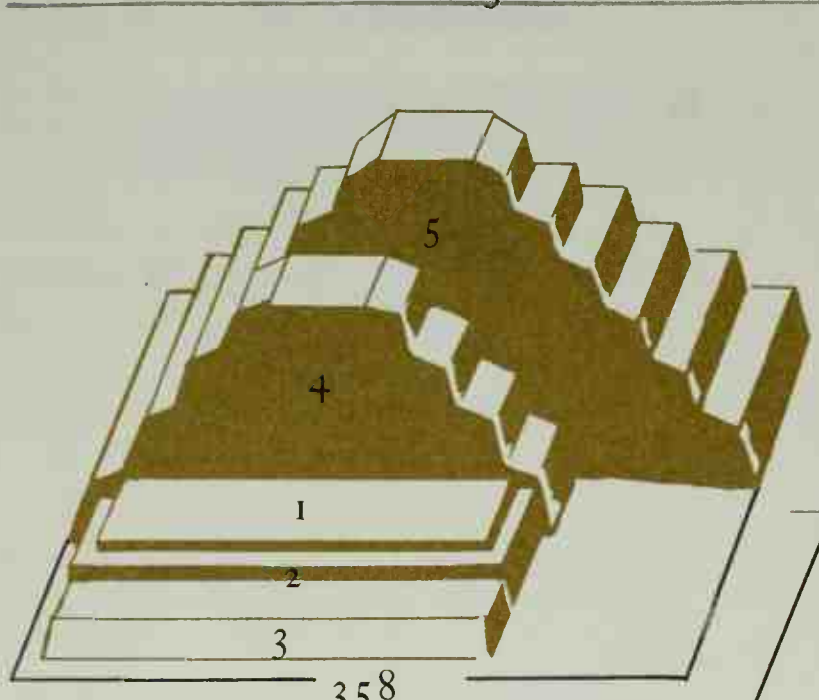
Walls of sun-dried brick

Beginning of *stone* masonry



c. 3200 B.C.

Dynasties I-II



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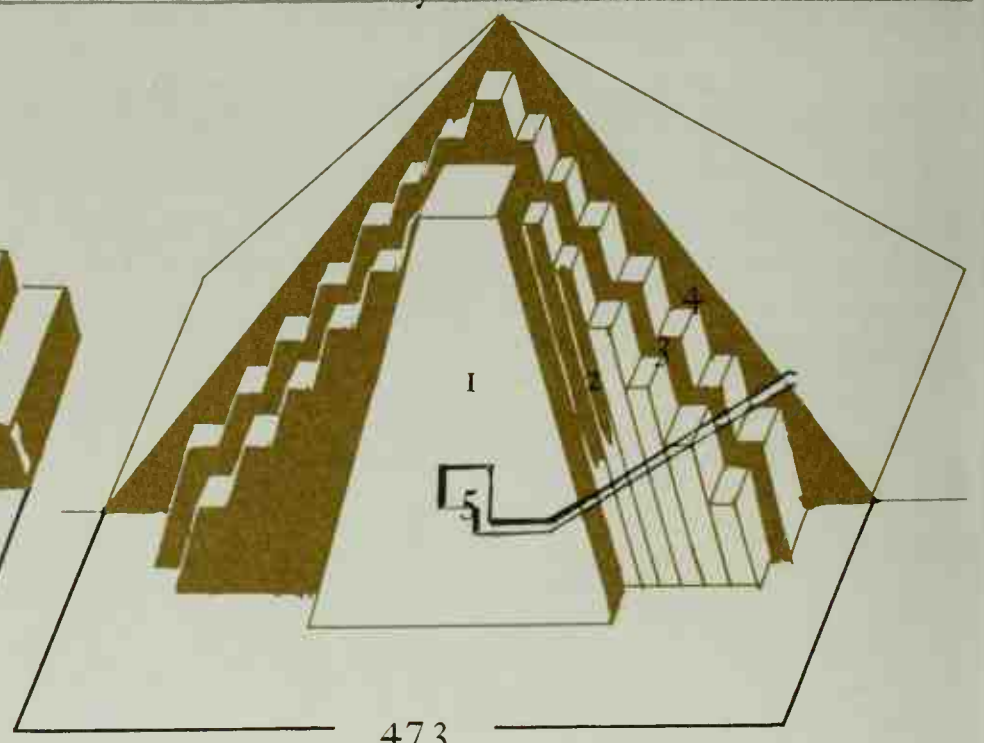

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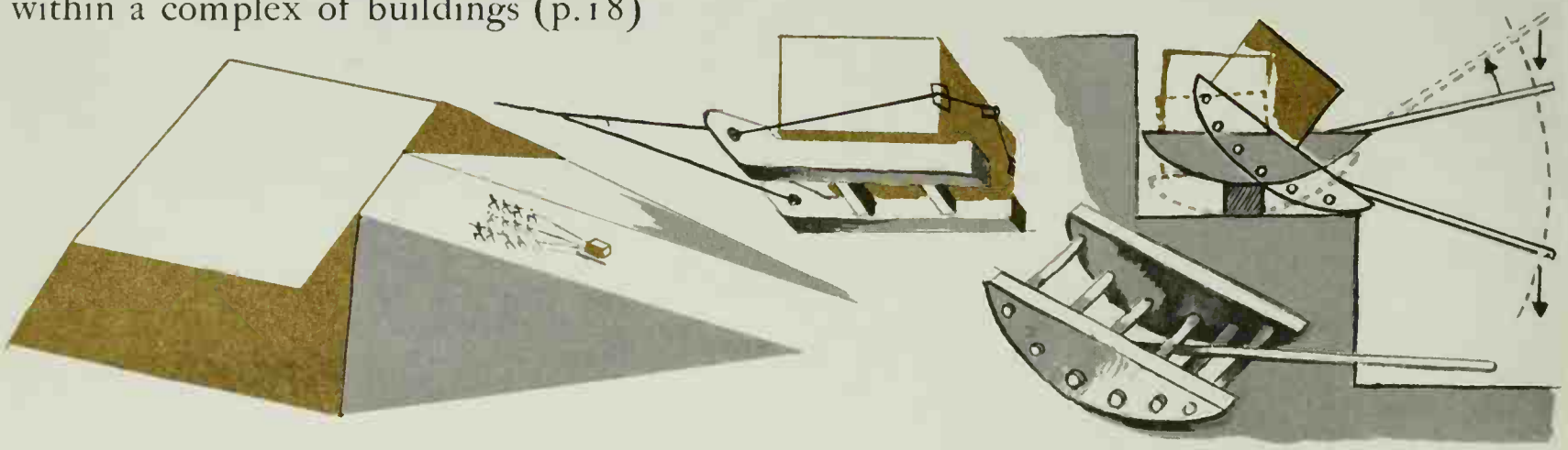
THE STEP PYRAMID, Saqqara, Dynasty III: Section looking west
Built by Imhotep, architect to King Zoser.
1 Begun as a mastaba-tomb. 2-5 Then successively enlarged, in limestone. Set within a complex of buildings (p. 18)

THE PYRAMID OF MEDUM, Dynasties III-IV
Section looking west, reconstructed
1 Centre core. 2 Successive layers added, at about 75°, each of local stone and cased with limestone. 3 Enlargement of the pyramid. 4 Steps filled in with a facing of limestone. 5 The tomb chamber

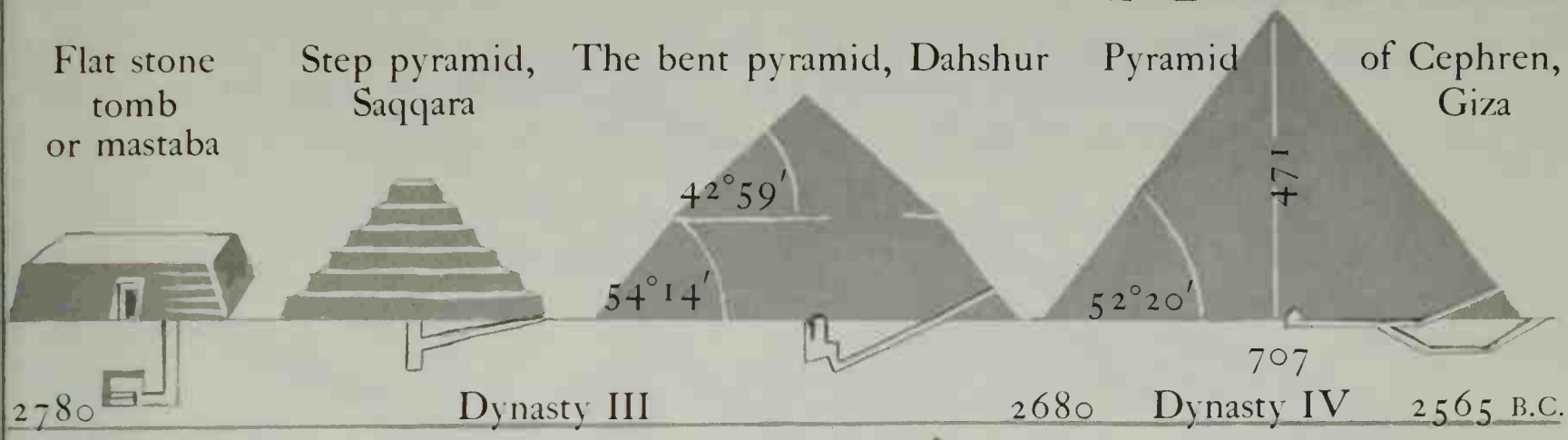


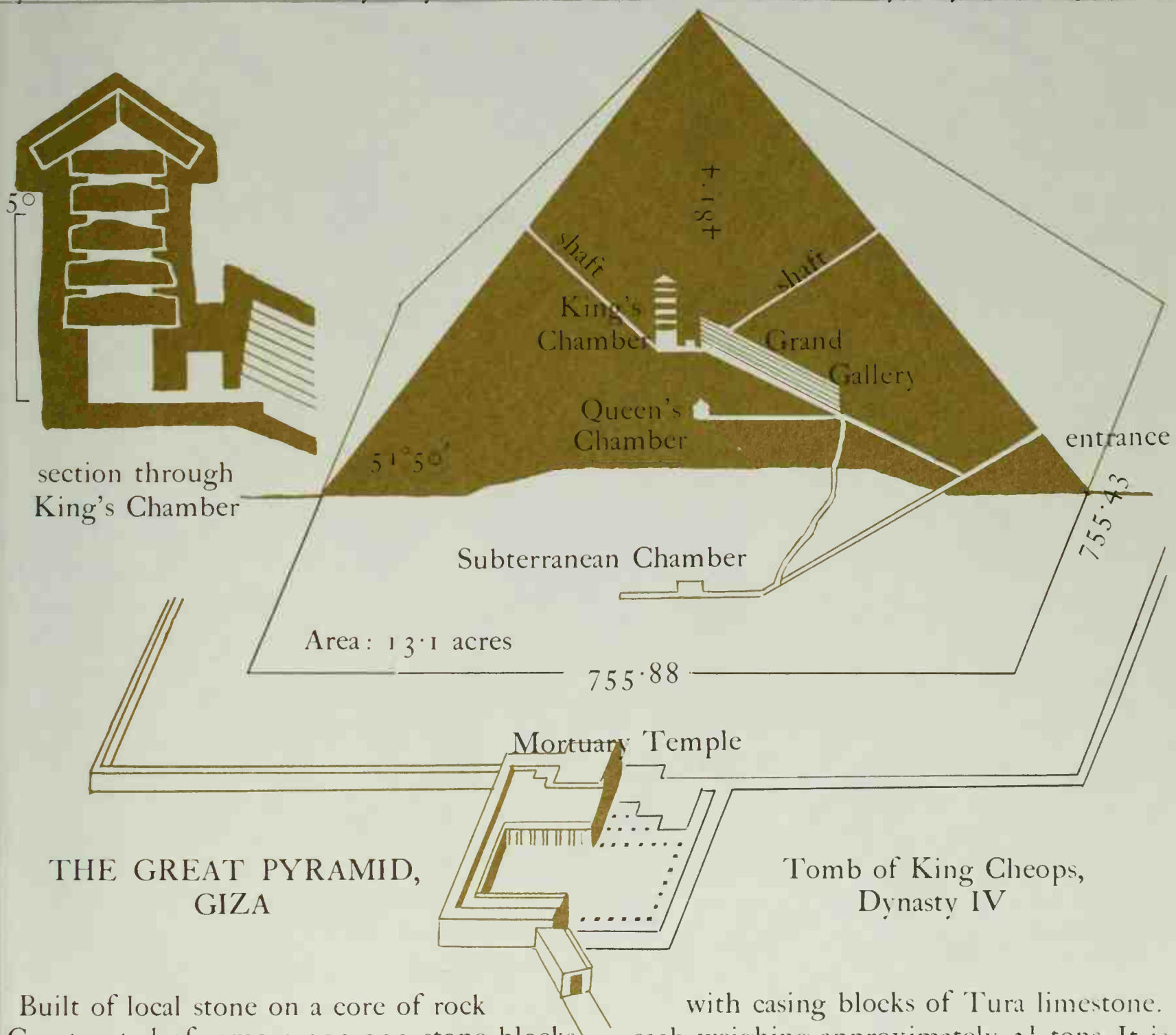
Stones on sledges. pulled up long earth ramps

The Rocker; pulleys were unknown

Suggested methods of hauling and lifting stones

PYRAMIDS





THE GREAT PYRAMID, GIZA

Tomb of King Cheops, Dynasty IV

Built of local stone on a core of rock with casing blocks of Tura limestone. Constructed of some 2,300,000 stone blocks, each weighing approximately $2\frac{1}{2}$ tons. It is probable that for a period of twenty years 100,000 men were levied annually, during the three months' inundation of the Nile (July to October), for transporting stone. Also about 4,000 permanent skilled masons and attendant labourers were employed

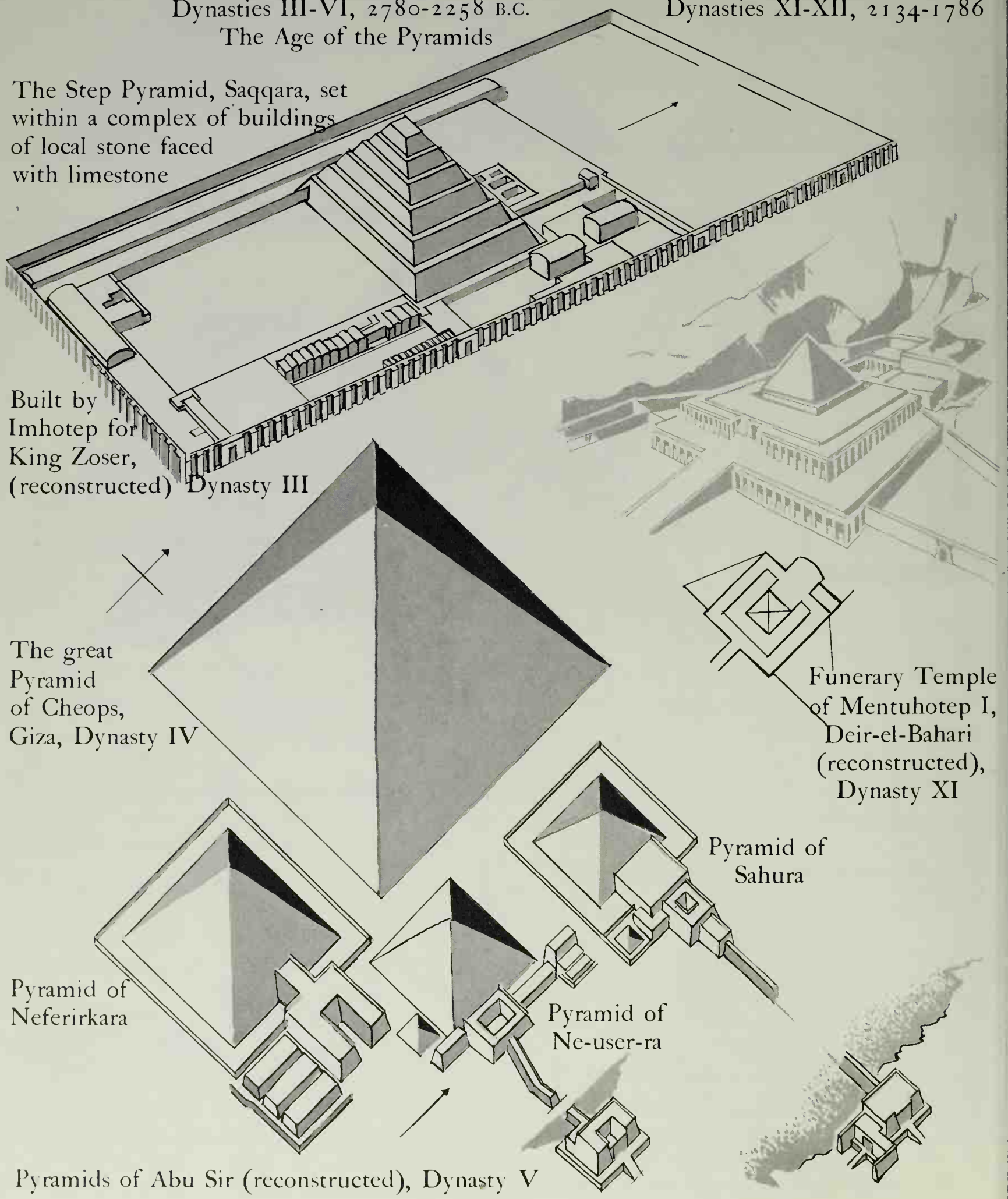
EGYPT

THE OLD KINGDOM
Dynasties III-VI, 2780-2258 B.C.
The Age of the Pyramids

THE MIDDLE KINGDOM
Dynasties XI-XII, 2134-1786

The Step Pyramid, Saqqara, set within a complex of buildings of local stone faced with limestone

Built by Imhotep for King Zoser, (reconstructed) Dynasty III



The great Pyramid of Cheops, Giza, Dynasty IV

Funerary Temple of Mentuhotep I, Deir-el-Bahari (reconstructed), Dynasty XI

Pyramid of Sahura

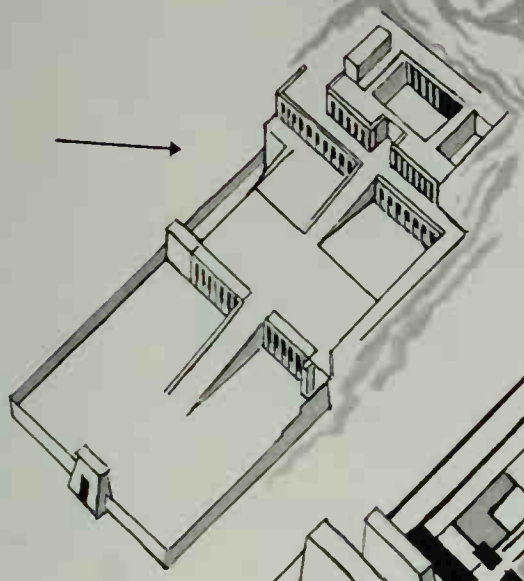
Pyramid of Neferirkara

Pyramid of Ne-user-ra

Pyramids of Abu Sir (reconstructed), Dynasty V

COMPARATIVE BUILDINGS & PLANS

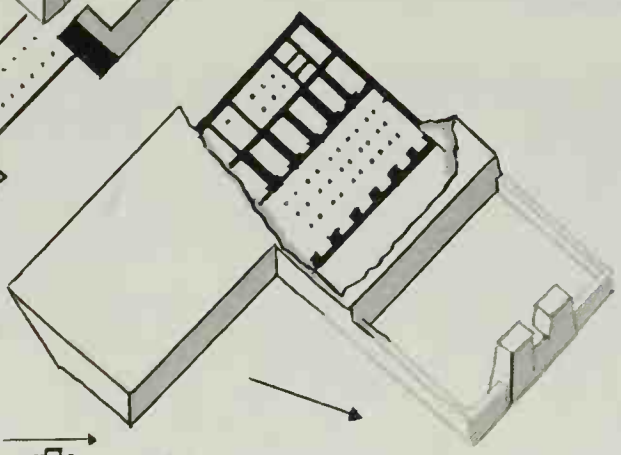
THE NEW KINGDOM
Dynasties XVIII-XX, 1570-1085 B.C.
The Age of the great Temples



Mortuary Temple of Amon,
Deir-el-Bahari (reconstructed),
Dynasty XVIII
Designed by Senmut and
built for Queen Hatshepsut

The Great Temple
of Amon, Karnak,
Dynasties XVIII-XXXI
(Foundations Dynasty XI)

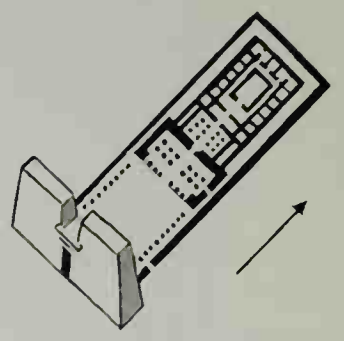
The Temple
of Amon, Luxor,
Dynasties XVIII-XIX
Begun by Amenhotep III
and added to by Rameses II



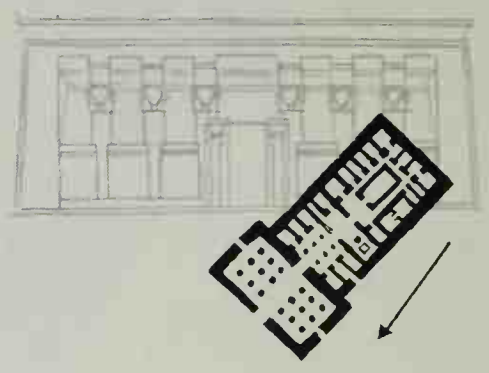
Temple of Seti I, Abydos,
Dynasty XIX

Great Temple, Abu Simbel, Nubia,
Dynasty XIX. Built for Rameses II

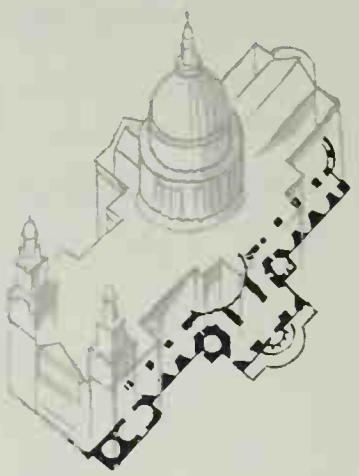
THE PTOLEMAIC PERIOD
332-30 B.C.
Revival of Temples



The Temple of Horus,
Edfu, 237-212 B.C.
Begun by Ptolemy III



The Temple of Hathor,
Dendera, 1st cent. B.C.



St Paul's, London

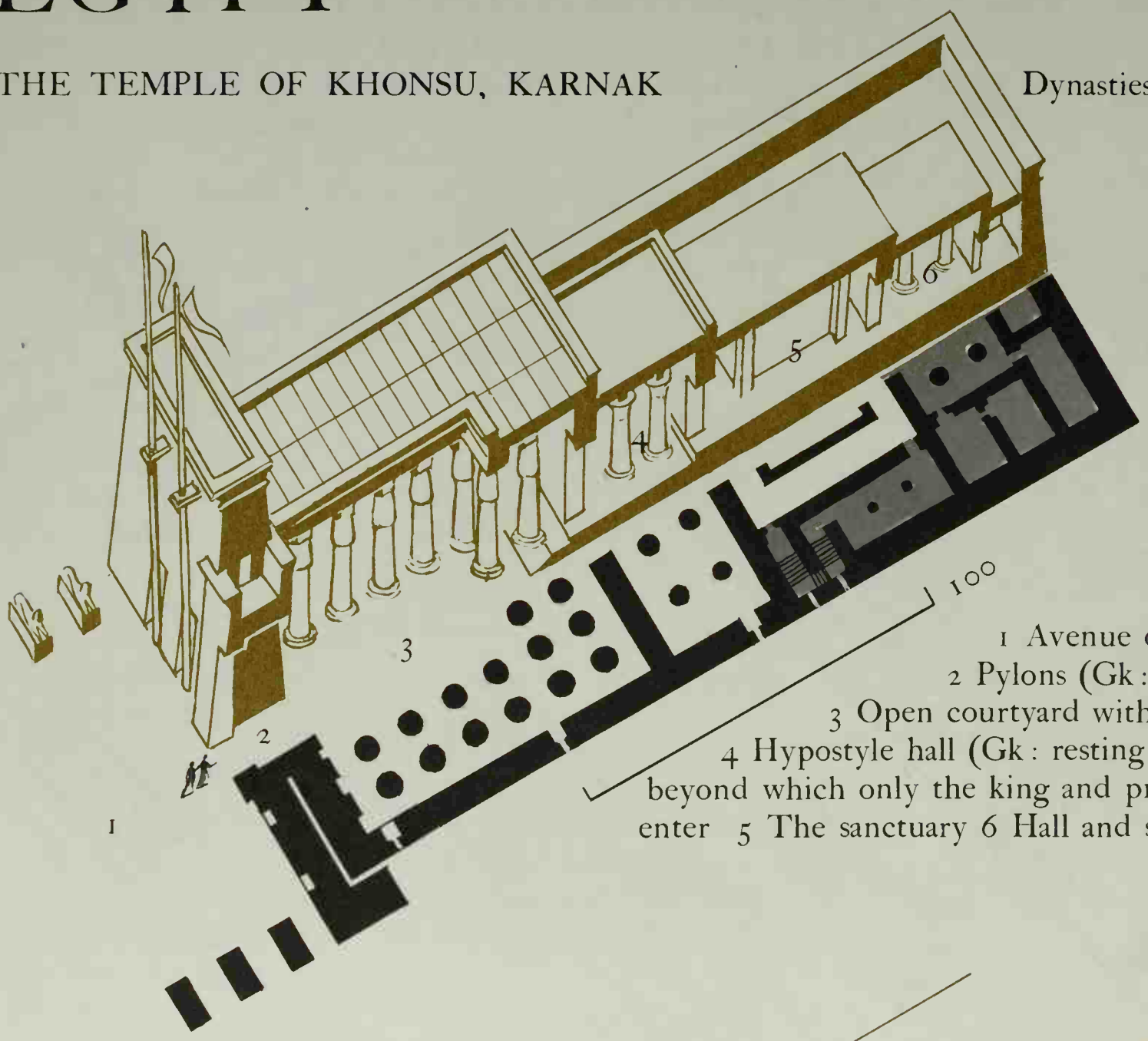
Plans and buildings in black
drawn to the same scale

500

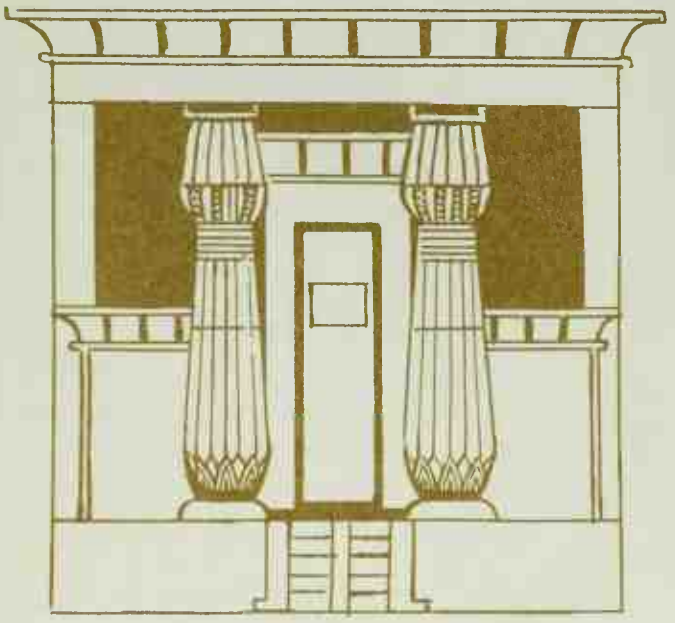
EGYPT

THE TEMPLE OF KHONSU, KARNAK

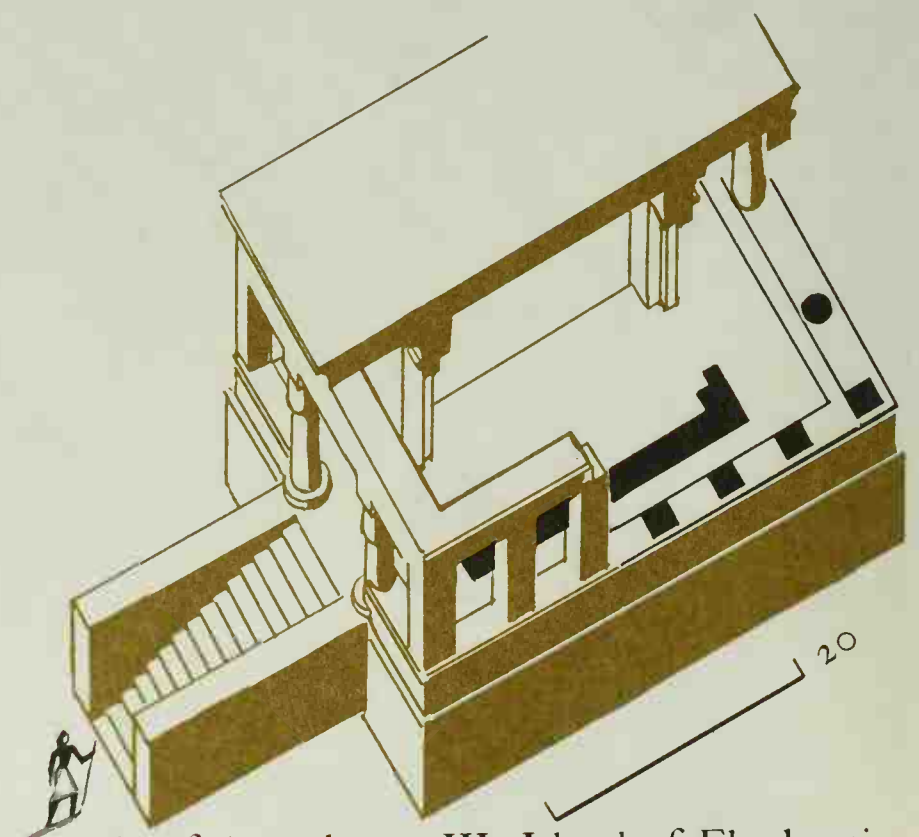
Dynasties XX-XXI



1 Avenue of sphinxes
2 Pylons (Gk: a gateway)
3 Open courtyard with colonnade
4 Hypostyle hall (Gk: resting on pillars), beyond which only the king and priests might enter 5 The sanctuary 6 Hall and store rooms

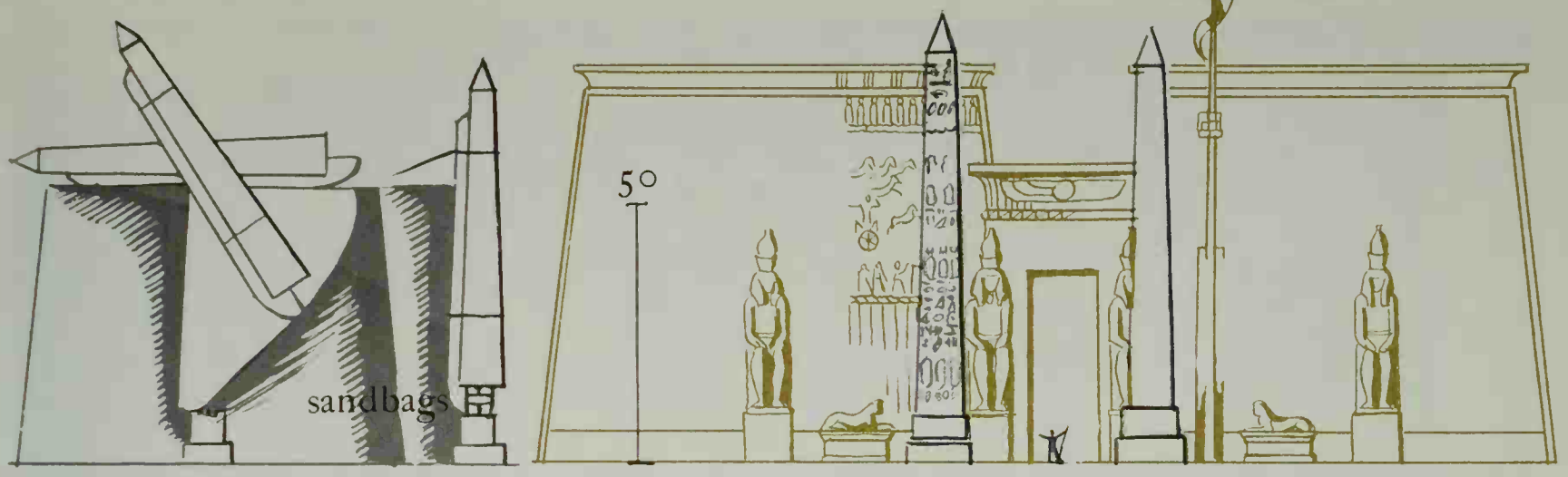


A garden shrine from a painting in a tomb, Thebes, Dynasty XIX



Temple of Amenhotep III, Island of Elephantine, Dynasty XVIII (Destroyed A.D. 1822)

TEMPLES

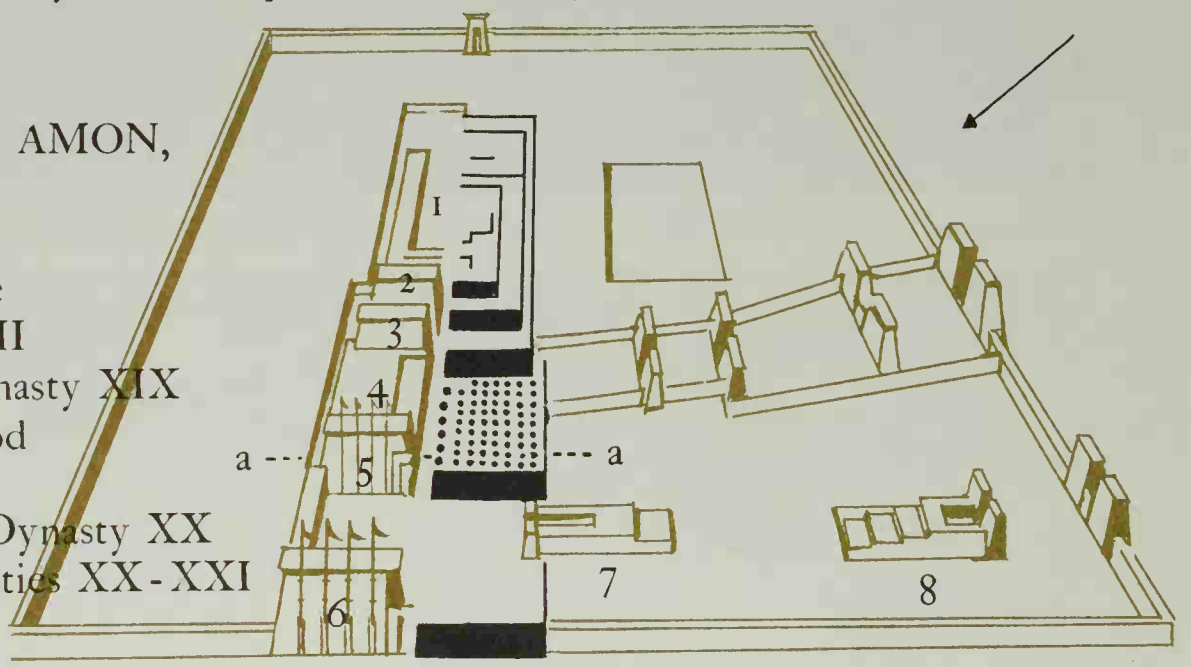


Pylons, Temple of Luxor, Dynasty XIX. Built by Rameses II

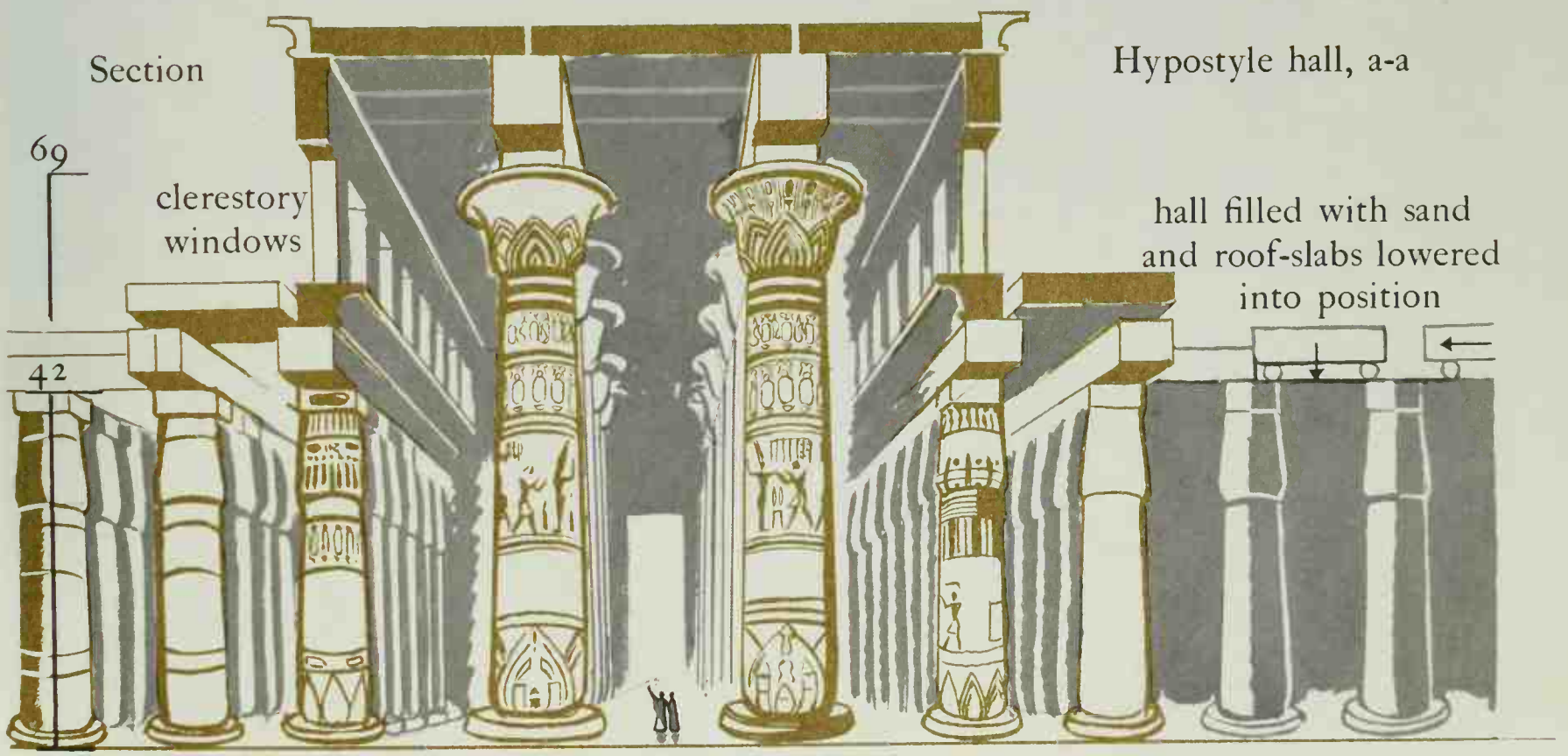
GREAT TEMPLE OF AMON, KARNAK

Built of sandstone
Begun Dynasty XII
1-4 Dynasty XVIII 5 Dynasty XIX
6 Ptolemaic period

7 Temple of Rameses III, Dynasty XX
8 Temple of Khonsu, Dynasties XX-XXI



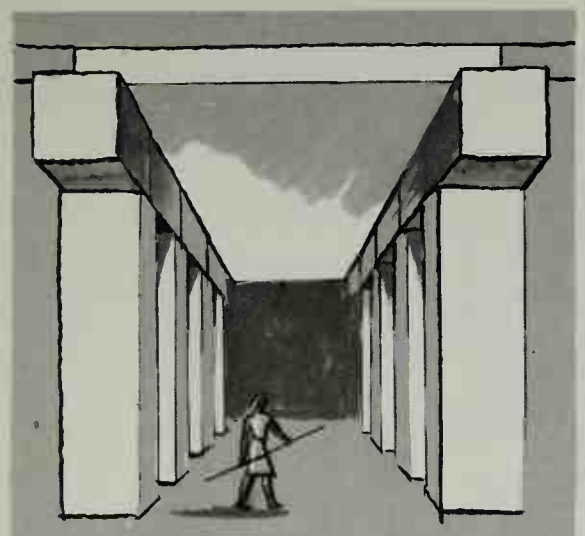
Section



Hypostyle hall, a-a

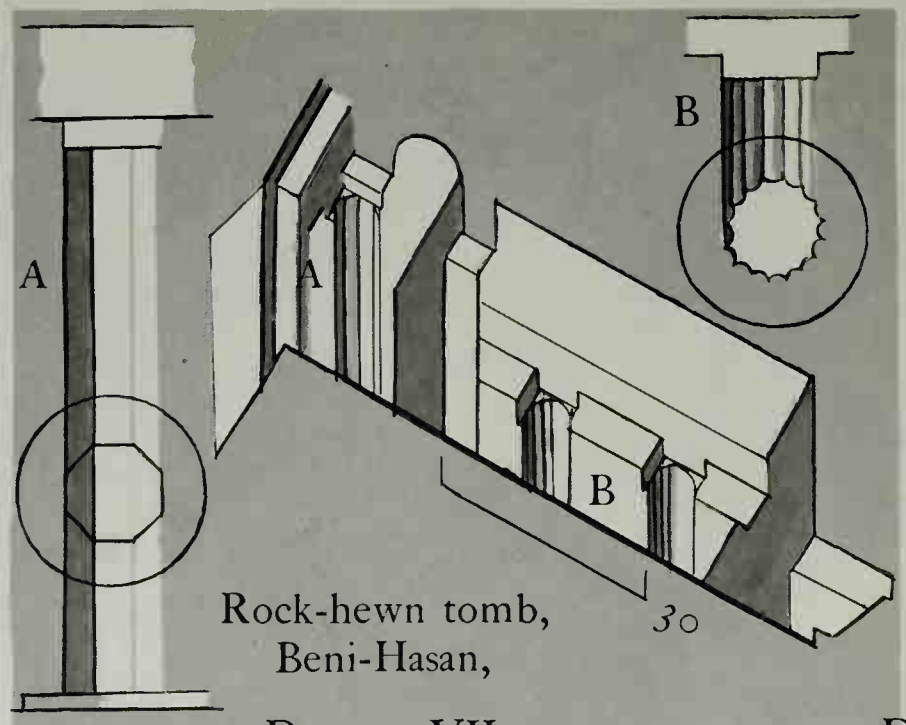
hall filled with sand and roof-slabs lowered into position

EGYPT



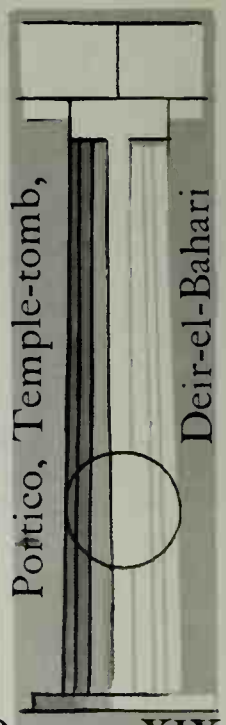
Valley Temple
built of granite:
Pyramid of Cephren, Giza.

Dynasty IV



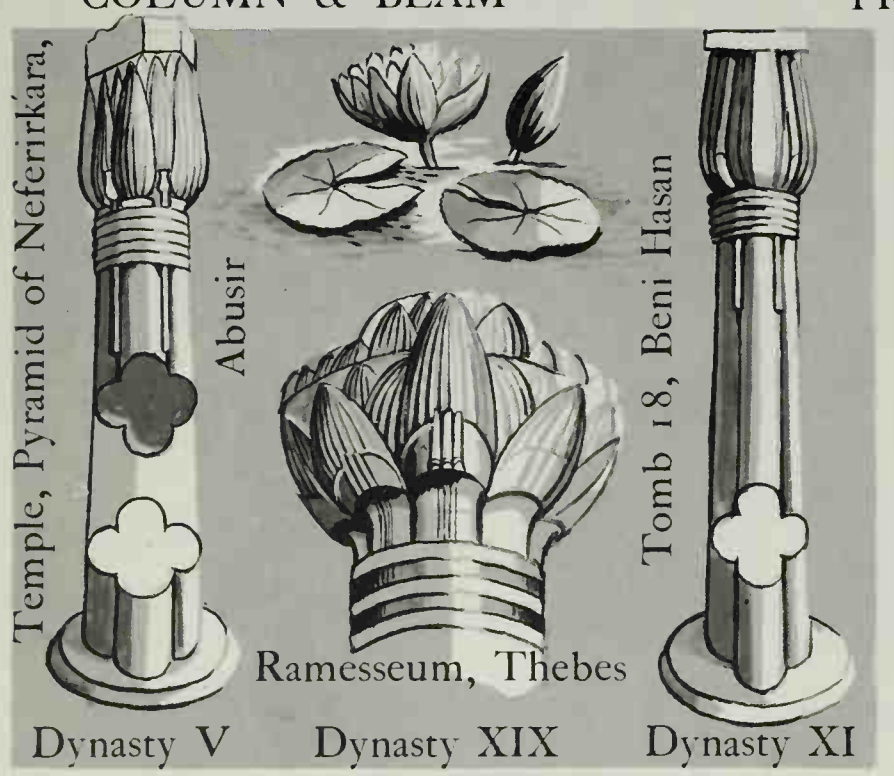
Rock-hewn tomb,
Beni-Hasan,

Dynasty VII



Dynasty XIX

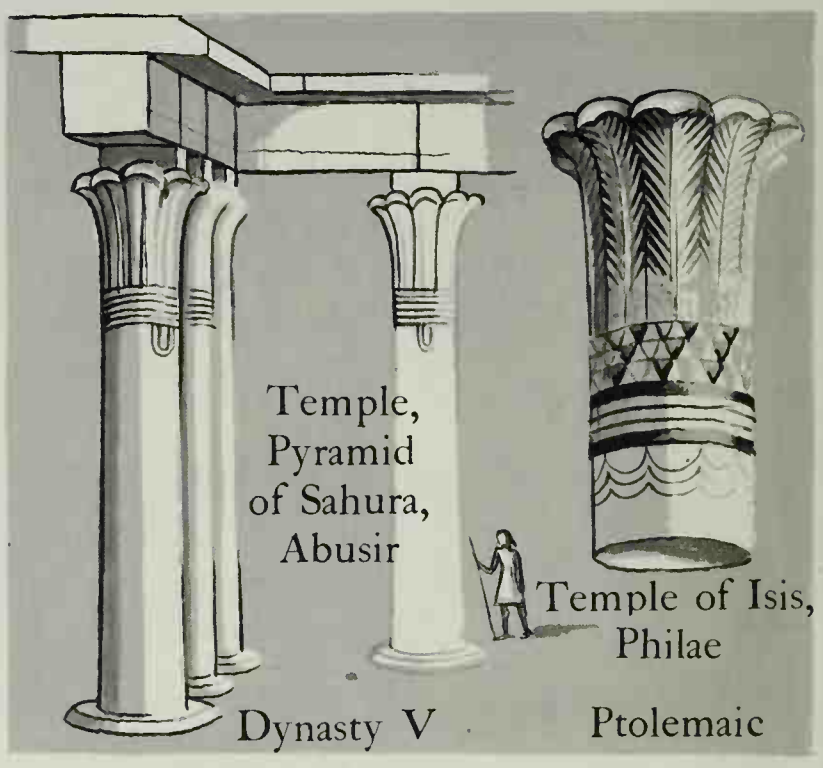
COLUMN & BEAM



Ramesseum, Thebes

Dynasty V Dynasty XIX Dynasty XI

PROTO-DORIC COLUMNS

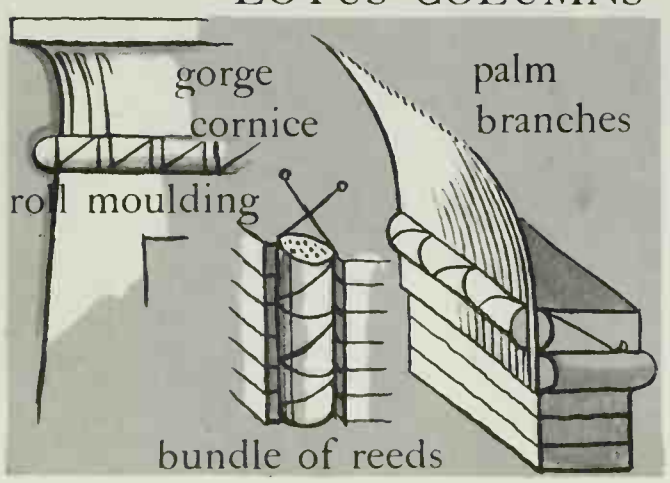


Temple,
Pyramid
of Sahura,
Abusir

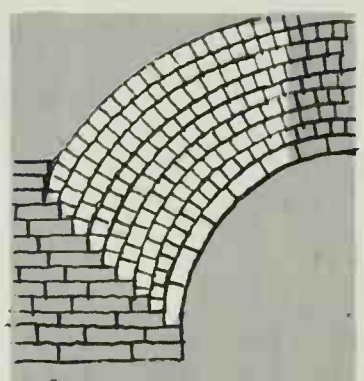
Temple of Isis,
Philae

Dynasty V Ptolemaic

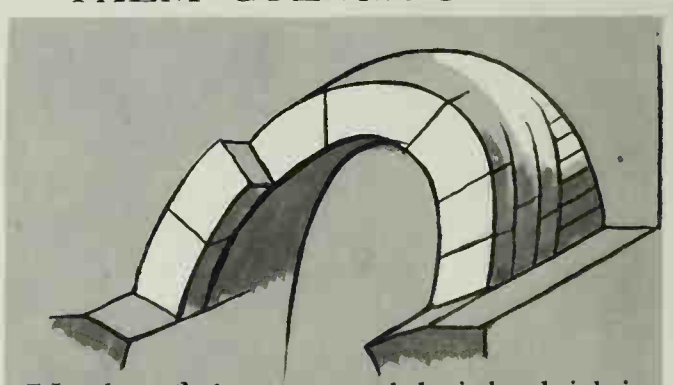
LOTUS COLUMNS



PALM COLUMNS

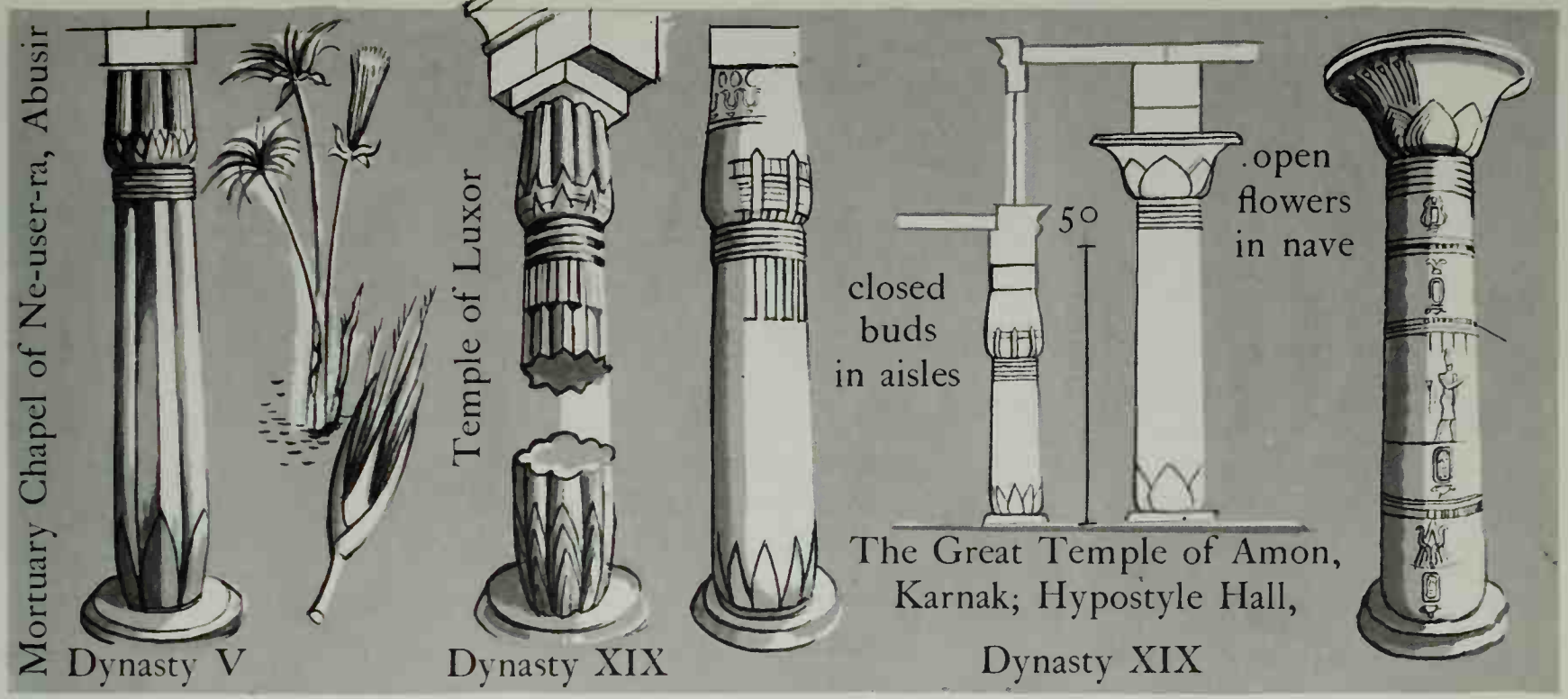


Brick arch,
el 'Asaseef, Thebes

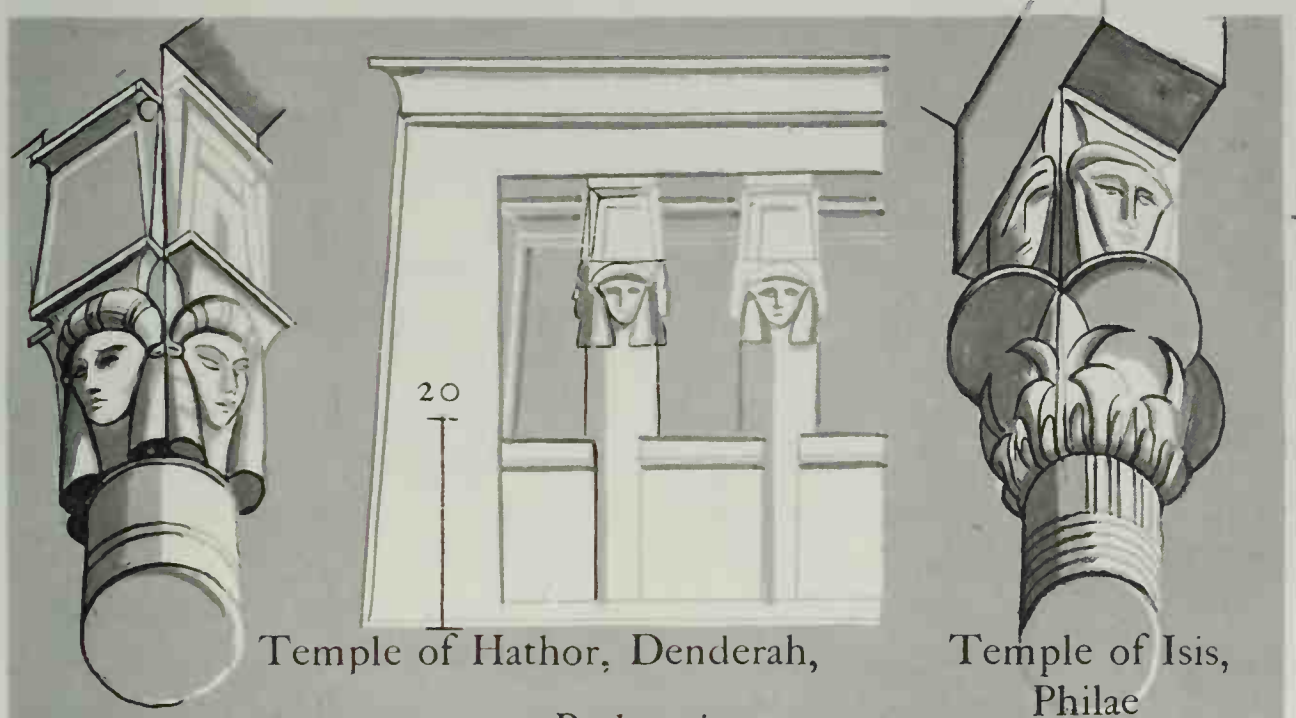


Vault of damp mud bricks laid in
slanted courses without centering

COLUMN BEAM & ARCH

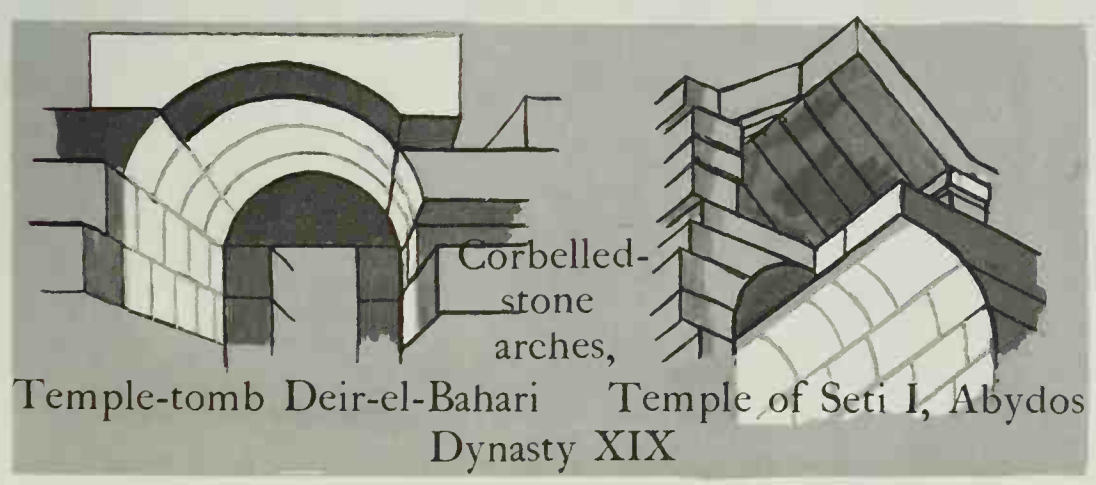


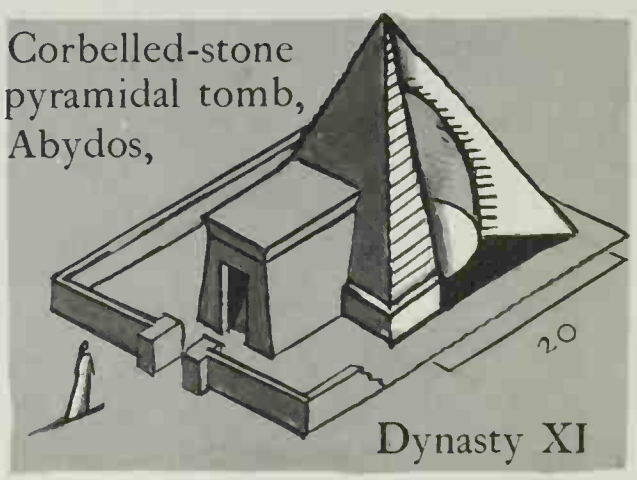
PAPYRUS COLUMNS



HATHOR-HEADED COLUMNS

COMPOSITE





WESTERN ASIA

SUMERIAN CITY KINGDOMS

Civilization in Western Asia began with city kingdoms in the rich alluvial plain between the lower Tigris and the Euphrates, an area about that of Wales (Map p. 14). Tower-temples or ziggurats were the centre of city life. There was no stone and little timber but clay was moulded into sun-dried brick. Buildings were faced with kiln-baked bricks, sparingly owing to lack of fuel.

ASSYRIA

Assyria was set on a high tableland of lime-stone, harder rock & alabaster, but the Assyrians continued to use sun-dried and kiln-baked bricks. Palaces of warrior-kings were built on large platforms of brick 30-50 feet high. Lower courses of walls were faced with slabs of alabaster 9-12 feet high and carved with bas-reliefs or covered with plaster and painted with bright colour. The arch was constructed for gateways, vaults and drains.

SECOND BABYLONIAN EMPIRE

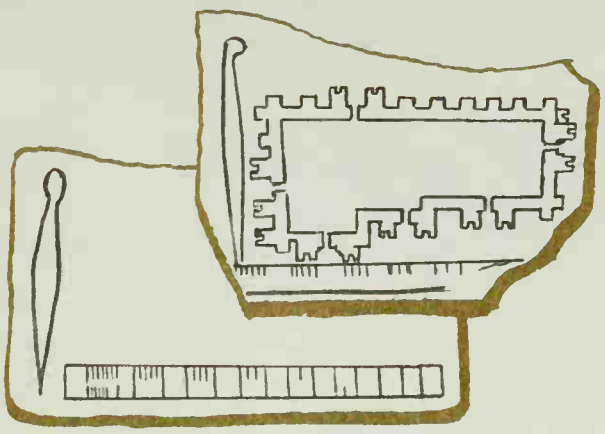
Nebuchadnezzar (604-561 B.C.) rebuilt Babylon to a regular plan described in *The Histories* by Herodotus (484-406 B.C.). Buildings were of kiln-baked brick and bitumen.

PERSIAN EMPIRE

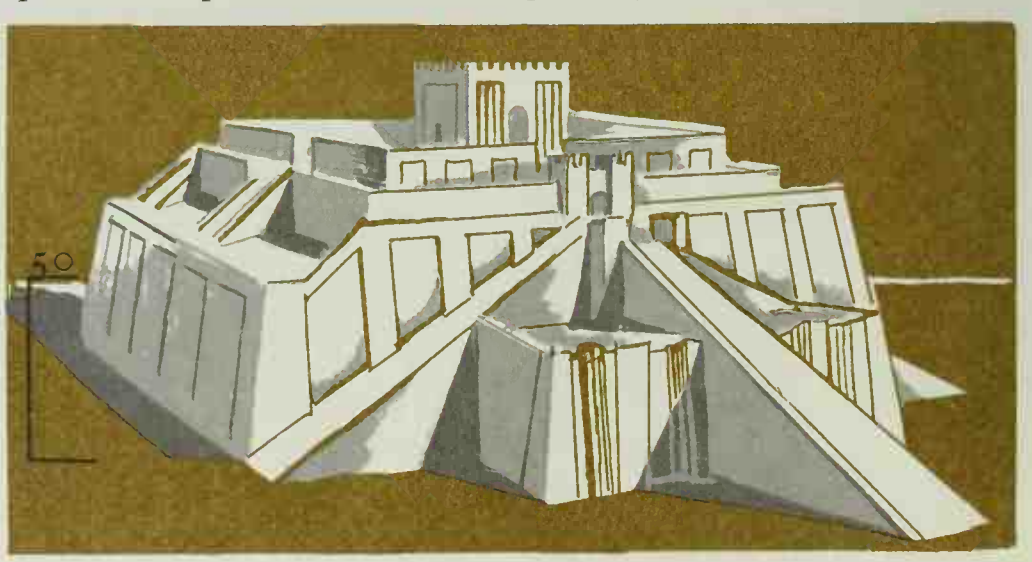
Palaces were built at the capital city of Susa, at Pasargadae and Persepolis, being constructed of stone which was abundant in Persia; whilst raised platforms and glazed coloured bricks were adapted from the Assyrians; also influences from Babylon, Syria and Egypt.

SECOND PERSIAN—SASSANID—EMPIRE

The capital city at Ctesiphon. Buildings were erected of kiln-baked brick, vaults and the earliest domes being built over square compartments, developed by the Byzantines.

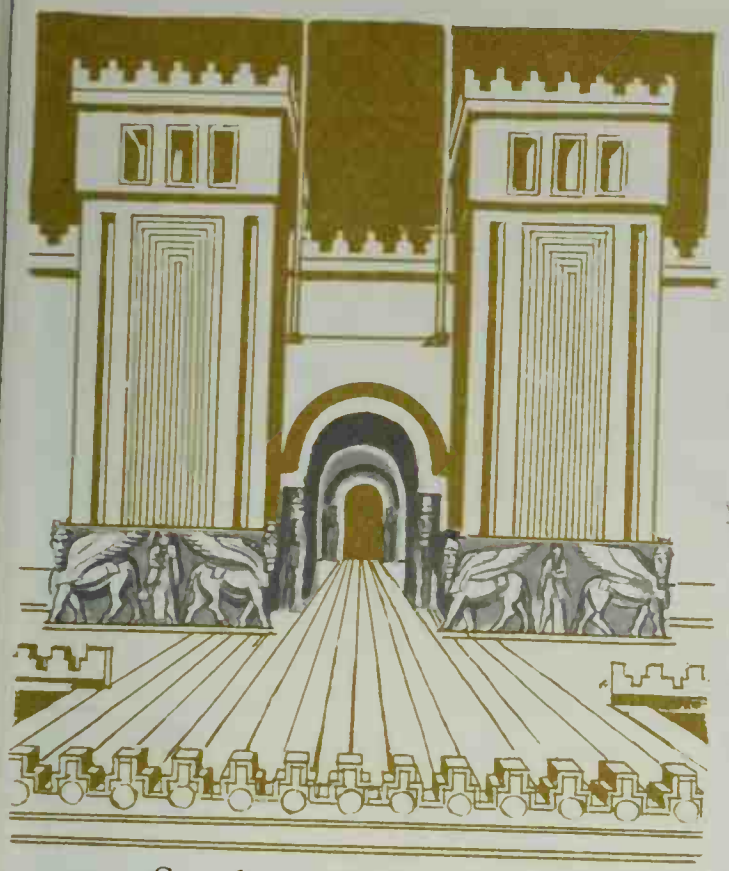


Stilus, scale and plan of King Gudea of Lagash, *c.* 2350 B.C.

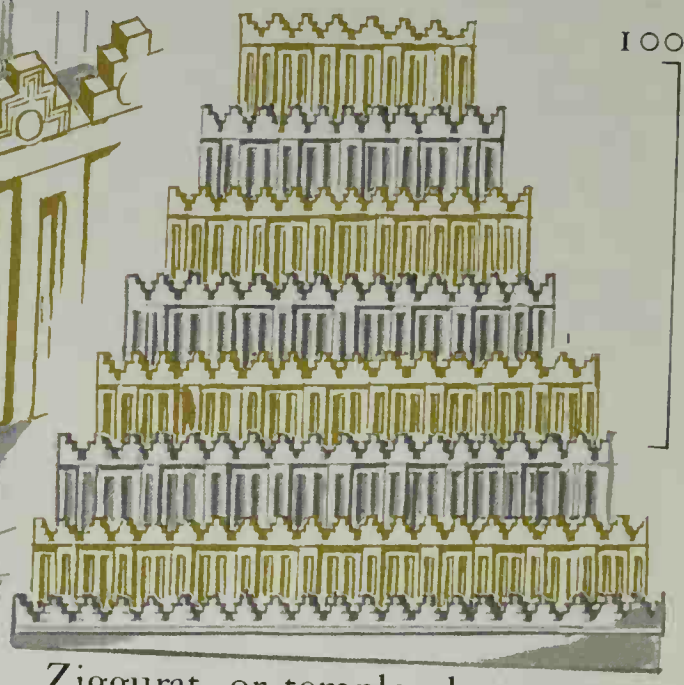


The Ziggurat, Ur (restored), *c.* 2350 B.C.

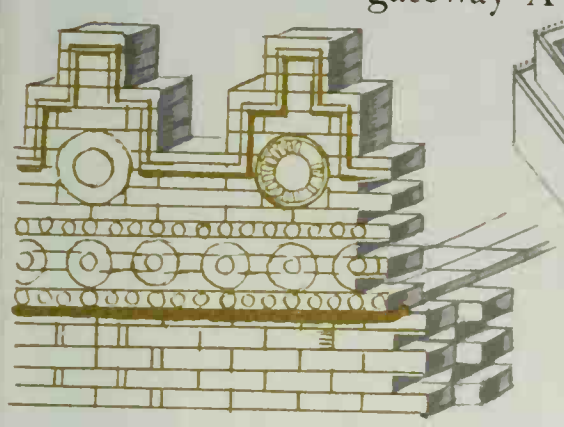
INTRODUCTION - ASSYRIA

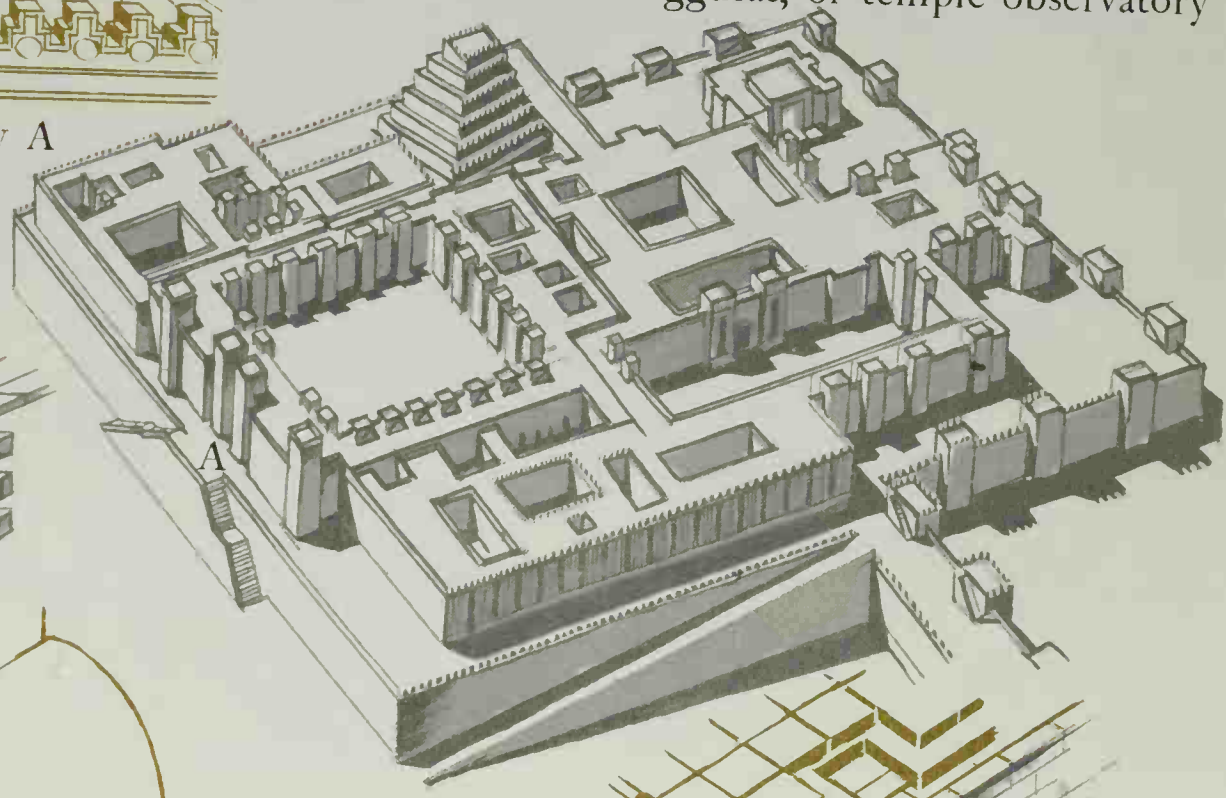


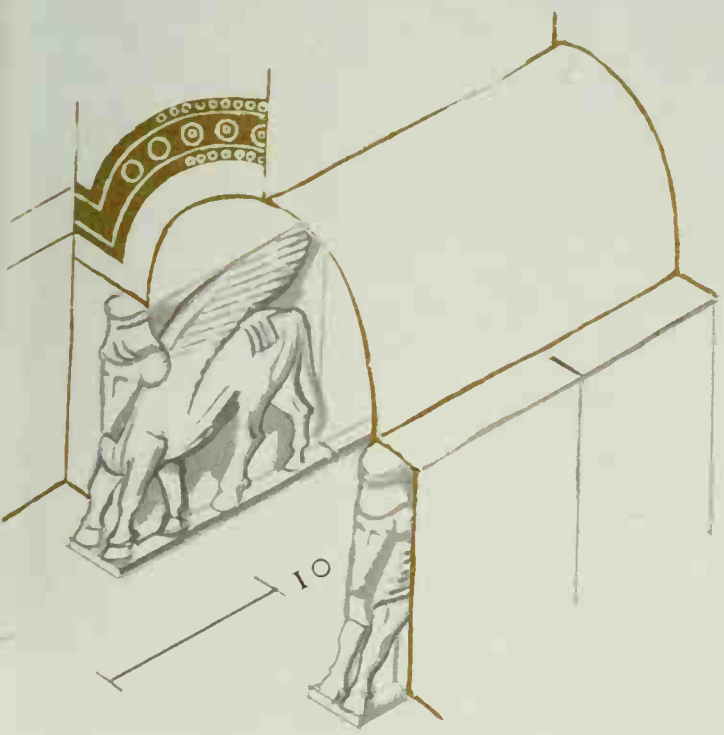
South-east gateway A



Ziggurat, or temple observatory





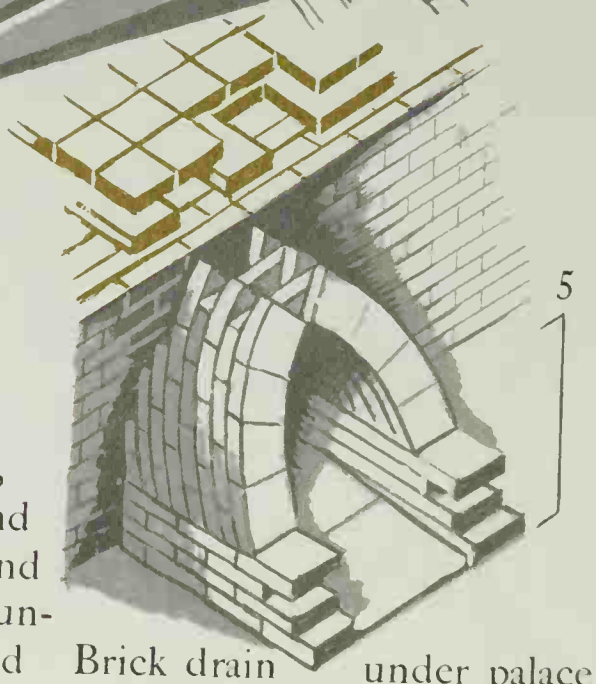


PALACE OF SAGON II KHORSABAD

(restored)

772-705 B.C.

Both the platform, about 50 ft high and 25 acres in extent, and the palace built of sun-dried brick and faced with kiln-baked brick



Brick drain under palace built without centering

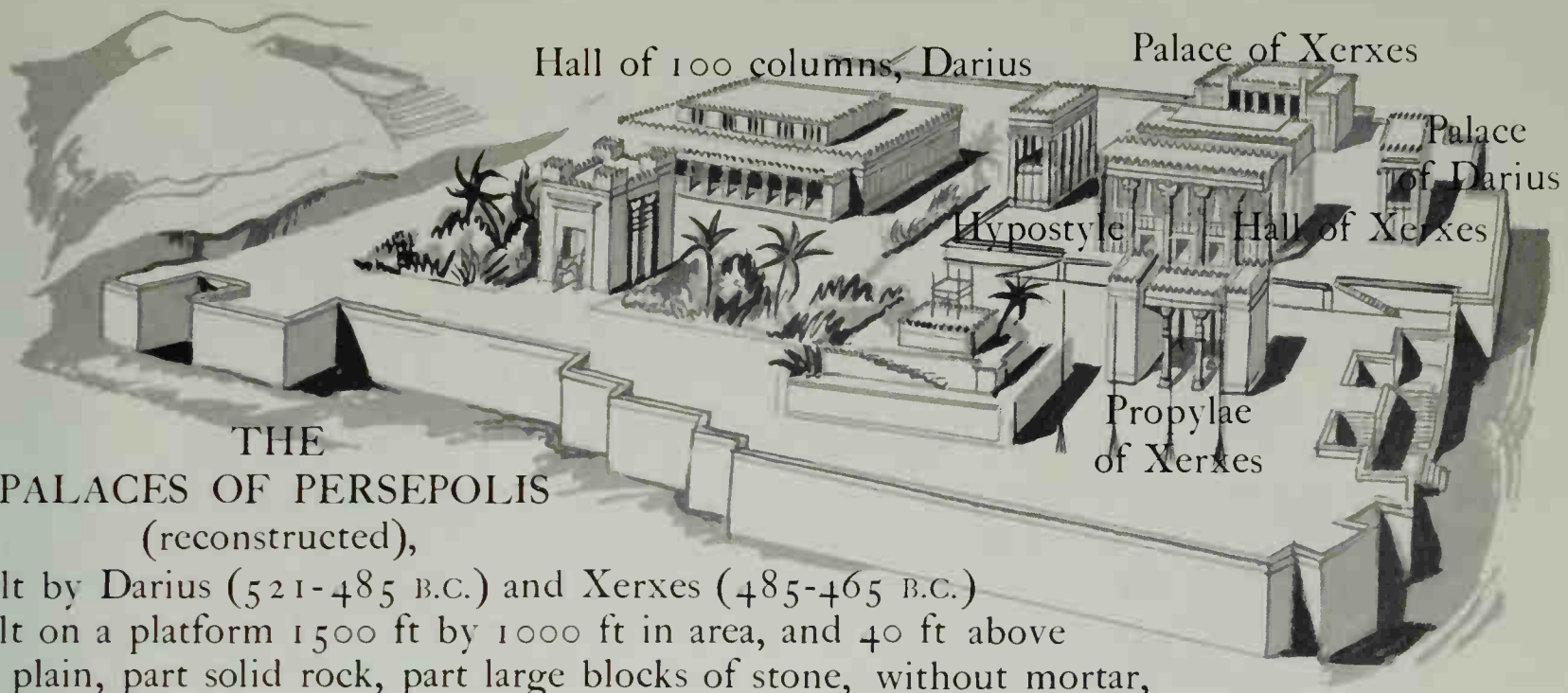
WESTERN ASIA

BABYLON

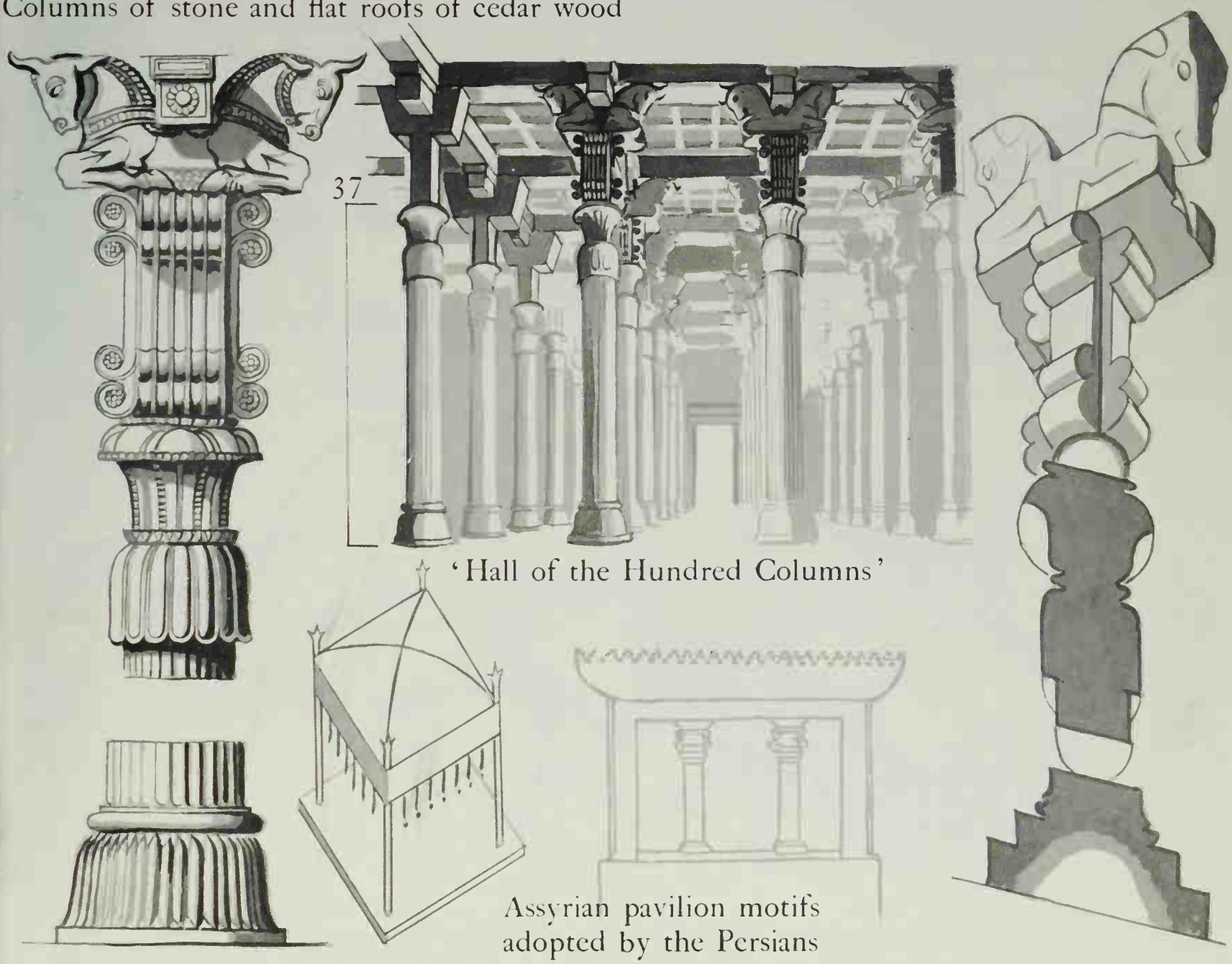
THE CITY OF BABYLON
(reconstructed),
as rebuilt by Nebuchadnezzar,
604-561 B.C., during the Second
Babylonian Empire.
Described in *The Histories* of Herodotus

House with roof-garden

PERSIA



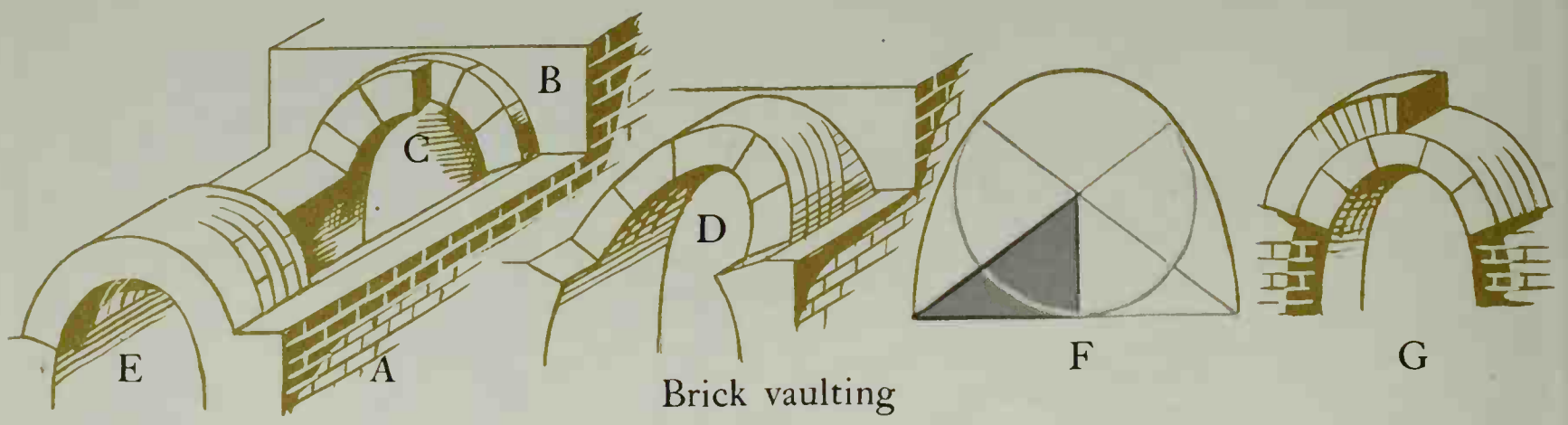
THE
PALACES OF PERSEPOLIS
(reconstructed),
Built by Darius (521-485 B.C.) and Xerxes (485-465 B.C.)
Built on a platform 1500 ft by 1000 ft in area, and 40 ft above the plain, part solid rock, part large blocks of stone, without mortar, held by metal cramps. Buildings constructed of sun-dried brick and faced with glazed bricks. Columns of stone and flat roofs of cedar wood



'Hall of the Hundred Columns'

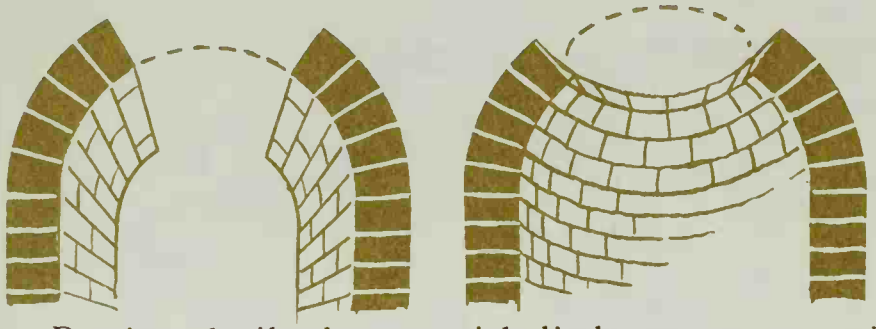
Assyrian pavilion motifs
adopted by the Persians

WESTERN ASIA VAULTS &

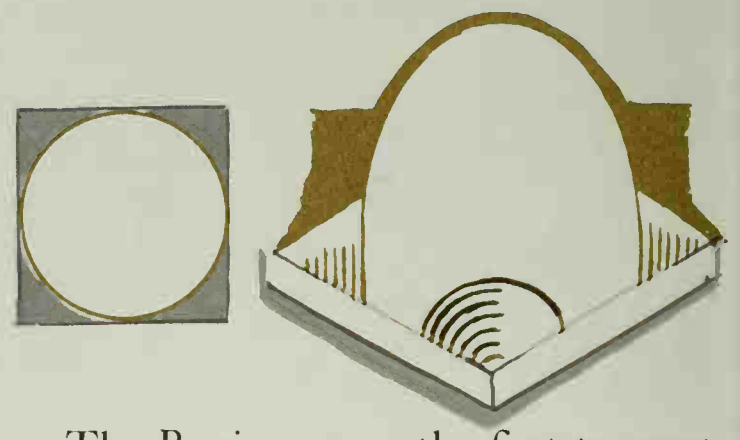


Brick vaulting

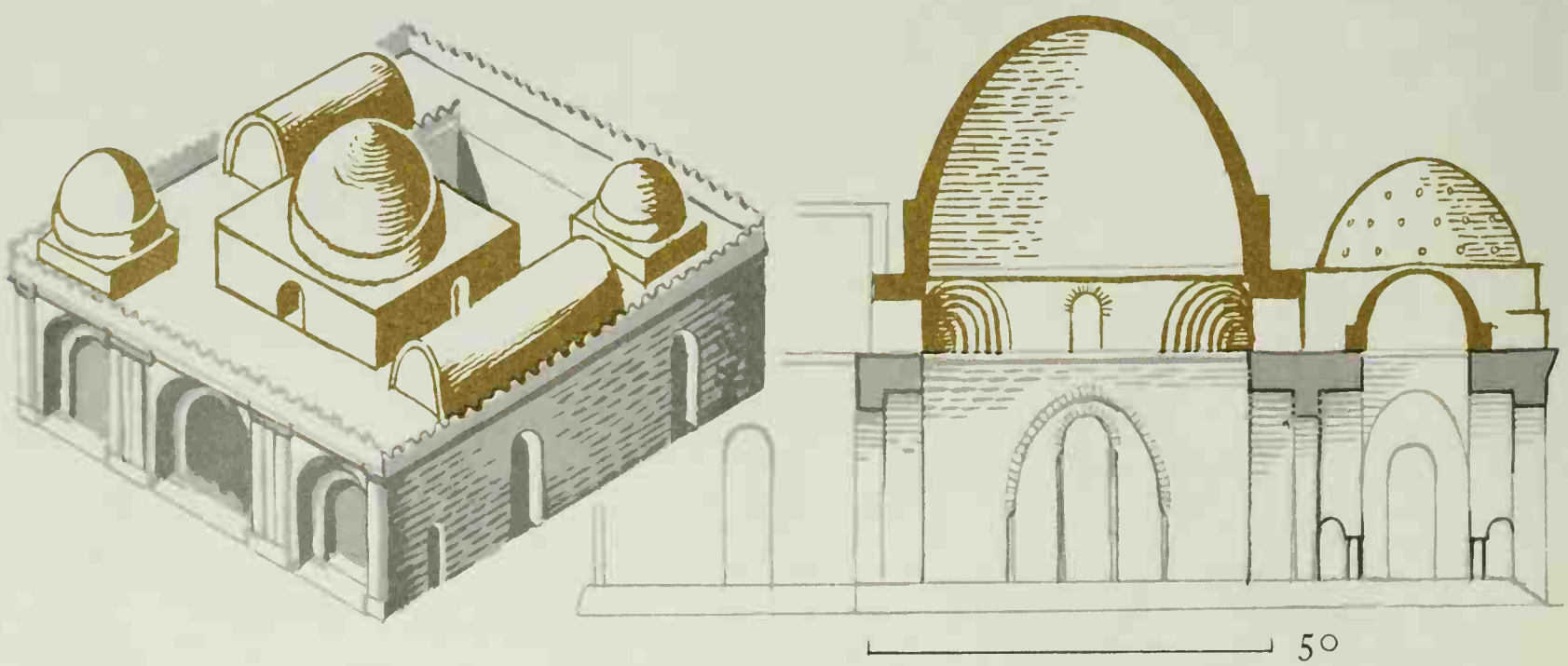
Bricks were laid to form a base A; against an end wall B wedge-shaped bricks were fixed with mortar C. To ensure adherence these were often laid in sloping courses D. An arch was constructed with little or no centering to complete the vault E. To facilitate work and to reduce pressure, vaults (and domes) had a high oval profile F. When completed vaults were often re-inforced by a second or more courses of brick G. Sassanid Persian buildings, vaults and domes were constructed of kiln-baked bricks laid with a mortar of lime and sand



The Persians built domes with little or no centering. A dome is an arched construction both vertically & horizontally: each ring of brick or stone once closed in cannot fall if it rests adequately on the ring below

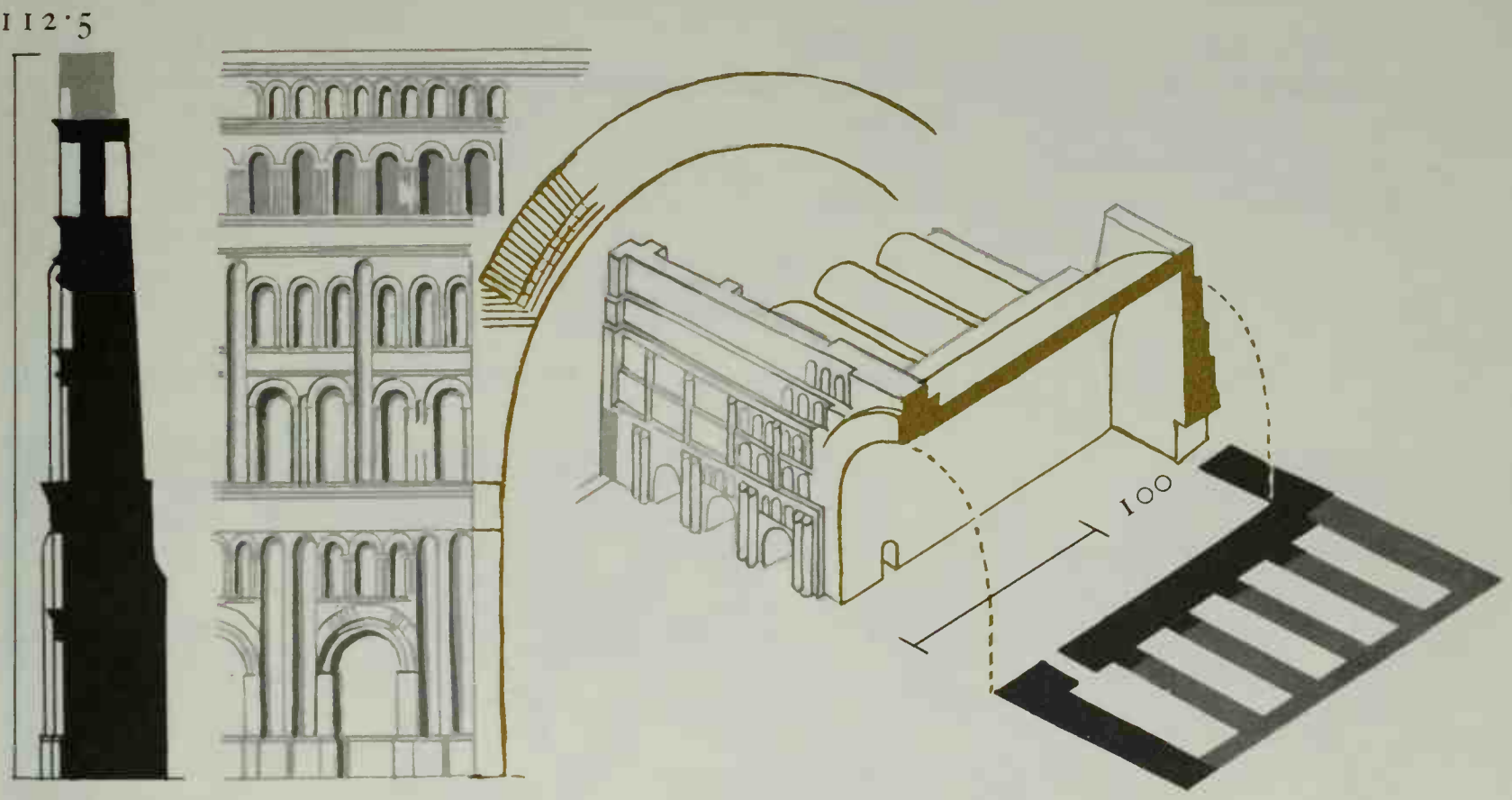


The Persians were the first to erect circular domes on square plans with four angular corbelled semi-domes

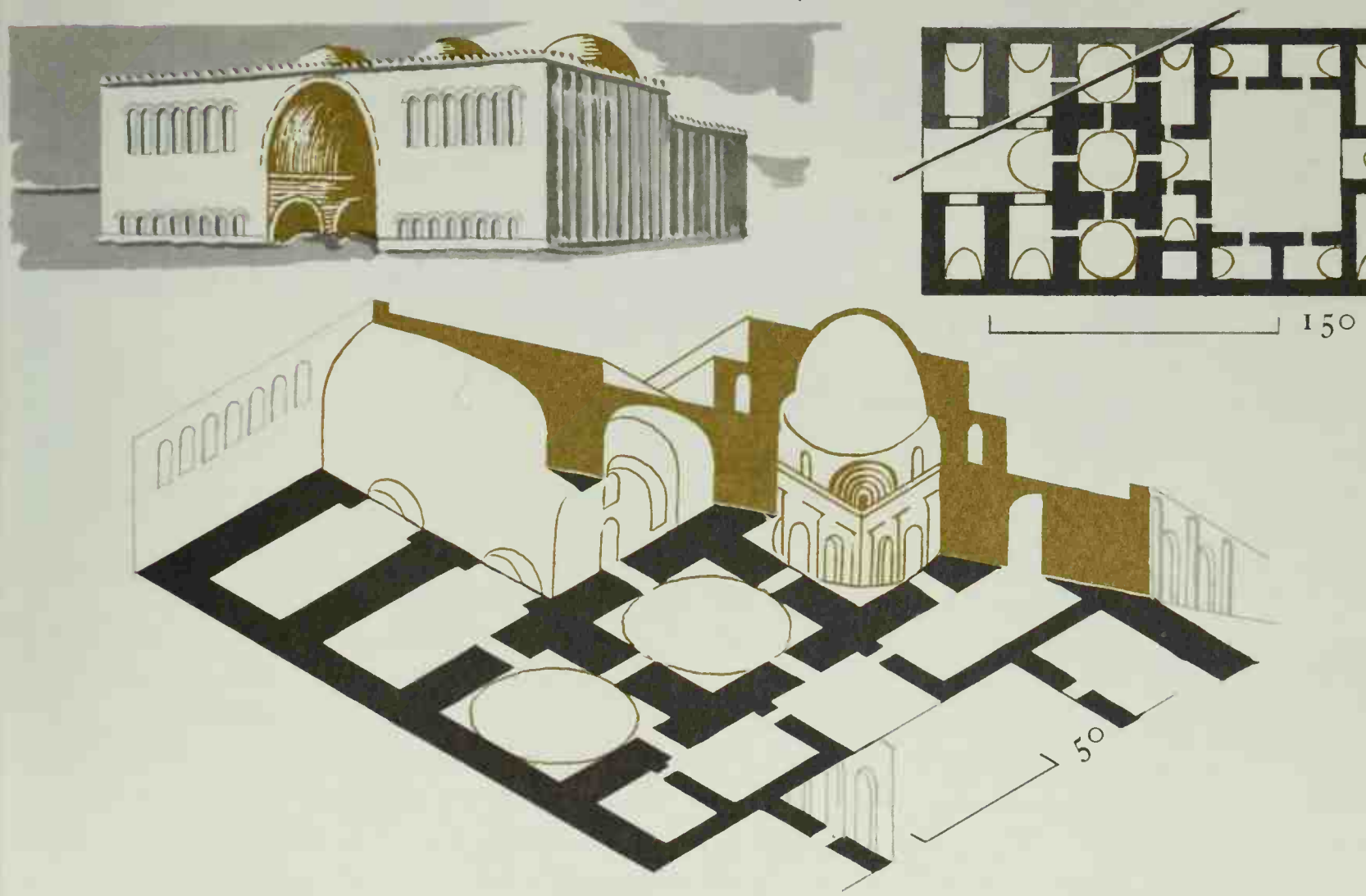


The Palace, Serbistan (exterior restored), *c.* A.D. 350

DOMES - SECOND PERSIAN EMPIRE



The Palace of Chosroes, Ctesiphon, 6th cent. A.D.



The Palace, Firouzabad (exterior restored), *c.* A.D.450

GREEK

AEGEAN

*c.*2500 B.C. — 1184

Minoan—Crete

1500 — 1184

Mycenaean

HELLENIC

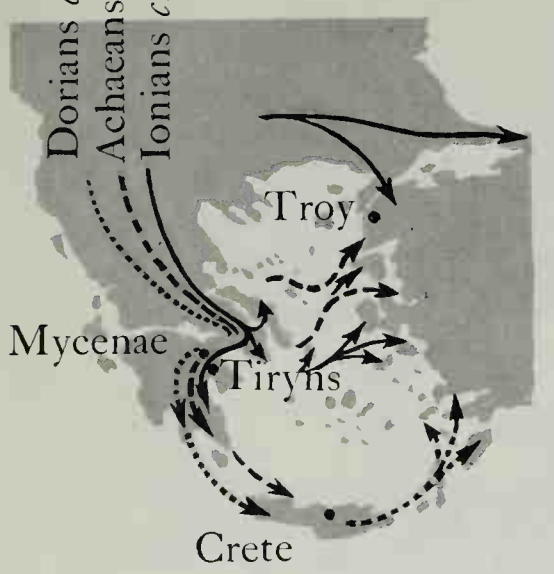
775/6 First Olympiad — 650 — 500

Archaic period

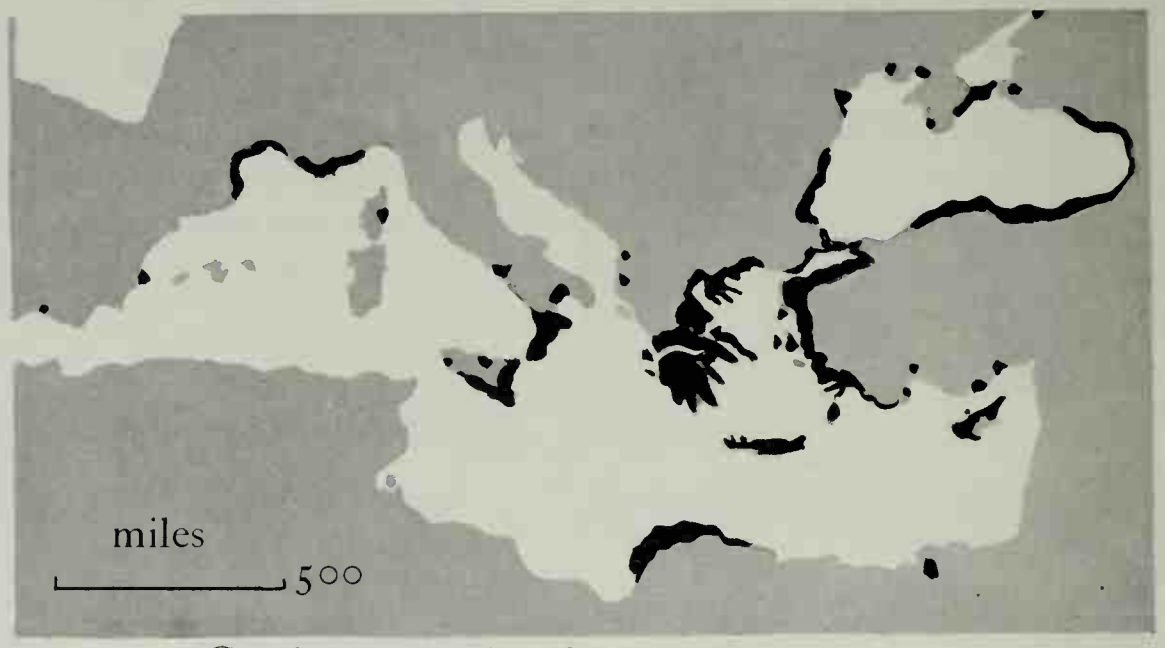
Establishment of Greek city-states along the Mediterranean and Black Sea

*c.*835 Homer

*c.*582 Pythagoras *c.*510



The Greek invasions



Greek colonisation 8th-6th centuries B.C.

INTRODUCTION

HELLENISTIC

492-479 War with Persia | 444-429 Ascendancy of Athens | 334—323 Alexander the Great King of Macedon | 146 Greece a Roman province | 31 B.C.

431 — 404 Peloponnesian War

429/8 Plato 347

384 Aristotle 332

323 Euclid 283

The Empire of Alexander the Great

The Aegean Period. 1 No records survive of the Minoan sea-kings of Crete except remains of palaces, e.g. Cnossus. 2 The Mycenaeans built massive citadels with Cyclopean masonry and domed tholos tombs on the mainland. The Aegean civilization fell before the Homeric Greeks.

The Hellenic Period. The Greeks called themselves Hellenes (Hellas was called Graecia by the Romans). They formed numerous small city states in which primitive houses surrounded a citadel and later a temple built on an acropolis or upper city. National unity was achieved by pan-Hellenic festivals held at Olympia, Delphi, Argos and Corinth every few years.

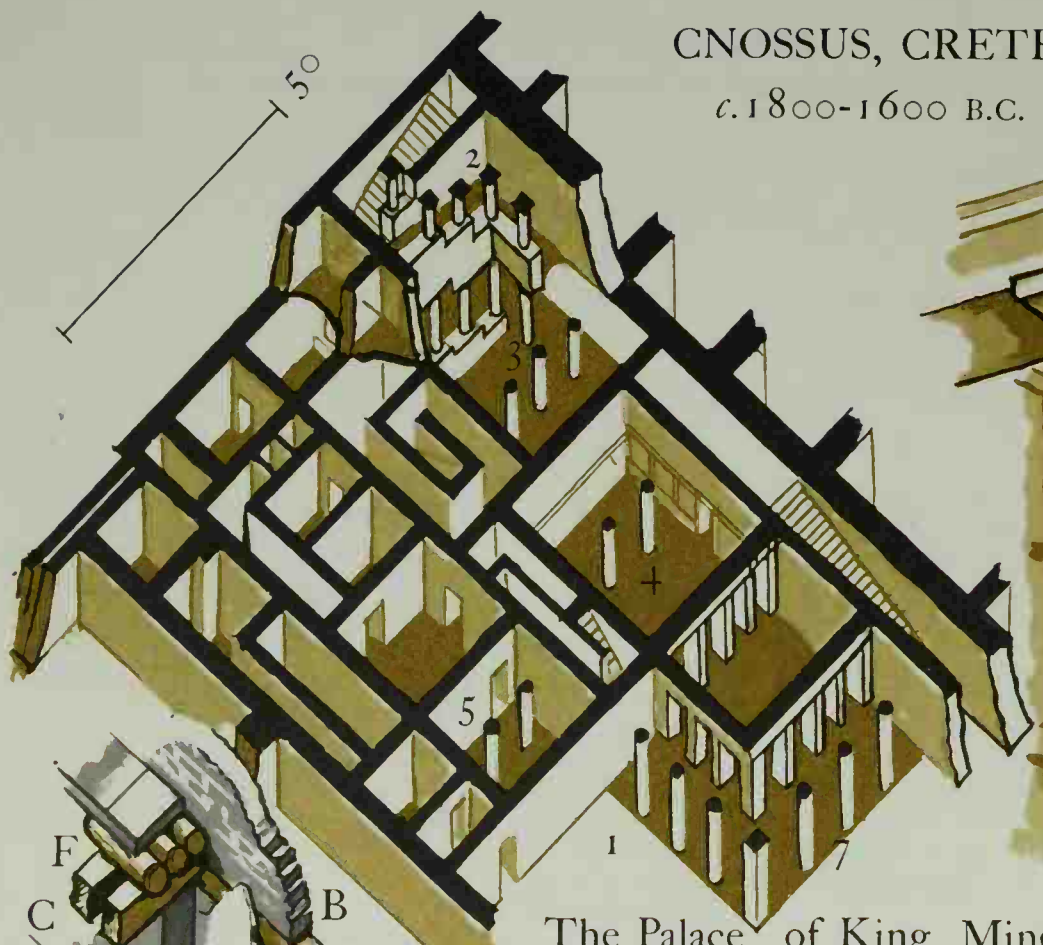
The Hellenistic Period began with the Empire created by Alexander the Great when many new cities were founded with monumental buildings.

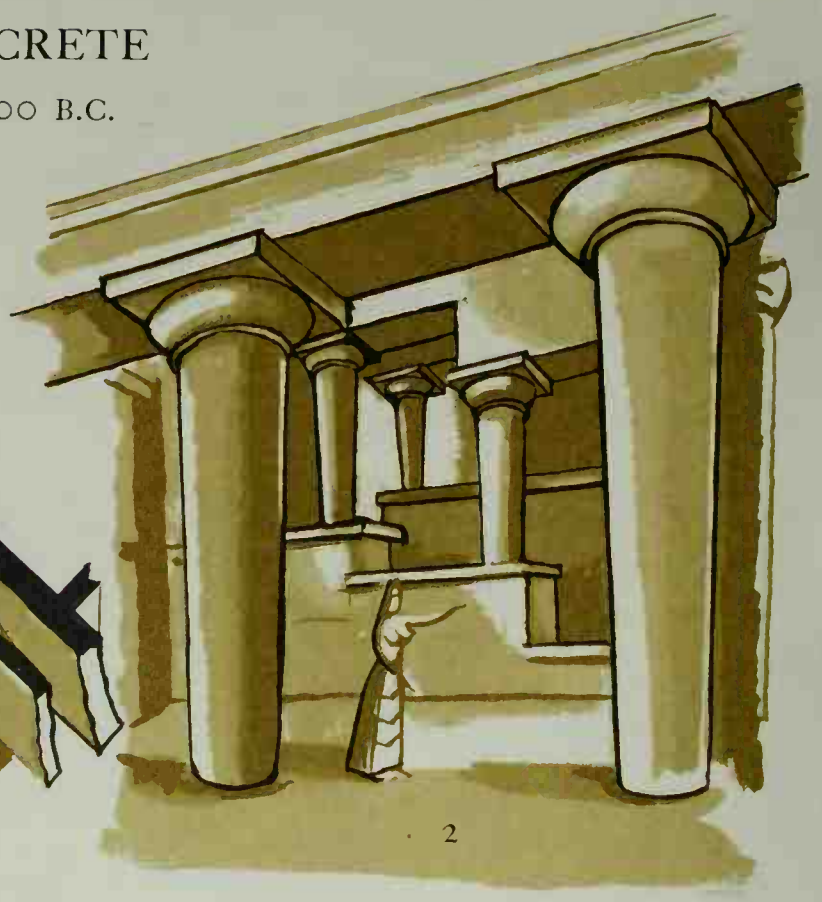
The Greek temple developed from the Mycenaean megaron built of sun-dried brick, stone and timber to house a deity and to be looked at from outside, not to contain a congregation within. The arch was known to the Greeks, but they based their temples on the column & beam. These developed from the 6th-4th centuries B.C., each with its own ratios of proportions established by experience. Columns were often placed closer than necessary to support the entablature in order to create a repetitive rhythm of solids and voids. Optical refinements displaying an appearance of vitality and strength have been measured in a number of them. Many architects wrote treatises about their buildings, cited by Vitruvius (1st cent. B.C.) who classified their plans and proportions.

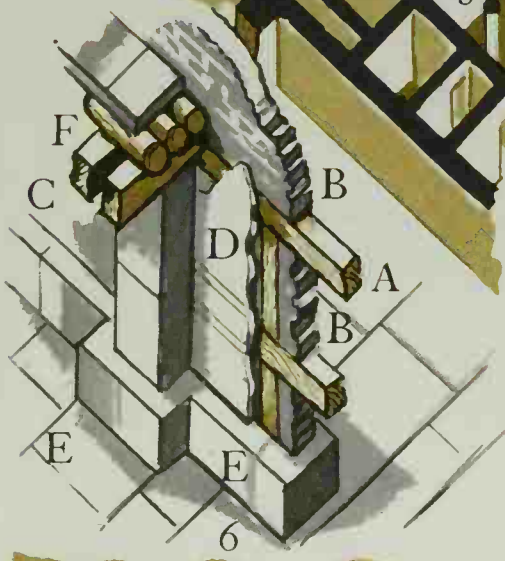
GREEK

CNOSSUS, CRETE

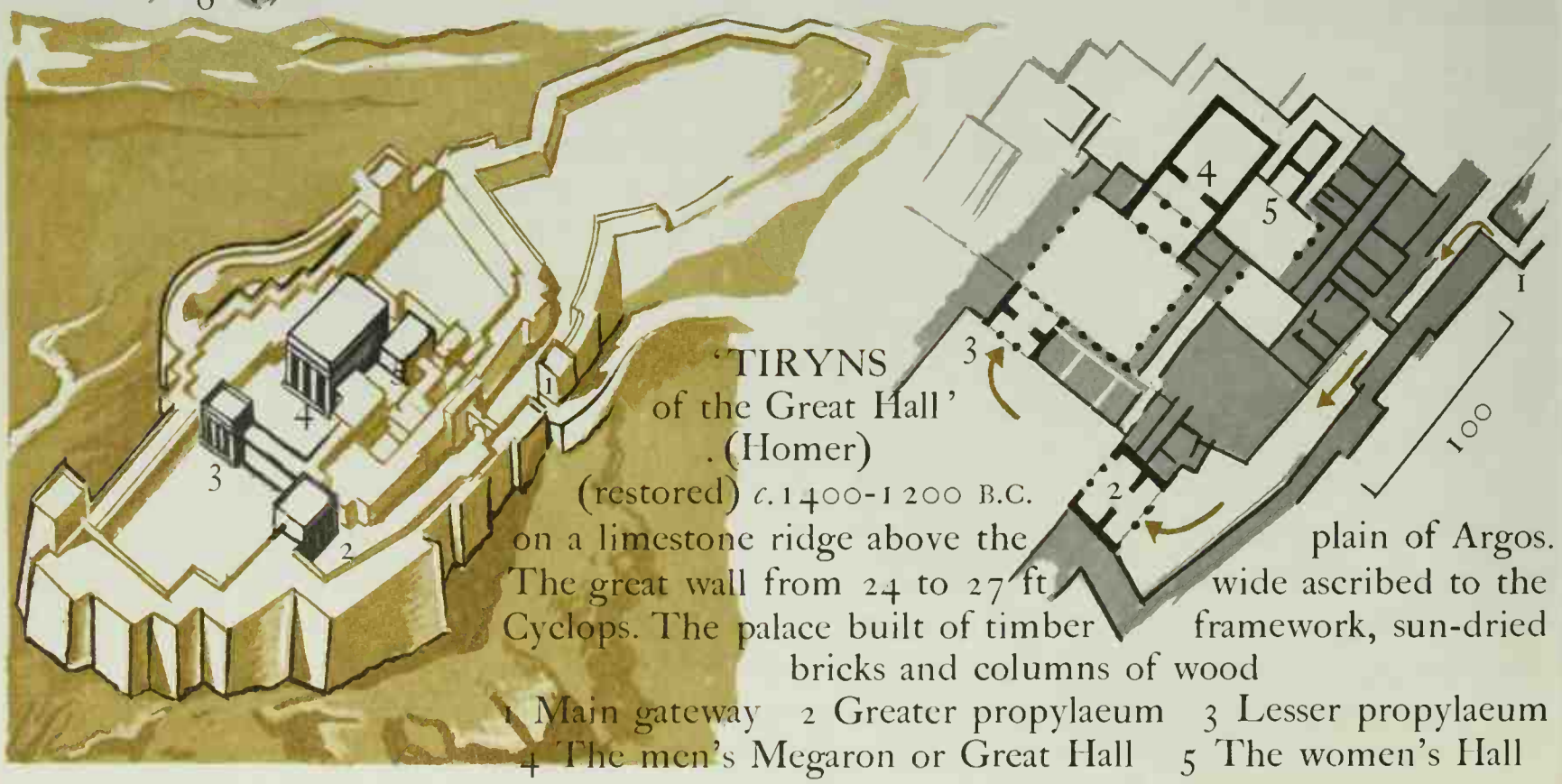
*c.*1800-1600 B.C.







The Palace of King Minos (restored), *c.*1800-1600 B.C.
1 The King and Queen's apartments 2 Great staircase 3 Hall of the Colonnade 4 Hall of the Double Axes 5 Queen's Megaron or Hall 6 Construction: A timber framework B sun-dried brick or rubble masonry C gypsum slabs or D plaster painted with frescoes E plinth and floor of gypsum or limestone F ceiling beams 7 Cypress columns



'TIRYNS
of the Great Hall'
. (Homer)
(restored) *c.*1400-1200 B.C.
on a limestone ridge above the plain of Argos.
The great wall from 24 to 27 ft wide ascribed to the Cyclops. The palace built of timber framework, sun-dried bricks and columns of wood
1 Main gateway 2 Greater propylaeum 3 Lesser propylaeum
4 The men's Megaron or Great Hall 5 The women's Hall

THE AEGEAN

MYCENAE (restored), *c.* 1350 B.C.
The citadel palace of Agamemnon,
Cyclopean walls of boulders weighing 5 to 6
tons were eased into alignment on pebbles

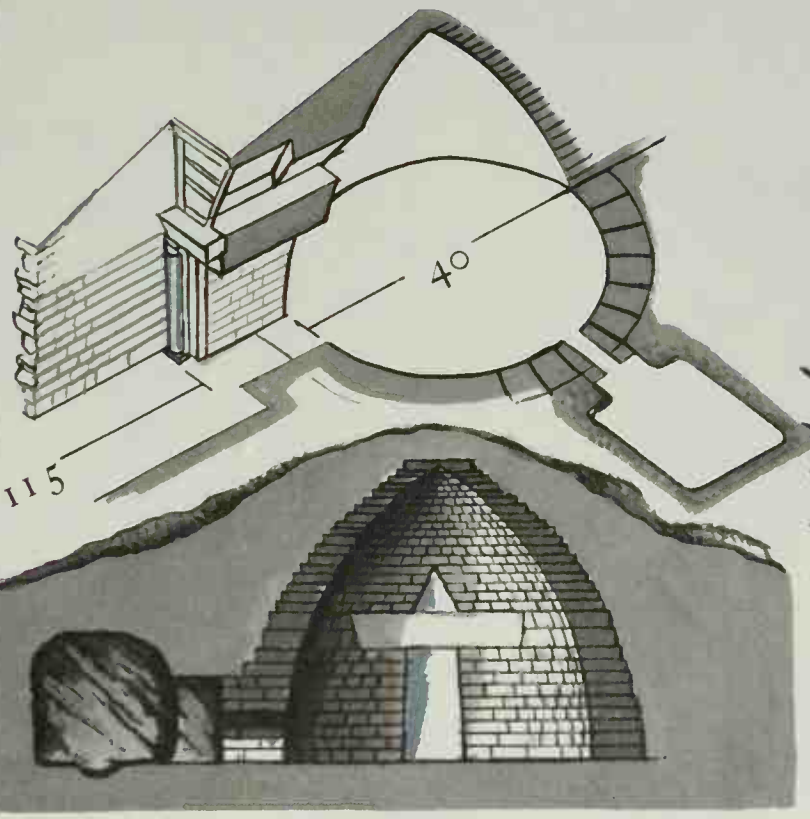
Lion Gate, Mycenae, *c.* 1200 B.C.

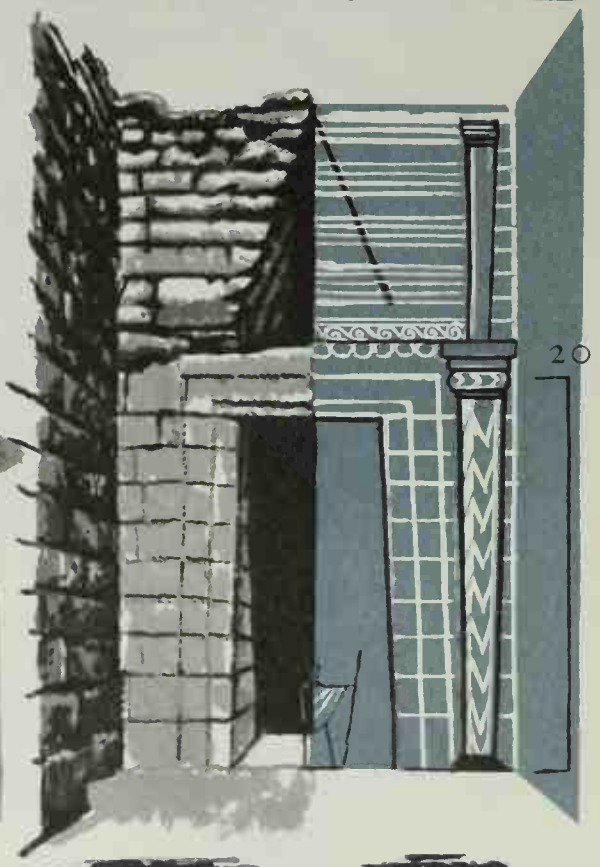
Cyclopean wall, Tiryns

Polygonal, Mycenae

Curvilinear, 7th cent.

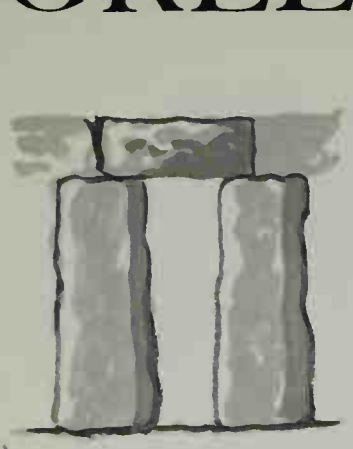
Rectangular, 5th cent.

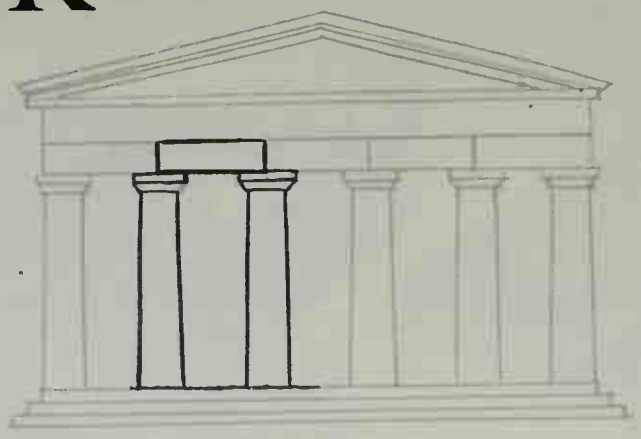


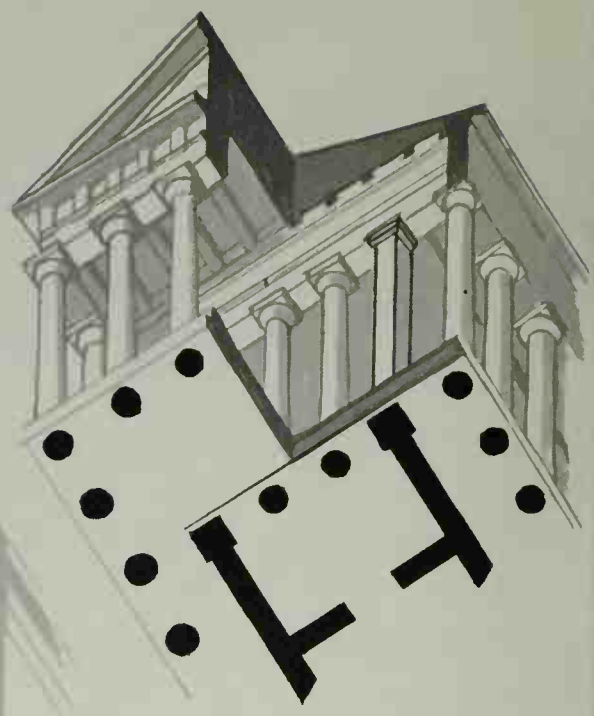


MYCENAE, The Treasury of Atreus,
1330-1300 B.C. One of some 40 beehive or
tholos tombs on the Greek mainland. Built of
horizontal overlapping courses of lime-stone or
corbelling without centering. The door-way
flanked by 2 green sandstone half-columns
with a relieving triangle above

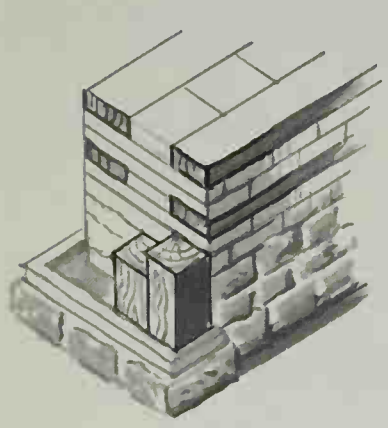
GREEK

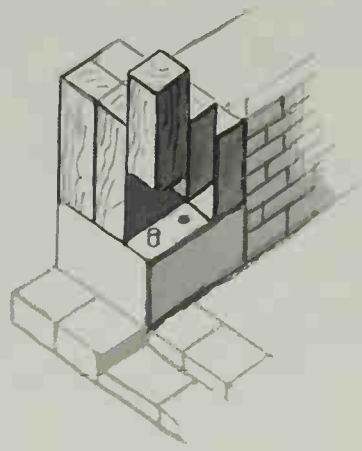






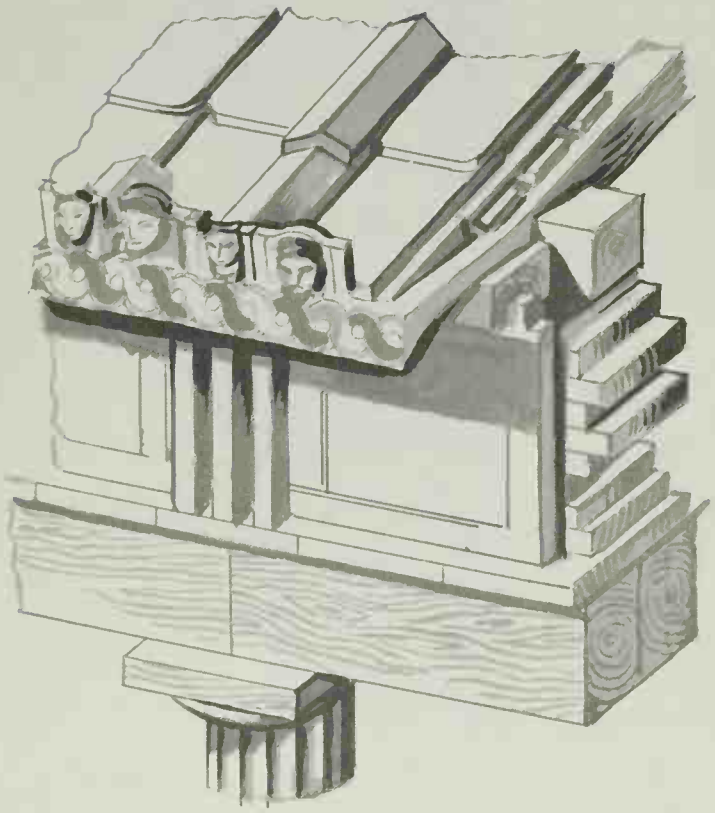
COLUMN AND BEAM



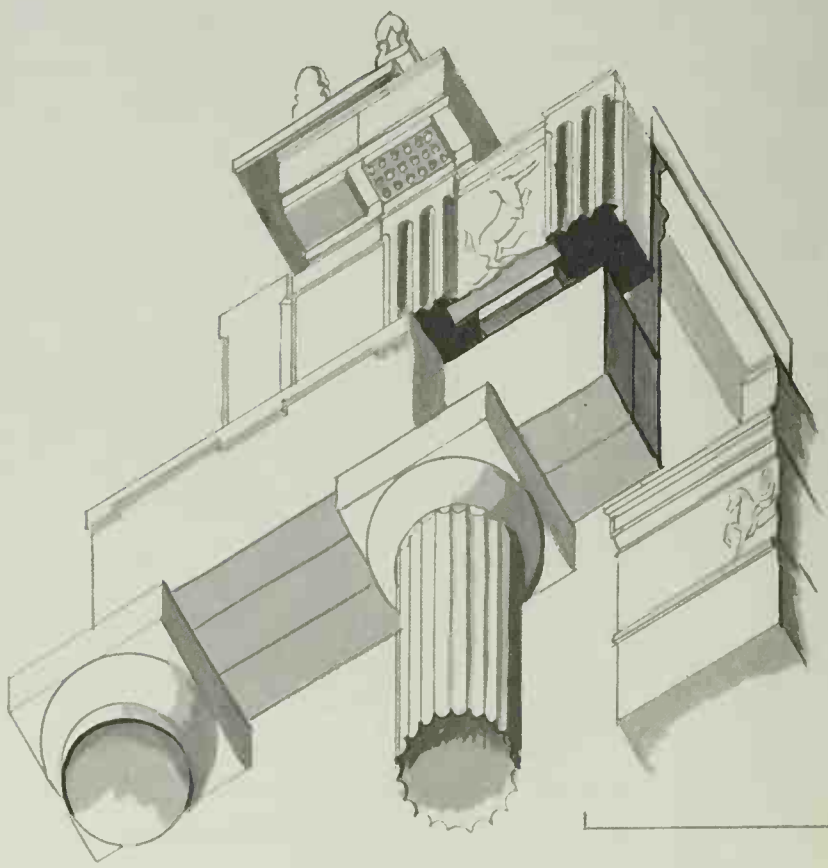


Stone beams of great span are liable to fracture, therefore columns were placed close together

TIMBER TO STONE ANTAE OR PILASTERS

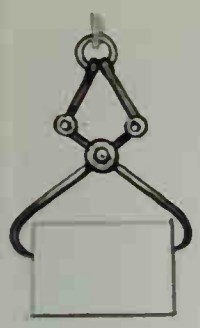


TIMBER construction, *c.*620 B.C.
Doric temple of Apollo, Thermum.
Wooden entablature and columns



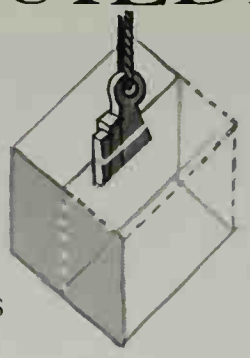
MARBLE construction, *c.*477-438 B.C.
The Parthenon, Athens

BUILDING METHODS



tongs

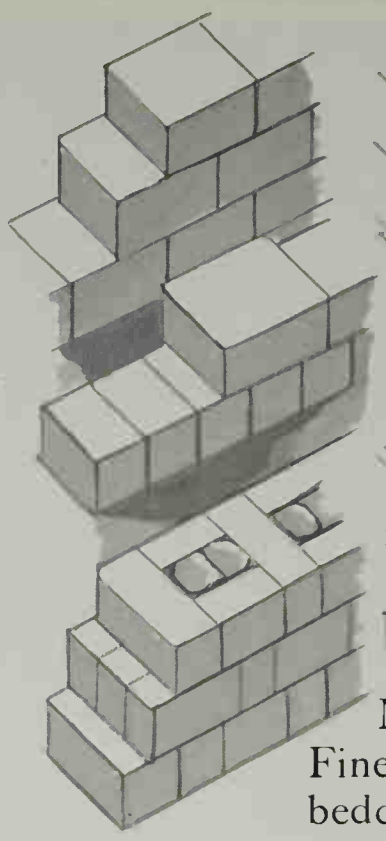
lewis

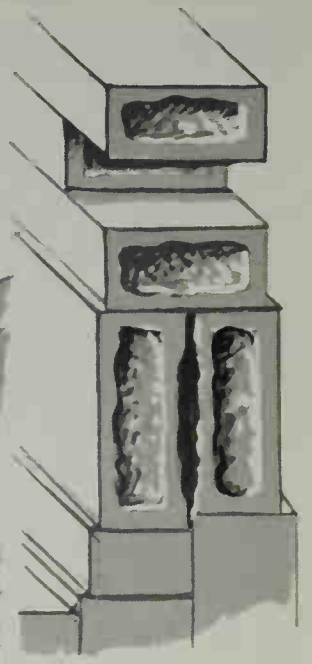


tongs

rope

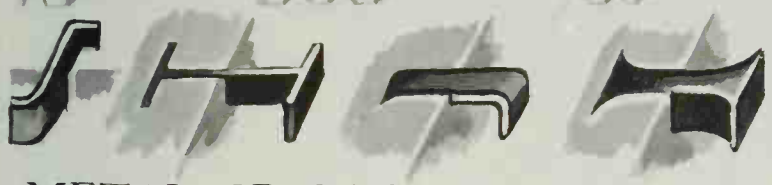
loops





MASONRY
Fine squared ashlar bedded and jointed without cement

LIFTING DEVICES

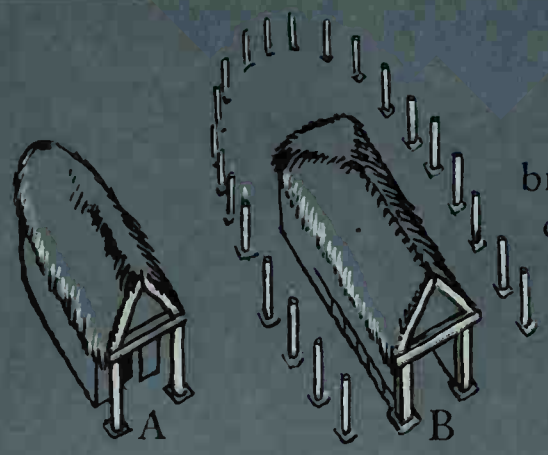


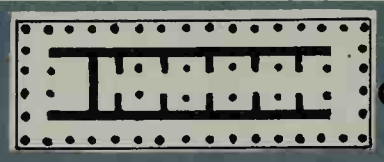
METAL CRAMPS set in molten lead

Stone left undressed to avoid damage in transport

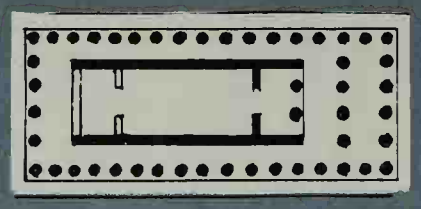
ERECTION OF A COLUMN

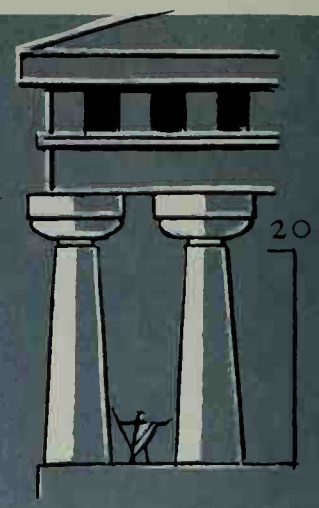
GREEK



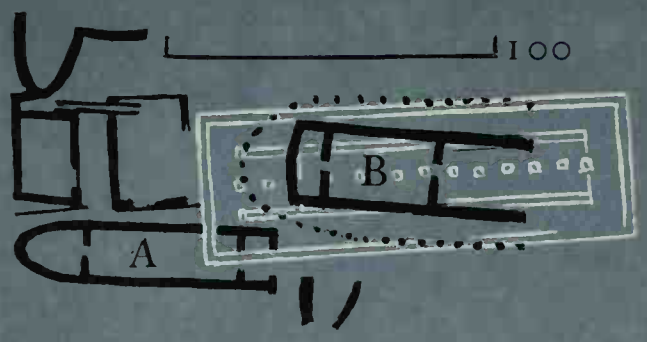


The Heraeum, Olympia, *c.*649 B.C.
Walls sun-dried brick. Stone replaced wood columns as they decayed. Gable roof with terracotta tiles





Temple of Apollo, Syracuse, *c.*575 B.C.
Monolithic stone columns

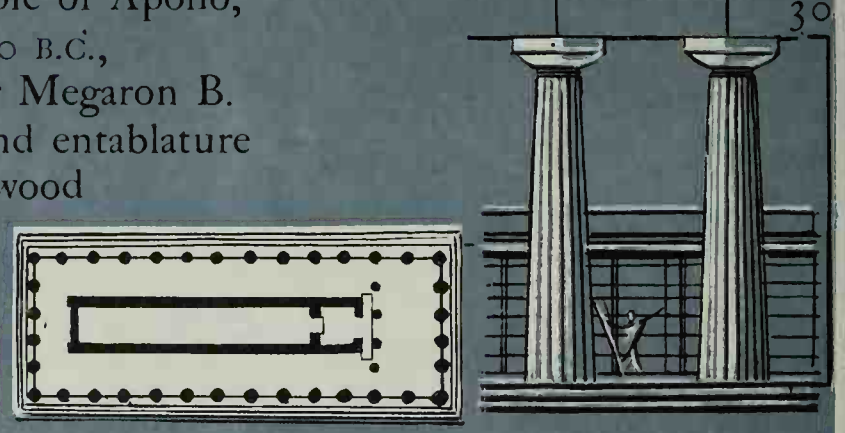


Sanctuary of Thermum, Aetolia

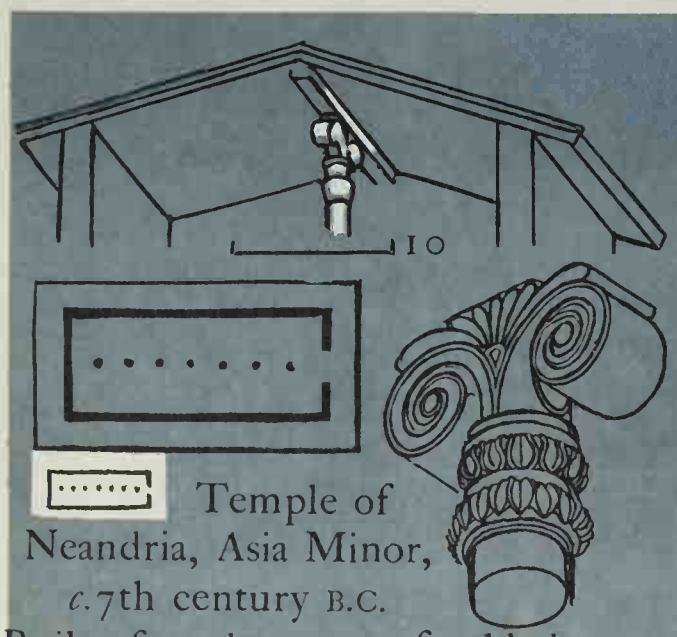
Megaron A, *c.*2000-1500 B.C.
Small stones carry walls of wood and clay, roof thatched with reeds

Megaron B, *c.*1000-800 B.C.
House or Temple. 18 posts formed the first known Greek peripteral temple scheme

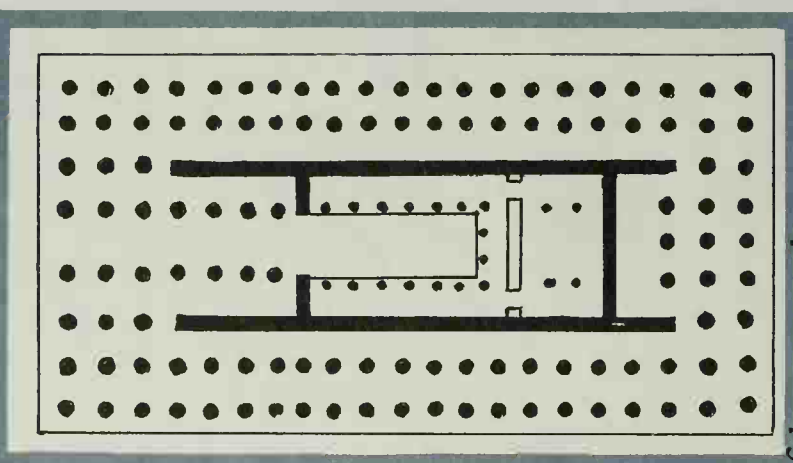
The Temple of Apollo, *c.*600 B.C., built over Megaron B.
Columns and entablature of wood



Temple F, Selinus, *c.*560 B.C.
Stone screens join the columns

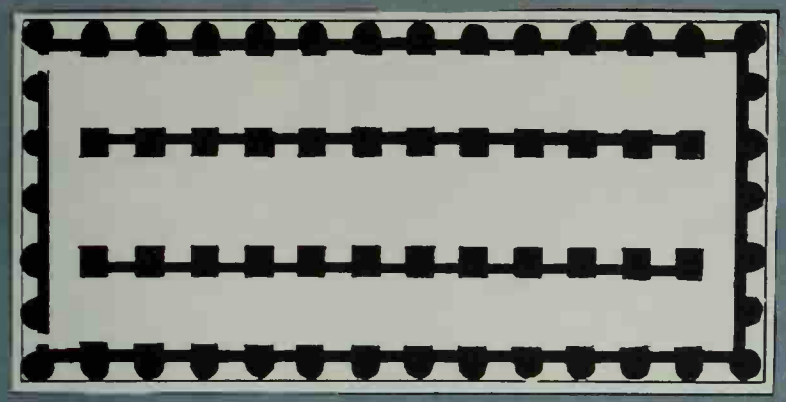


Temple of Neandria, Asia Minor, *c.*7th century B.C.
Built of sandstone, roof gabled with tiles, 7 stone columns have 'Aeolic' capitals, i.e. Asiatic-Ionic motifs.

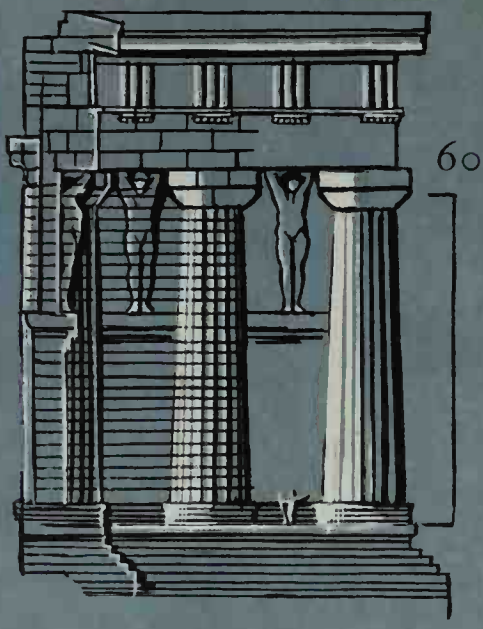


Archaic Temple of Artemis, Ephesus, *c.*560 B.C. Burnt down and rebuilt, 356 B.C.
Designed by Chersiphron of Cnossus and his son Metagenes who wrote a work on the temple, now lost, cited by Vitruvius.
Appearance conjectural, columns of marble, walls of limestone faced with marble

PLANS, DORIC & IONIC TEMPLES

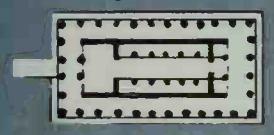


Temple of Zeus Olympius, Agrigentum,
*c.*480 B.C.
Built of coarse stone faced with marble dust cement; position of figures conjectural

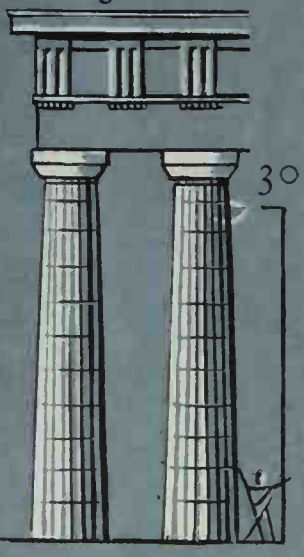


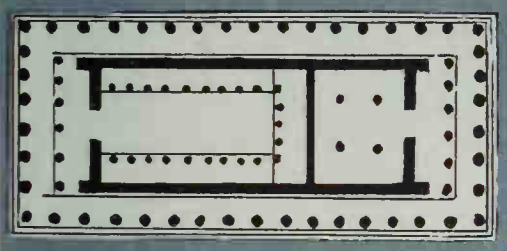
Plans
drawn in black
to the same scale

100

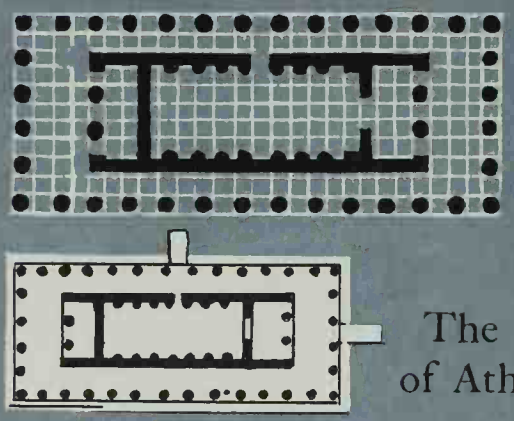


Temple of Aphaia, Aegina,
*c.*490 B.C.

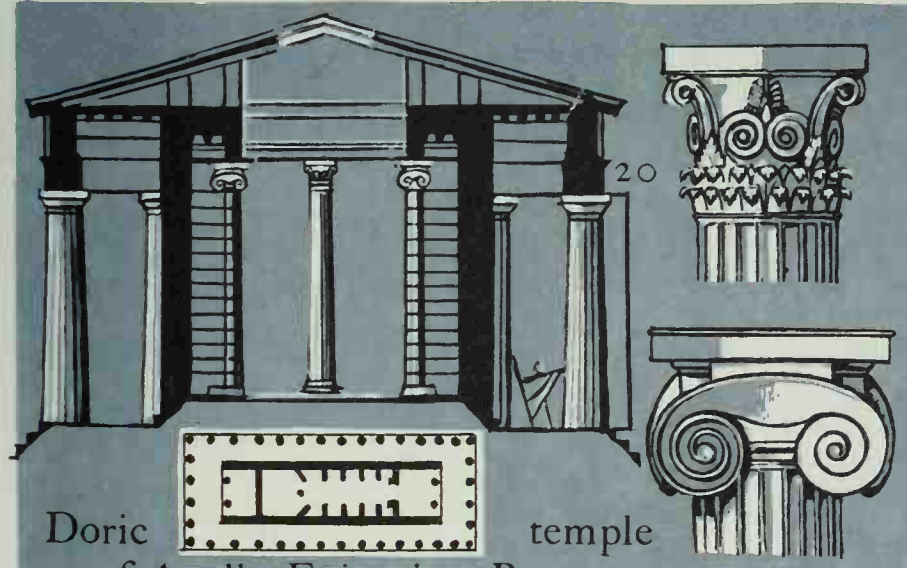




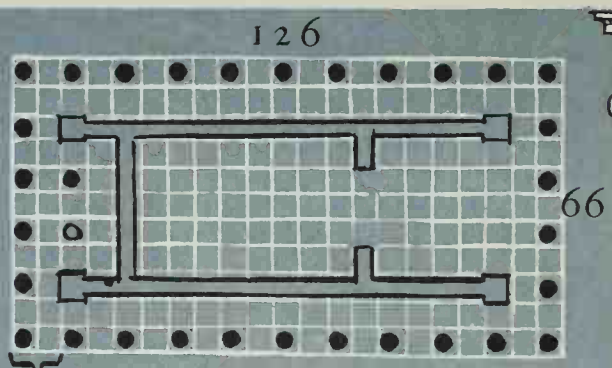
The Parthenon, Athens,
447-432 B.C.
Ictinus and Callicrates architects, Pheidias master sculptor; built of white marble

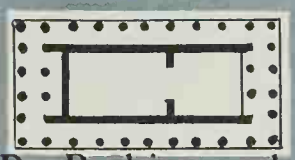


The Doric Temple
of Athena Alea, Tegea,
*c.*353 B.C.
Designed by the sculptor Scopas, the interior had 14 Corinthian engaged columns



Doric temple
of Apollo Epicurius, Bassae, *c.*430 B.C.
By Ictinus, architect of the Parthenon, Athens.
The Corinthian order used for the first time
Built of fine-grained, brittle grey limestone;
details in marble, roof of thin marble slabs.





Ionic temple
of Athena Polias,
Priene, *c.*334 B.C.
By Pythios, architect and sculptor of the Mausoleum, Halicarnassus, who wrote a book on the temple, since lost.
All the measurements are in multiples of the Ionic foot, i.e. 11·587 inches.

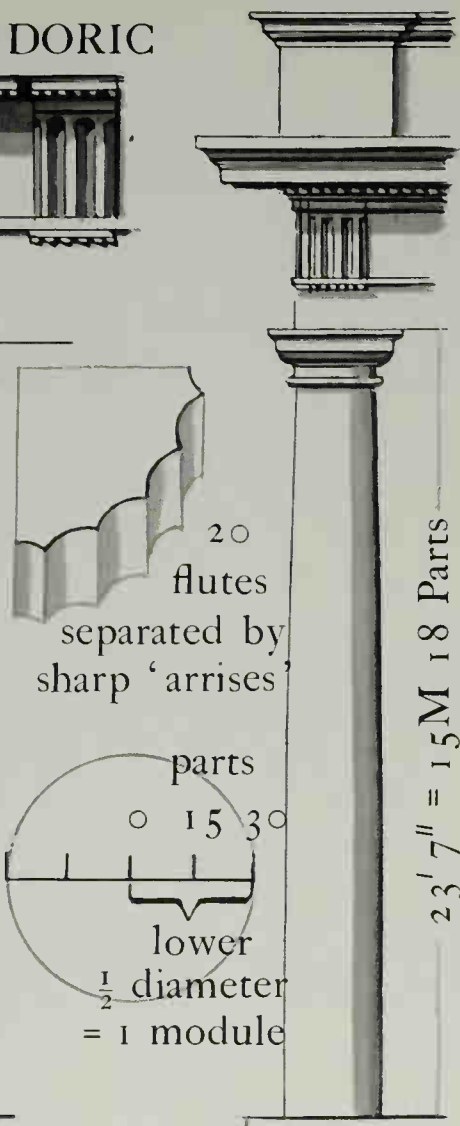
GREEK & ROMAN

DORIC

IONIC

Greek

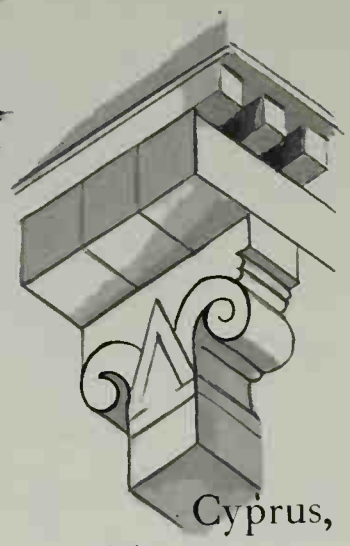
The Theseion, Athens



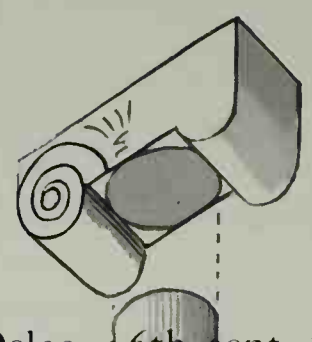
Roman

Theatre of Marcellus, Rome

20 flutes separated by sharp 'arrises'

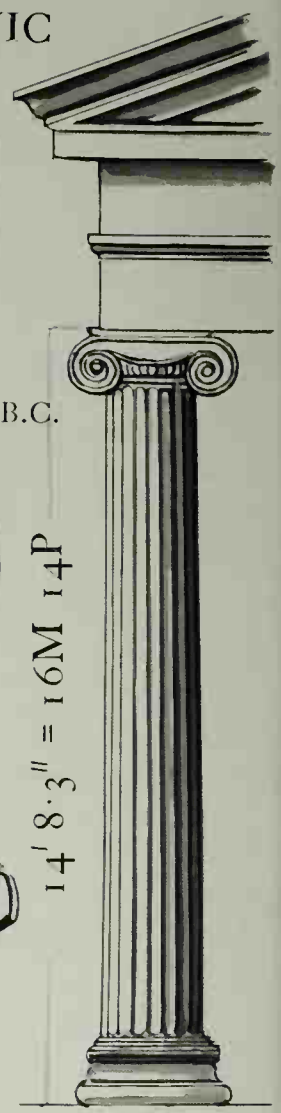


Cyprus, *c.*6th cent. B.C.



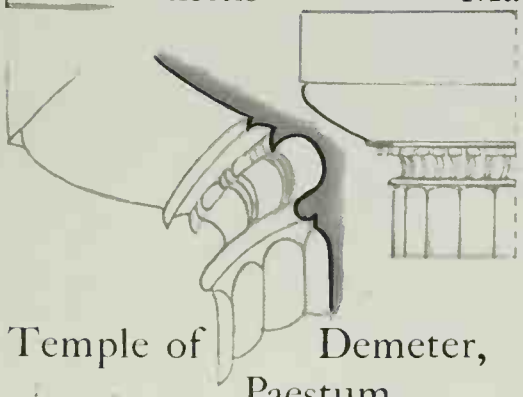
Delos, *c.*6th cent. B.C.

Neandria, *c.*6th cent. B.C.

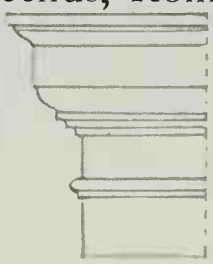


Greek

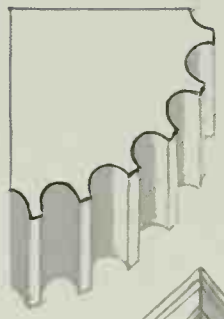
Temple on the Ilissus, Athens



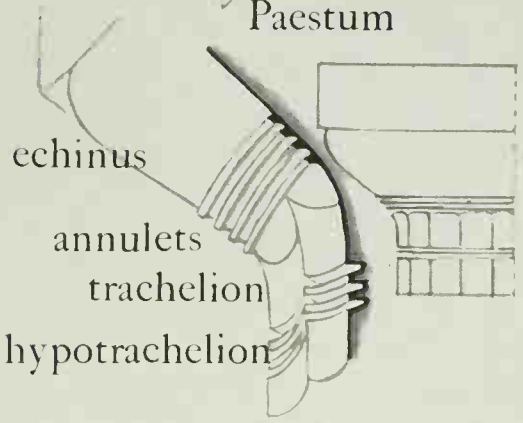
Temple of Demeter, Paestum



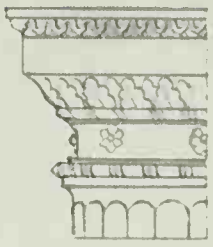
Theatre of Marcellus, Rome



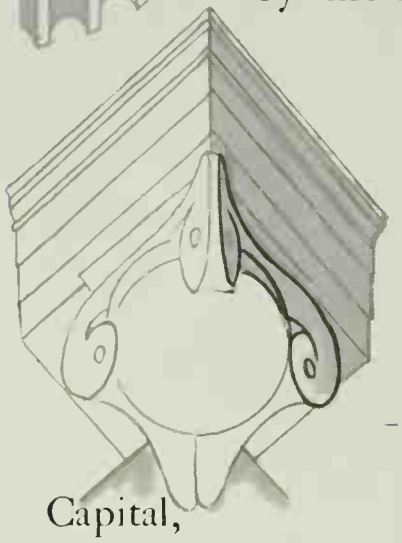
Ionic and Corinthian; 24 flutes separated by fillets



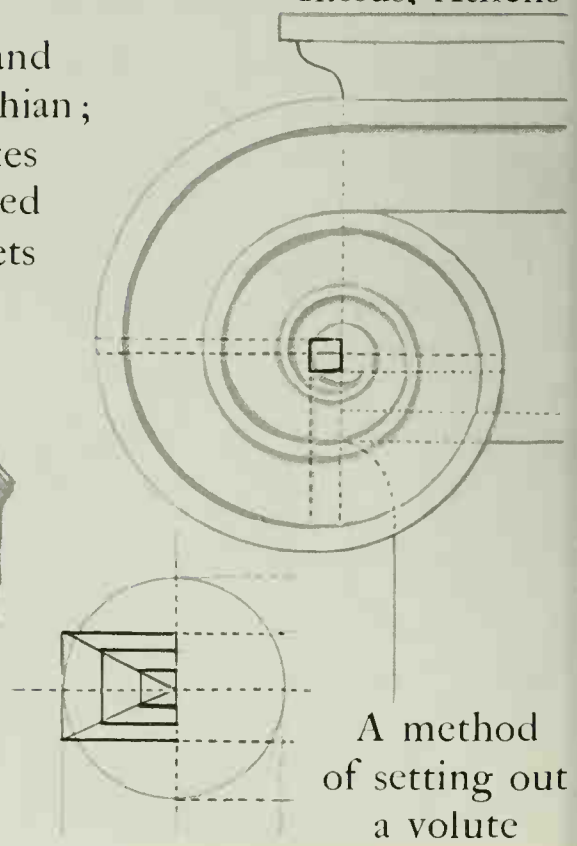
Temple of Aphaia, Aegina



Thermae of Diocletian, Rome



Capital, angle column



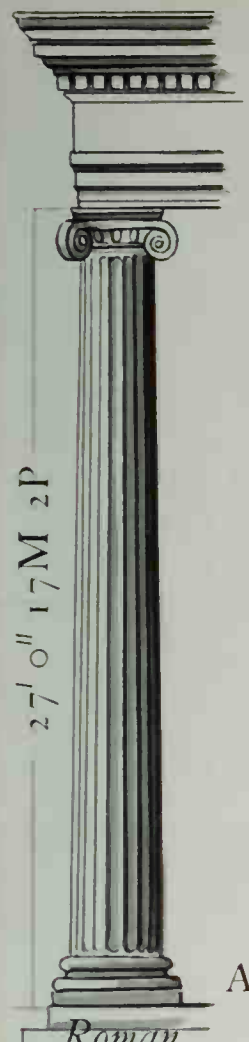
A method of setting out a volute

THE FIVE ORDERS

CORINTHIAN

COMPO-SITE

TUSCAN

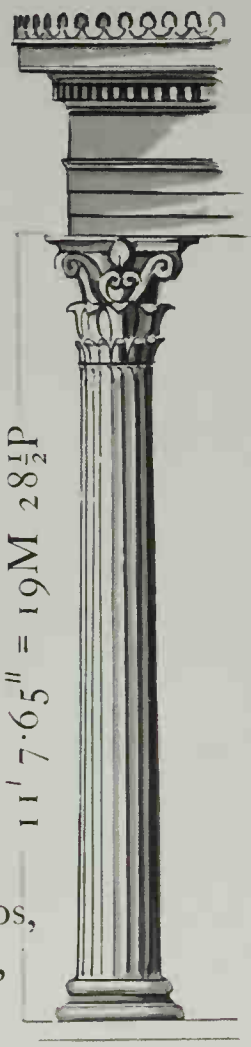


Roman
Temple Fortuna Virilis, Rome

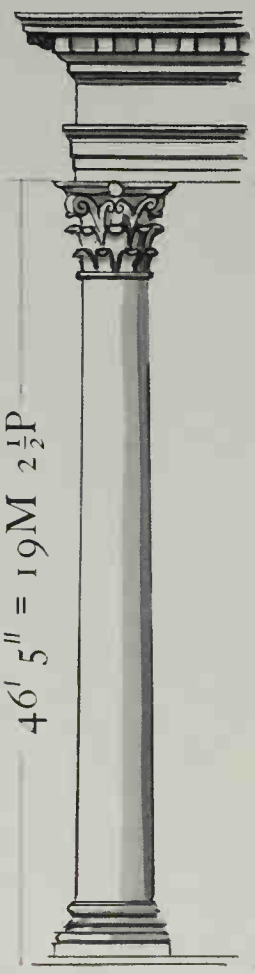
Egypt, Dynasty XIX

Tower of the Winds, Athens, *c.*334

The Tholos, Epidaurus, *c.*360 B.C.

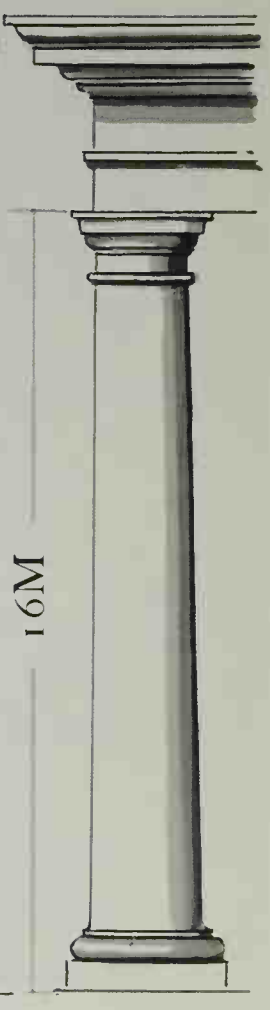


Greek
Choragic Monument, Athens



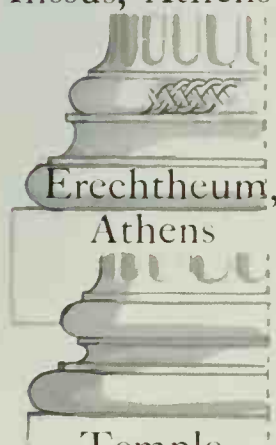
Roman
The Pantheon. Rome

Roman
Arch of Severus, Rome



Roman
Vitruvius (IV,7)

Ilissus, Athens



Erechtheum, Athens

Temple Fortuna Virilis, Rome

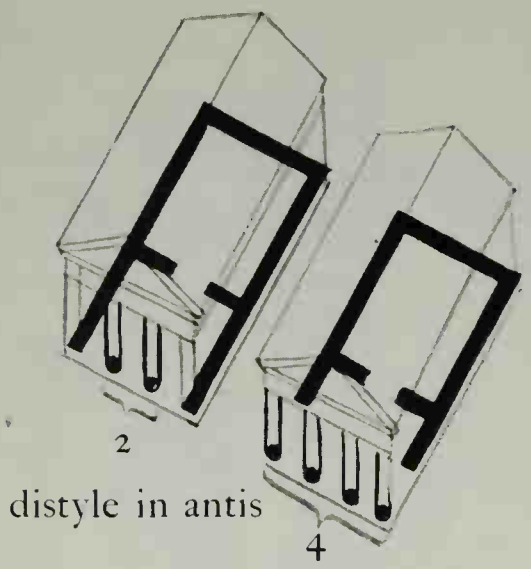
The Olympieum, Athens, *c.*174 B.C. Capitals taken to Rome, 86 B.C.

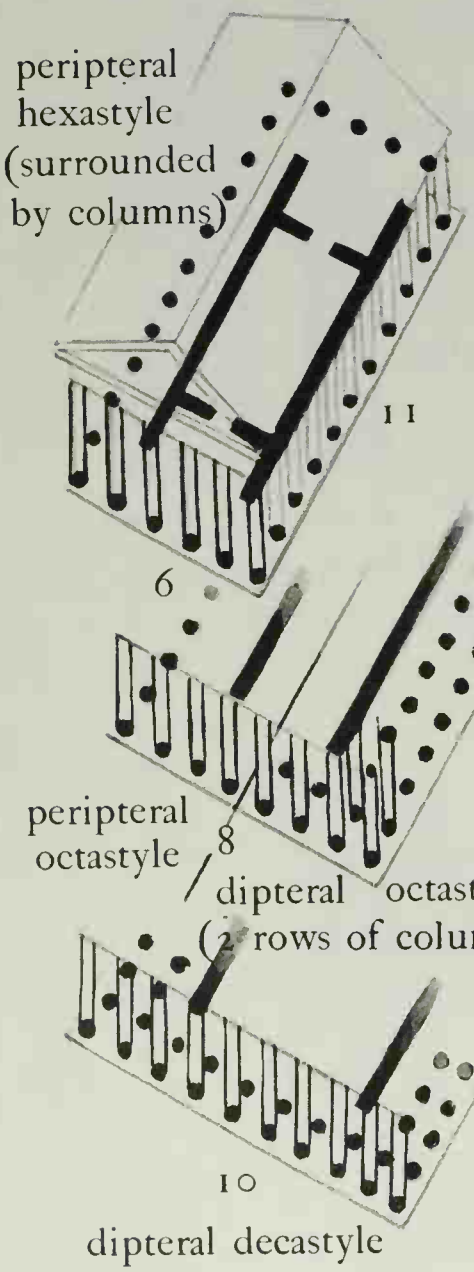
Temple of Castor and Pollux, Rome, A.D. 16

Arch of Titus, Rome, A.D. 81

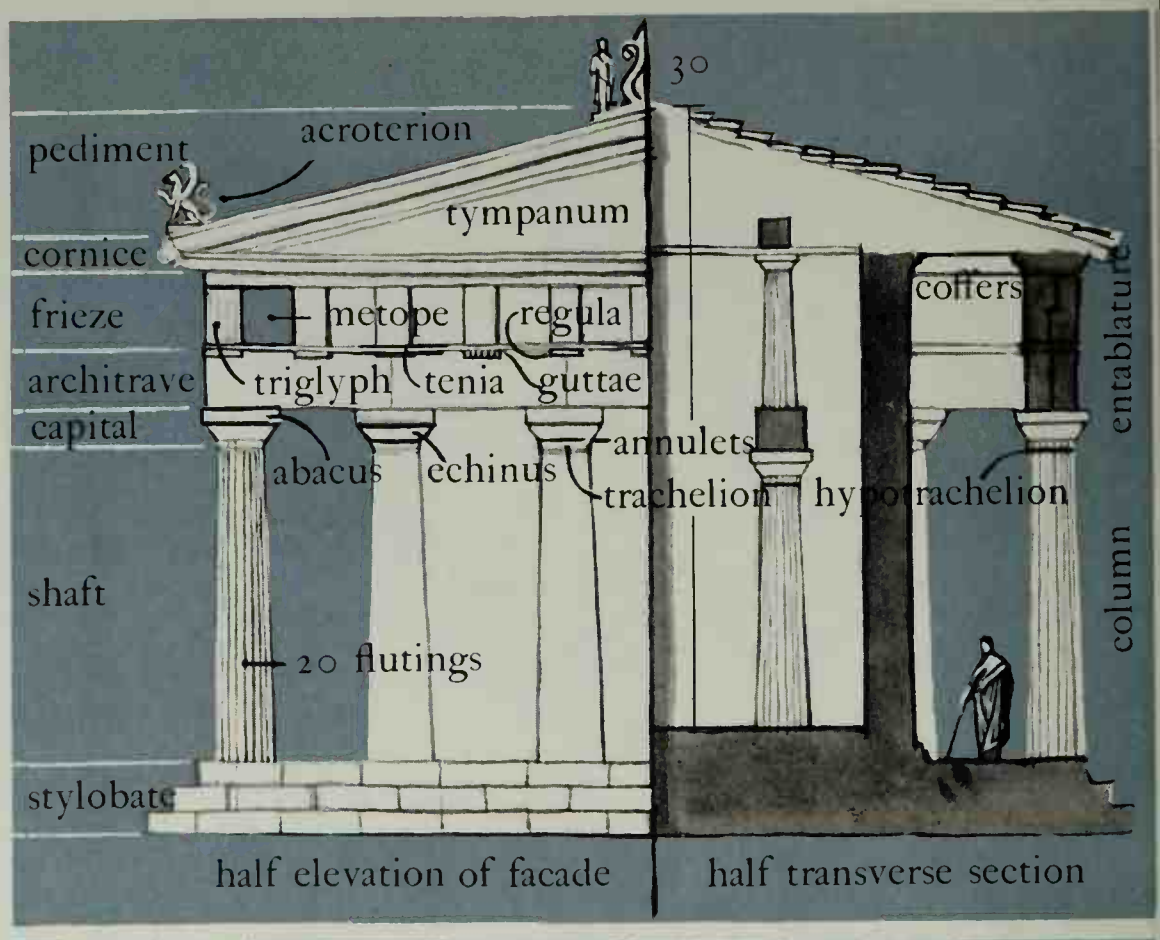
From *The Five Orders of Architecture* by Vignola (A.D. 1509-73)

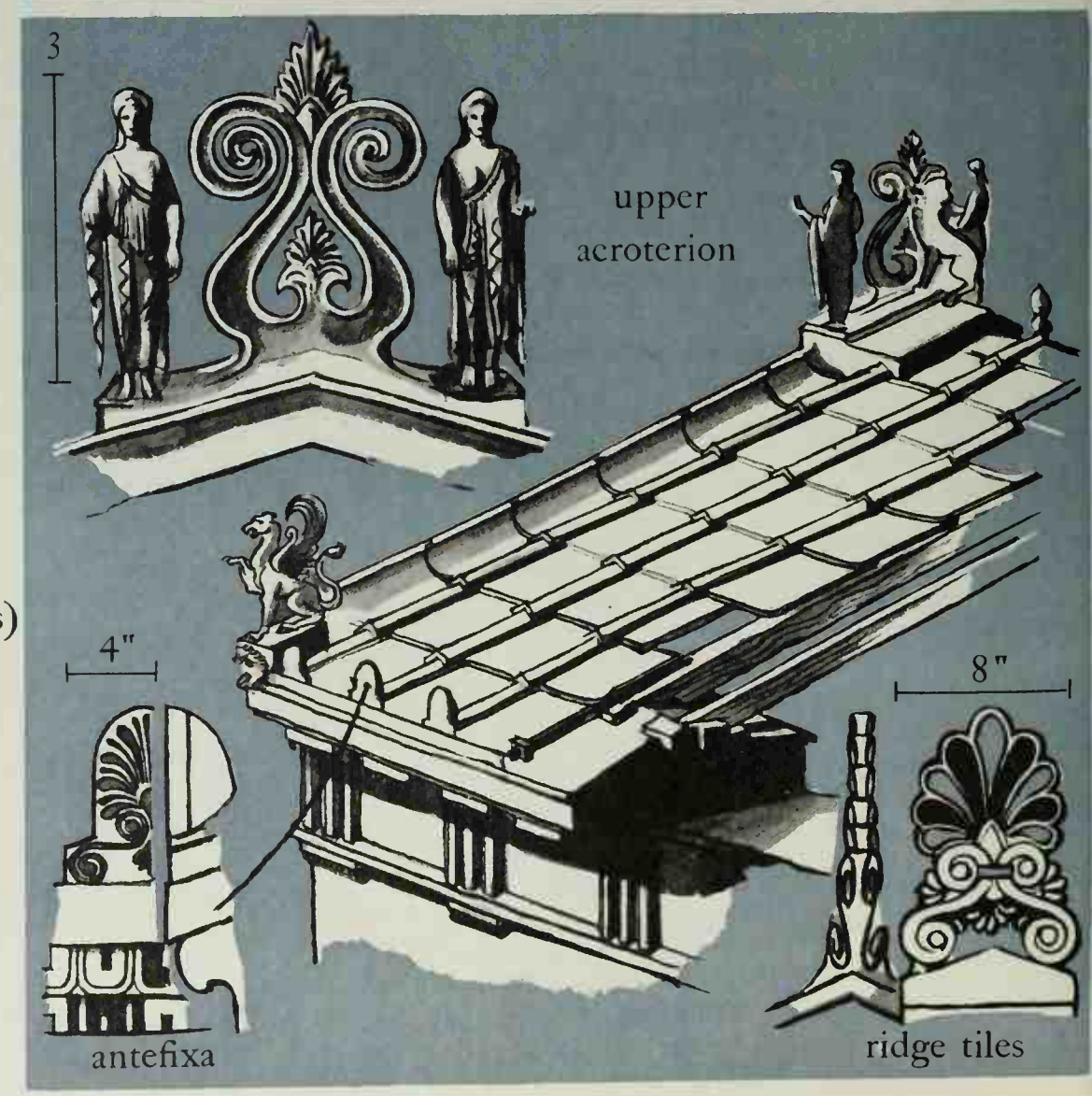
GREEK



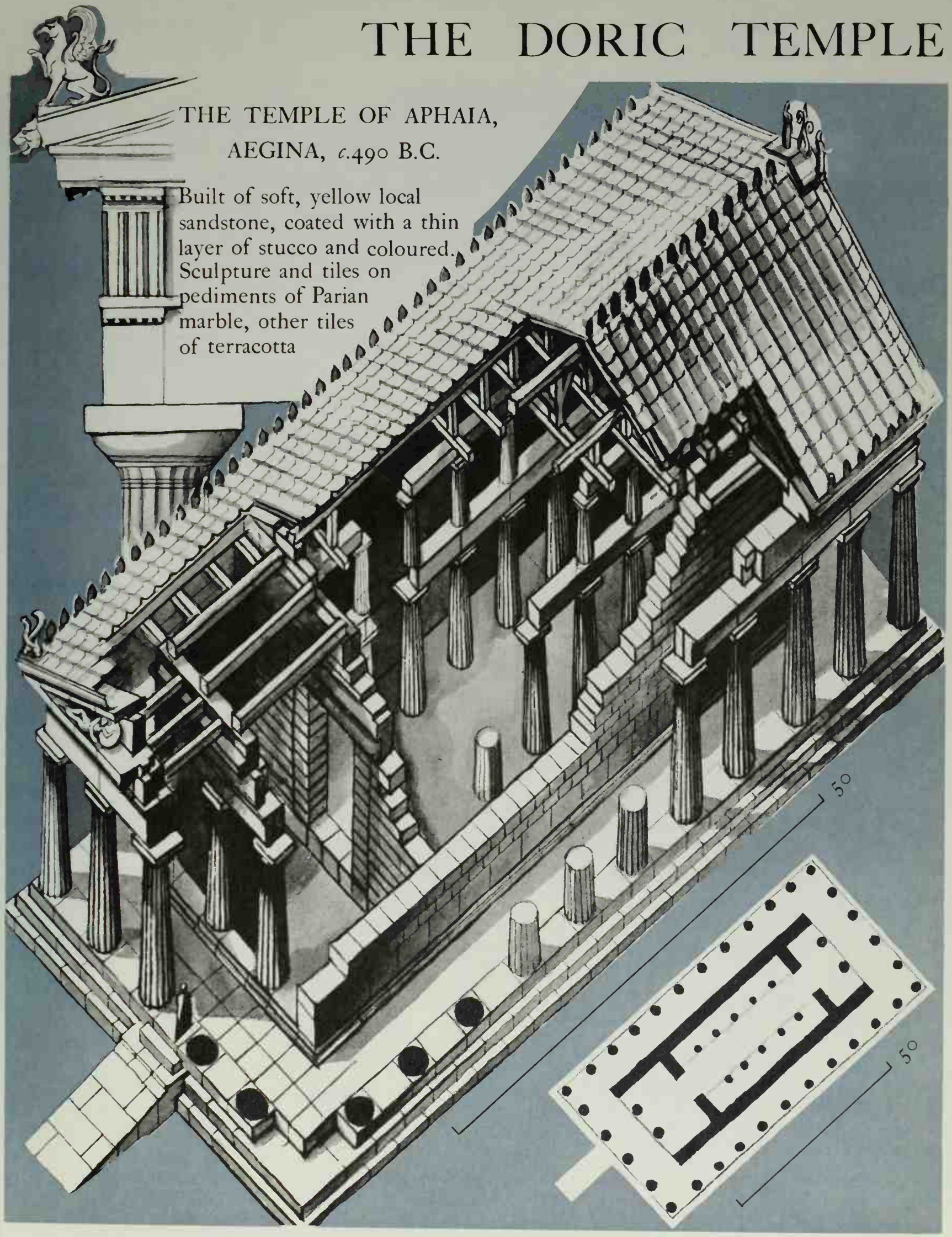


Classification of columnan arrangement according to Vitruvius (III, 2)





THE DORIC TEMPLE



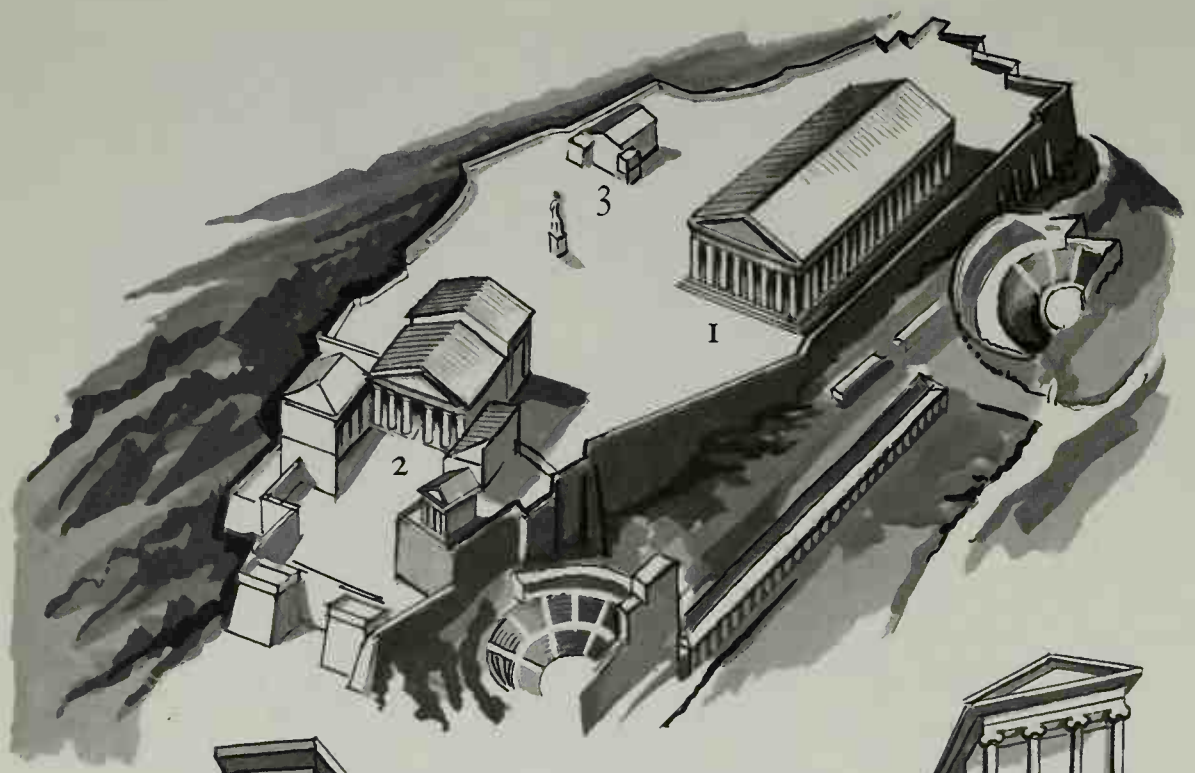
THE TEMPLE OF APHAIA,
AEGINA, *c.*490 B.C.

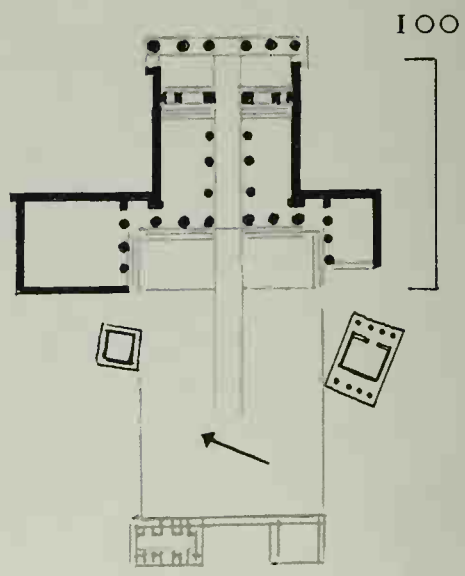
Built of soft, yellow local sandstone, coated with a thin layer of stucco and coloured. Sculpture and tiles on pediments of Parian marble, other tiles of terracotta

GREEK ATHENS,

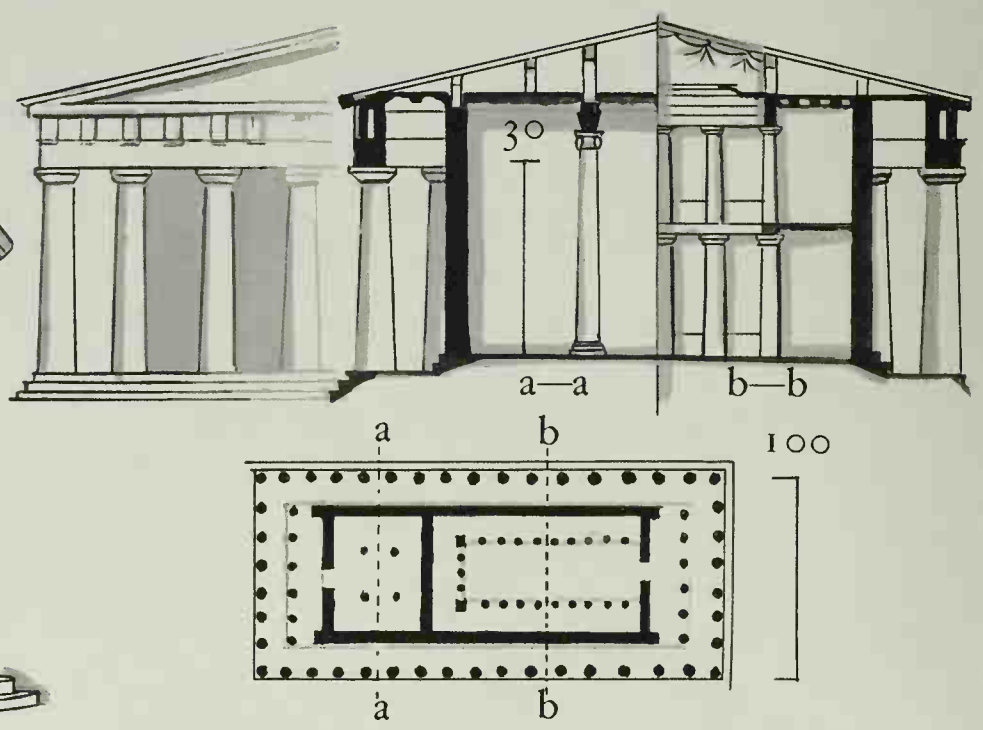
Between the Greeks' defeat of the Persians in 479 B.C. and the Peloponnesian War (431-404 B.C.) Athens rose to her zenith; under the leadership of Pericles buildings were erected on the Acropolis:

1 The Parthenon
2 The Propylaea
3 The Erechtheum (restored)



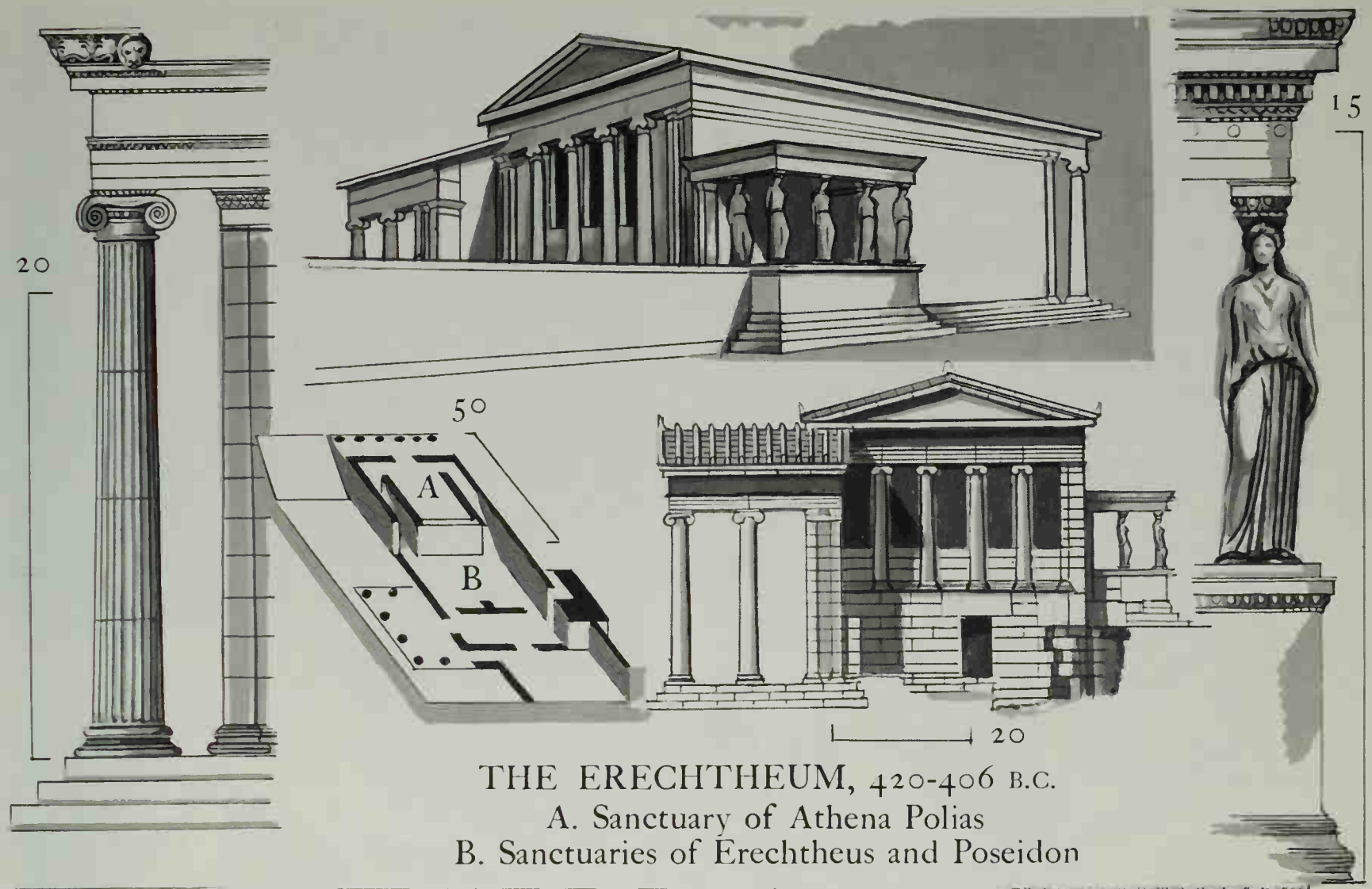


THE PROPYLAEA, entrance to the Acropolis, 437-432 B.C. Mnesicles, architect. Built of marble

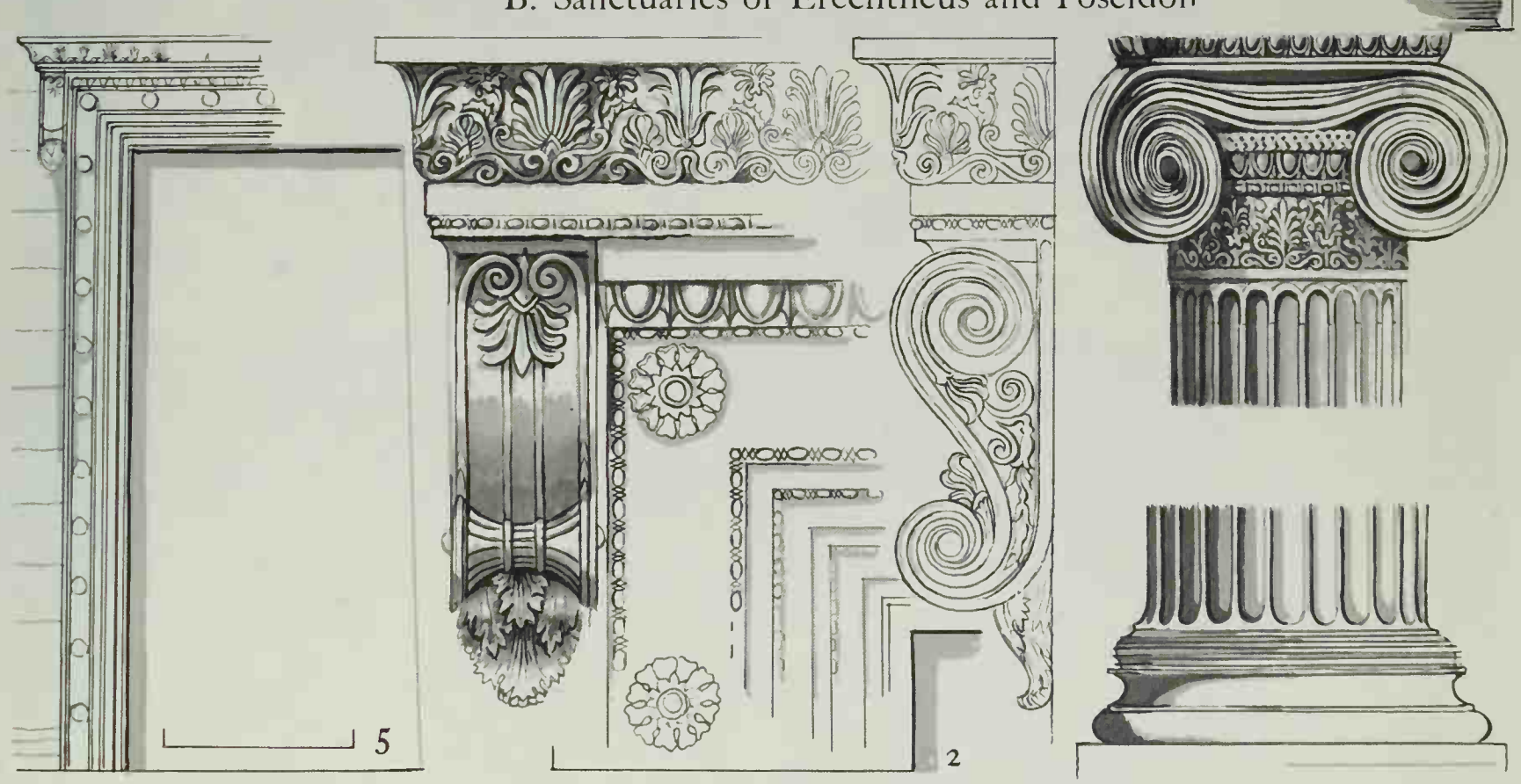


THE PARTHENON, 447-432 B.C. Doric temple dedicated to Athena. Ictinus and Callicrates, architects; Phidias, master sculptor. Optical refinements p. 38

BUILDINGS ON THE ACROPOLIS



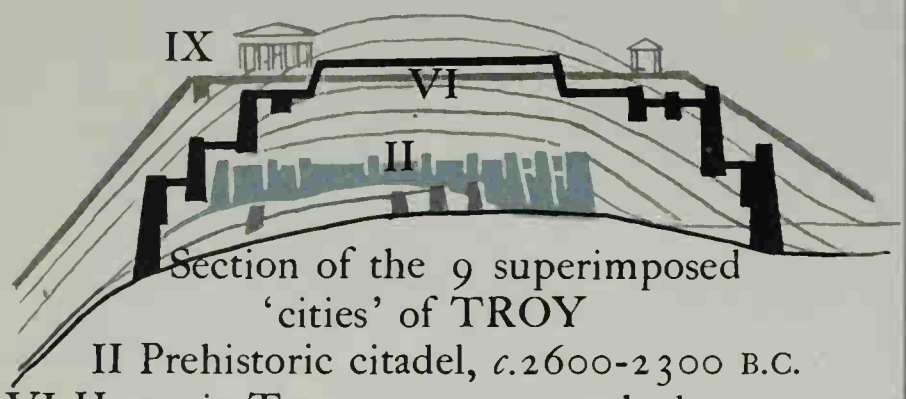
THE ERECHTHEUM, 420-406 B.C.
A. Sanctuary of Athena Polias
B. Sanctuaries of Erechtheus and Poseidon



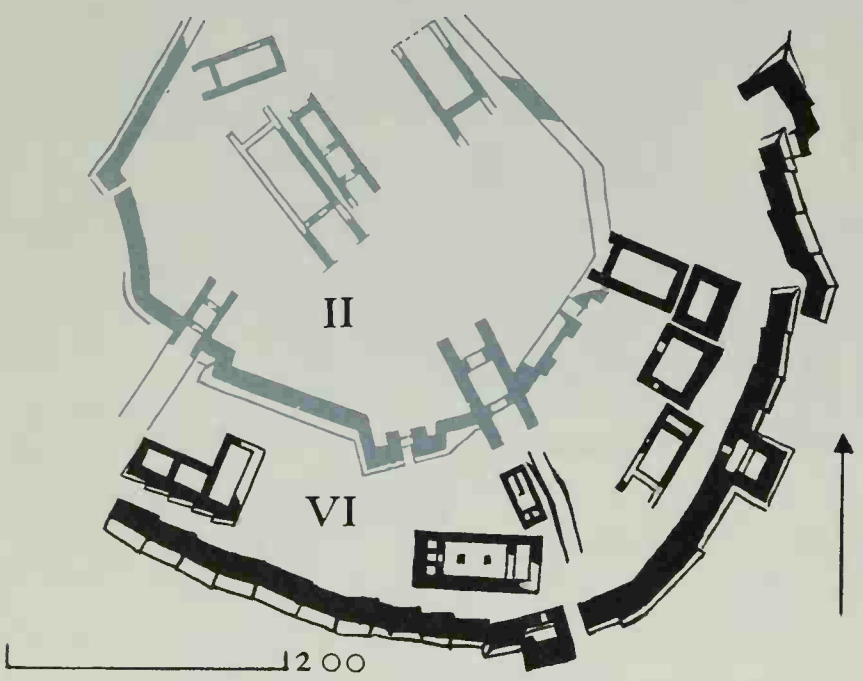
Possible architect Mnesicles. The caryatids and column capitals may have been designed by Callimachus, inventor of the Corinthian capital. Built on 4 levels, irregular in plan to preserve places sacred to Athens; built of white marble

GREEK CITY

AEGEAN



Section of the 9 superimposed 'cities' of TROY
II Prehistoric citadel, *c.*2600-2300 B.C.
VI Homeric Troy, 1900 B.C.; sacked *c.*1200 B.C.
IX The Roman acropolis, *c.*30 B.C.-A.D. 14.



Plan of selected buildings, Troy
II Prehistoric citadel VI Homeric Troy

HELLENIC

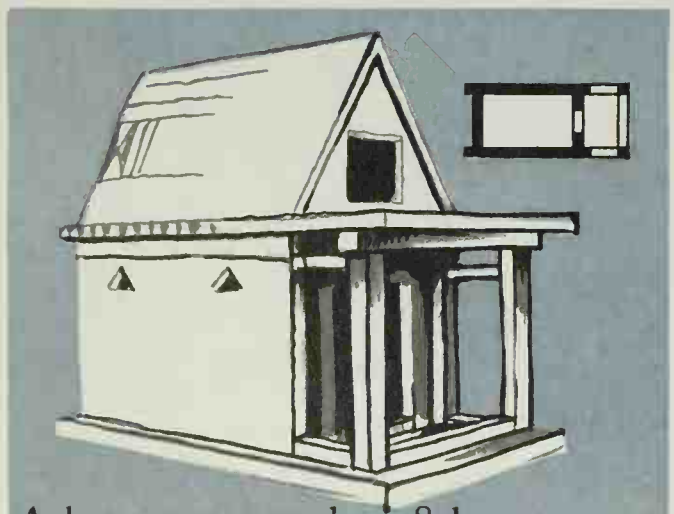
Little is known of Greek city planning before Hippodamus laid out his native city

MILETUS
*c.*479 or 466 B.C.

and 'discovered the method of dividing up cities' (Aristotle *Politics*)

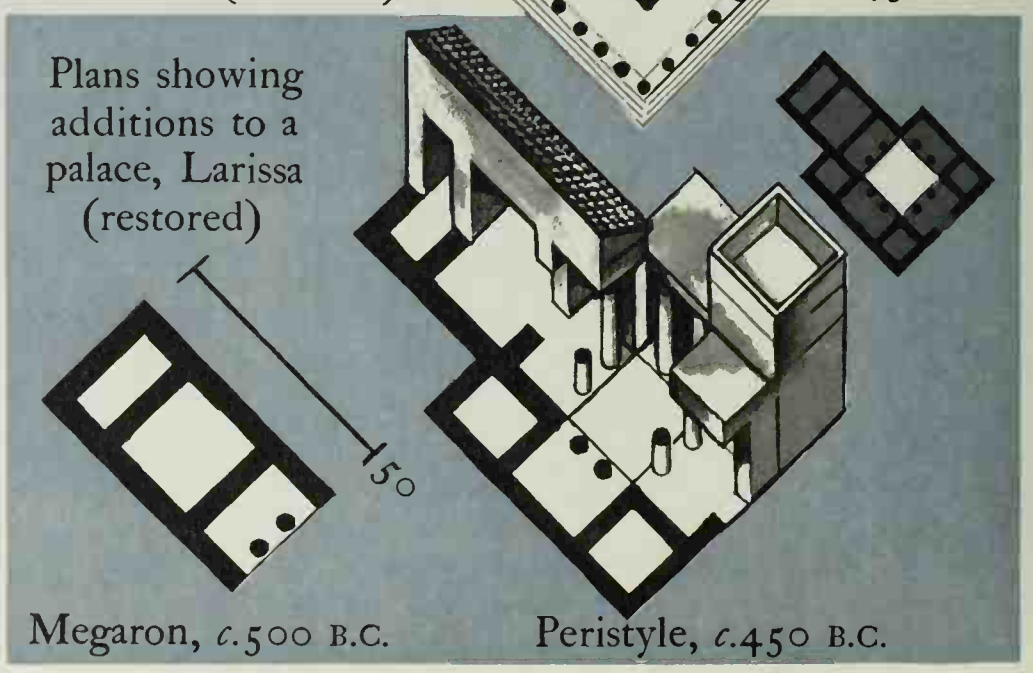
The Telesterion or Hall of the Mysteries, Eleusis

Scheme of Ictinus (restored), *c.*430 B.C.



A house or temple, *c.*8th cent. B.C. after a terracotta model from Argive Heraeum

Plans showing additions to a palace, Larissa (restored)



Megaron, *c.*500 B.C.

Peristyle, *c.*450 B.C.

PLANS, BUILDINGS AND HOUSES

City state of PRIENE, *c.*350 B.C.; about 5000 inhabitants

theatre

Temple of Athena

gymnasium

council hall

agora

1000

HELLENISTIC

Dynamic planning Upper citadel, PERGAMUM, *c.*241-159 B.C.

store houses

barracks

palaces

temple

gateway

library

theatre

altar

agora

500

council hall

250

temple

Agora or market place, Priene (restored)

The Bouleuterion or Council Hall, Miletus (restored), *c.*175-164 B.C.

100

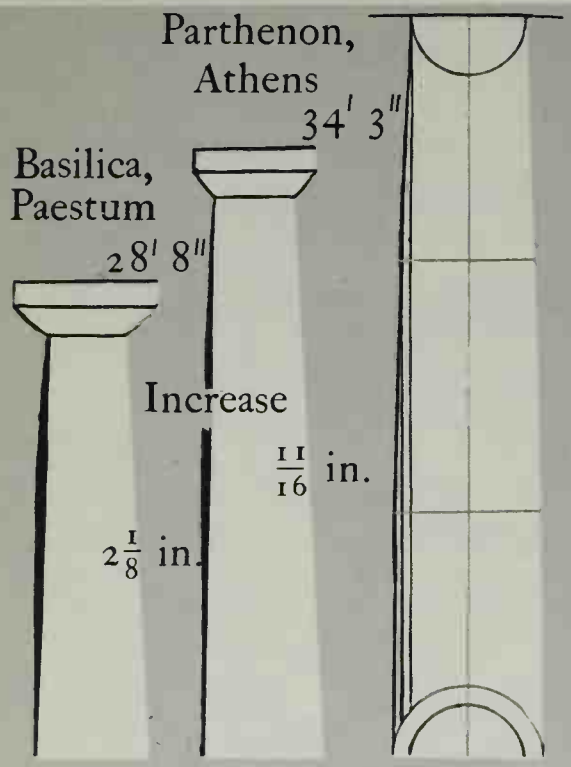
50

House, Priene, *c.*350 B.C. Built of stone and sun-dried bricks (restored)

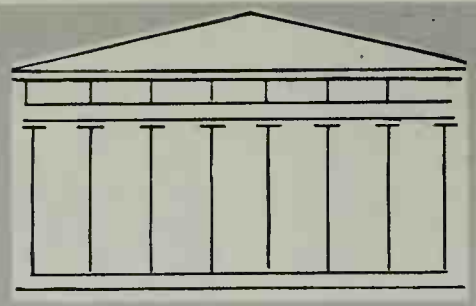
House, Built of stone (restored)

Delos, *c.*250 B.C. Introduction of the Peristyle

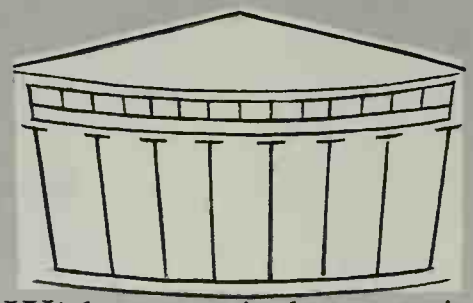
GREEK REFINEMENTS



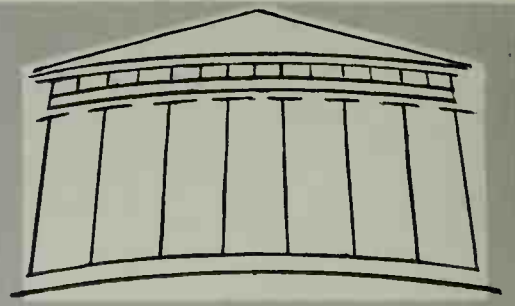
Entasis (Gk: distension) designed to counteract the illusion of the outline of a column curving inwards



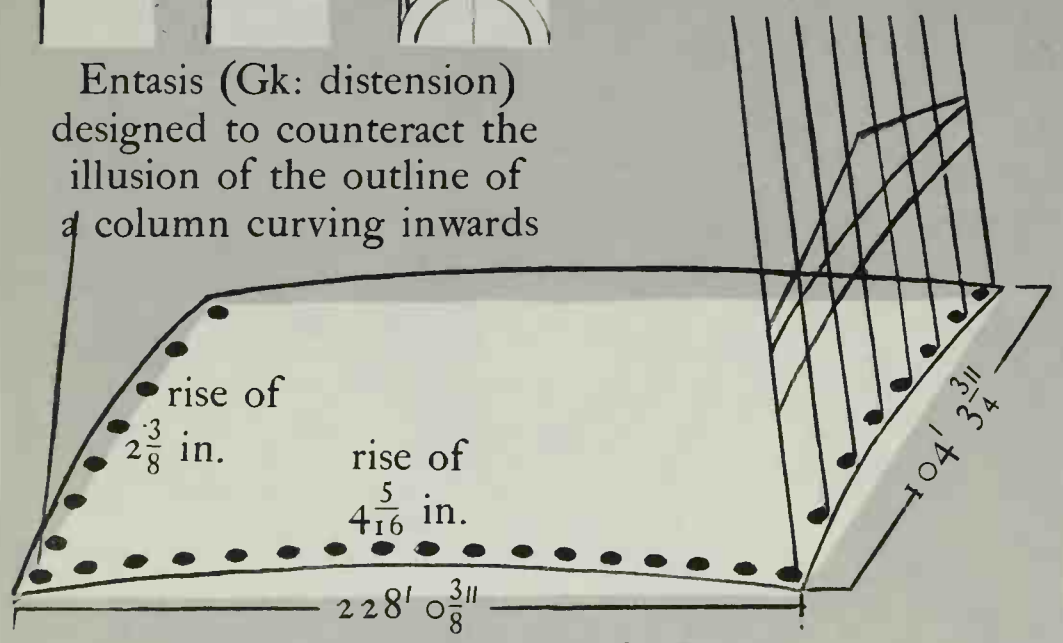
1 The Parthenon as seen



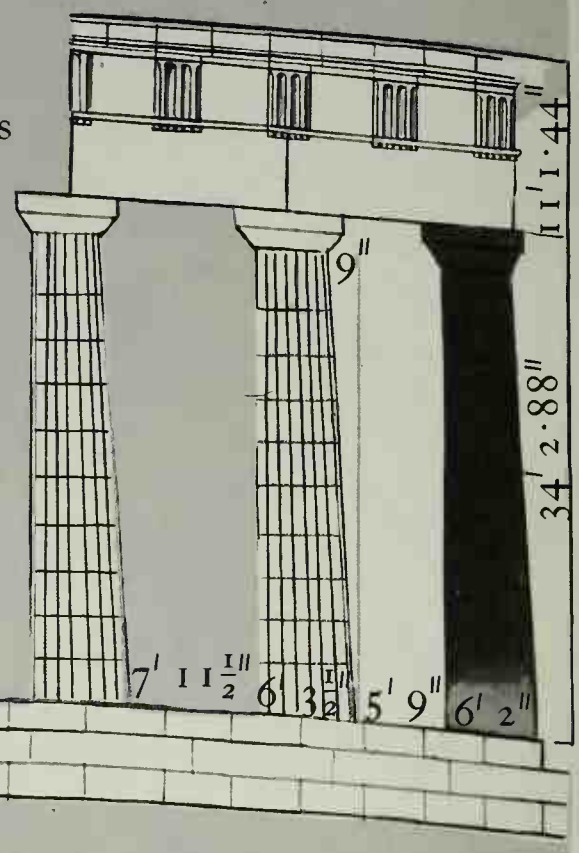
2 Without optical corrections



3 The front with inclined axes of columns and with convex stylobate and entablature producing the result seen at 1

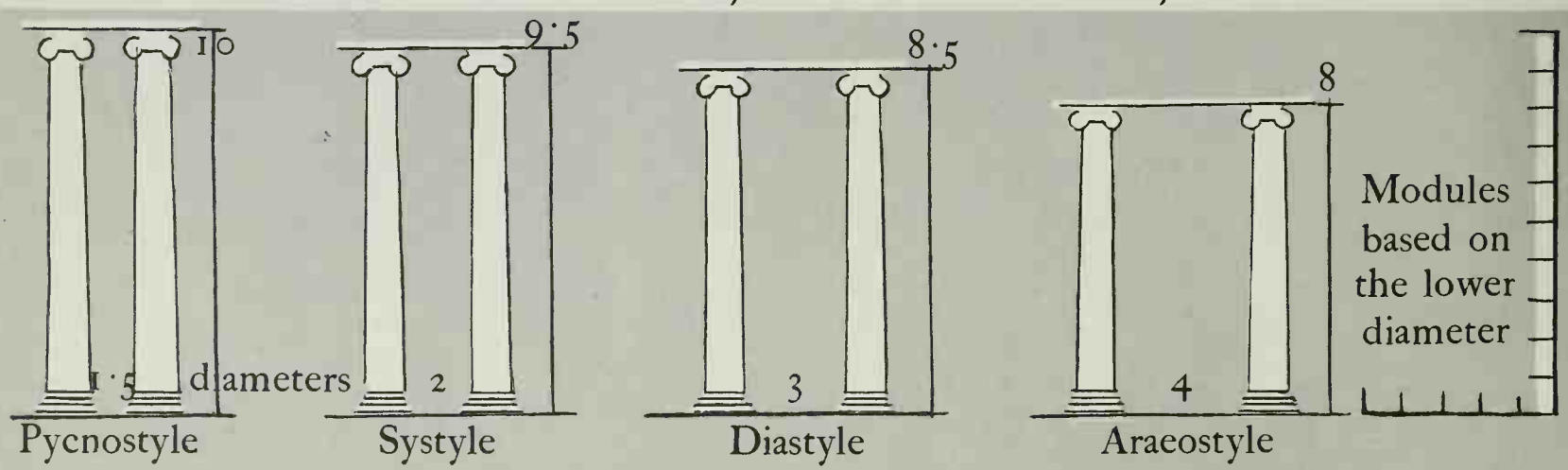


Exaggerated diagram of the rising curvature of the stylobate and inward inclination of the columns



Angle columns look thinner seen dark against light and are thickened by $1\frac{1}{2}$ in.

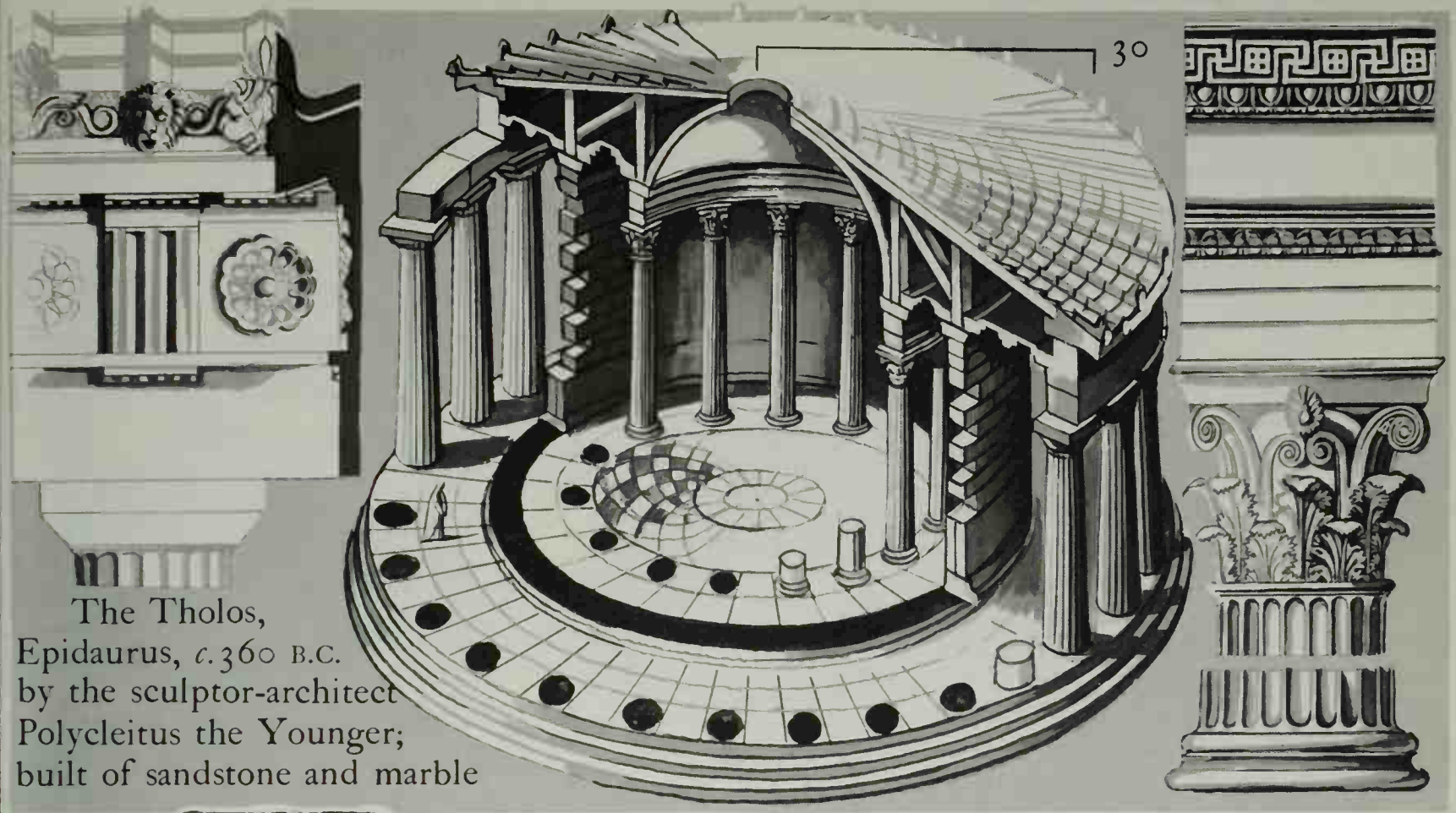
OPTICAL CORRECTIONS, THE PARTHENON, ATHENS



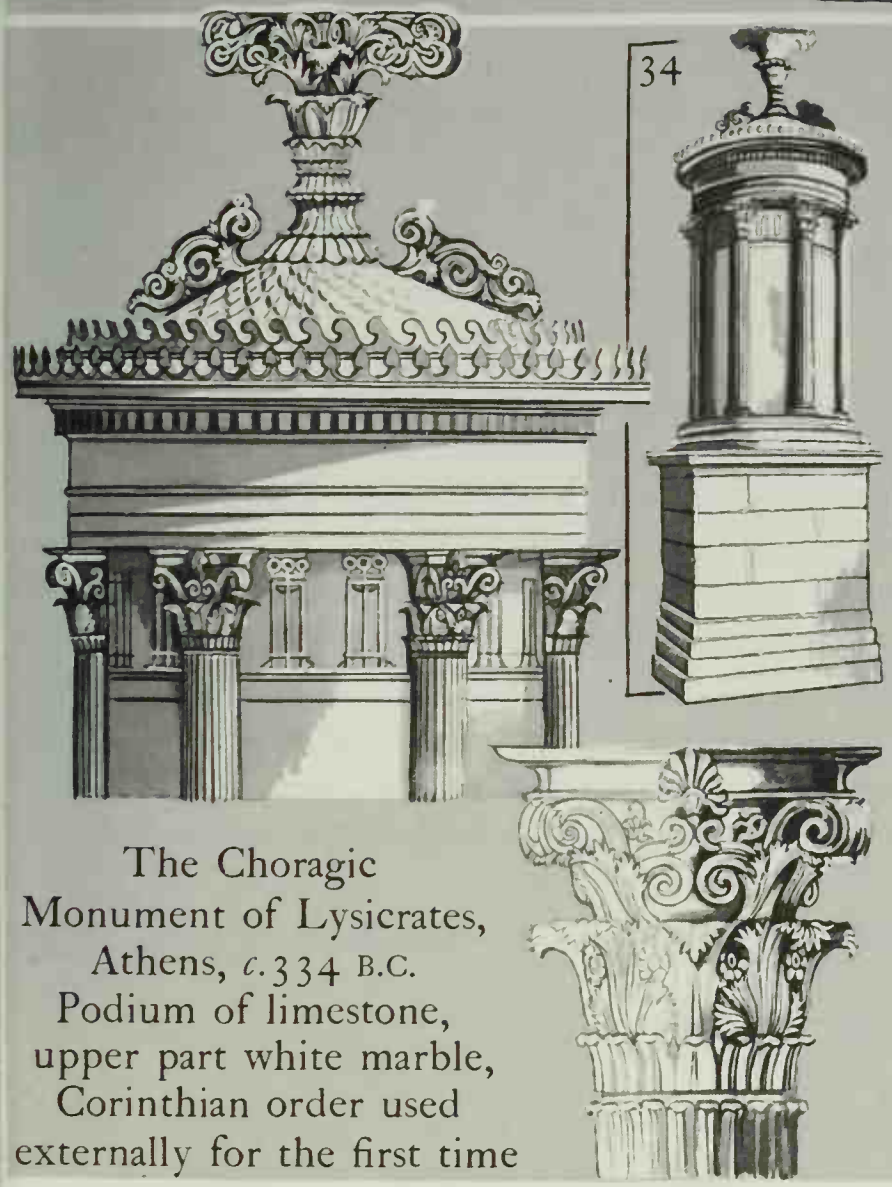
Pycnostyle Systyle Diastyle Araeostyle

Proportions of height, thickness & distance apart of columns according to Vitruvius (III,3)

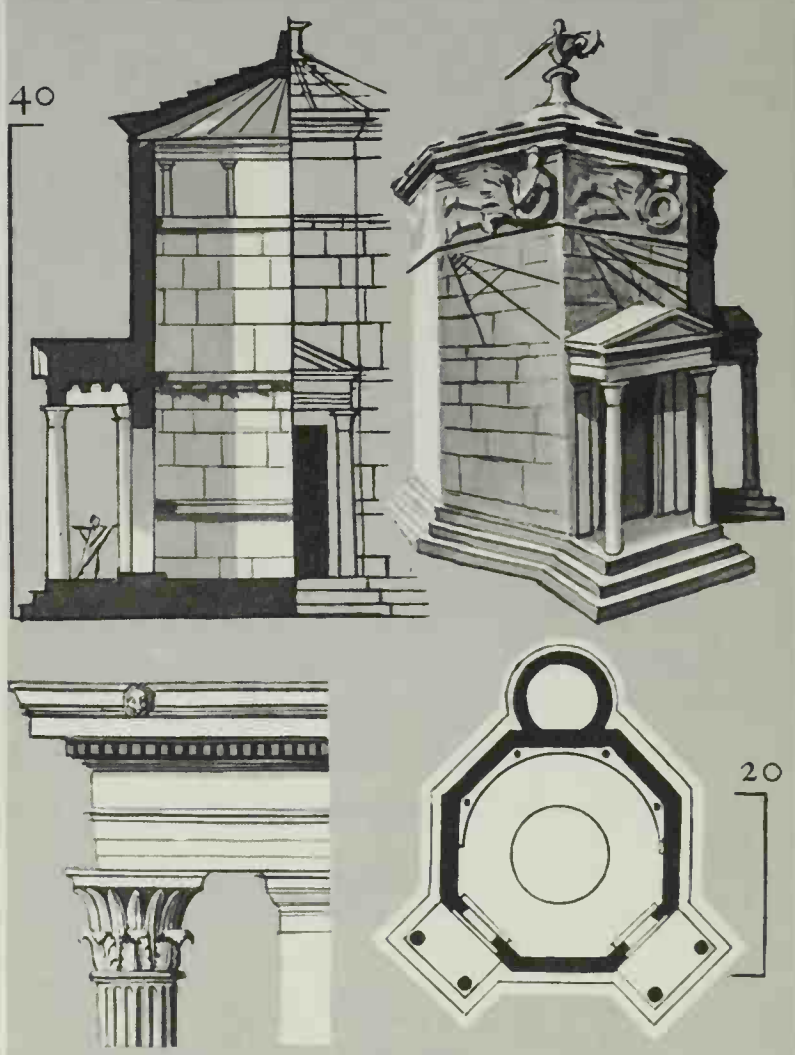
ORNAMENT



The Tholos,
Epidaurus, *c.*360 B.C.
by the sculptor-architect
Polycleitus the Younger;
built of sandstone and marble



The Choragic
Monument of Lysicrates,
Athens, *c.*334 B.C.
Podium of limestone,
upper part white marble,
Corinthian order used
externally for the first time



The Tower of the Winds, Athens,
*c.*50 B.C. Clock-tower built of marble

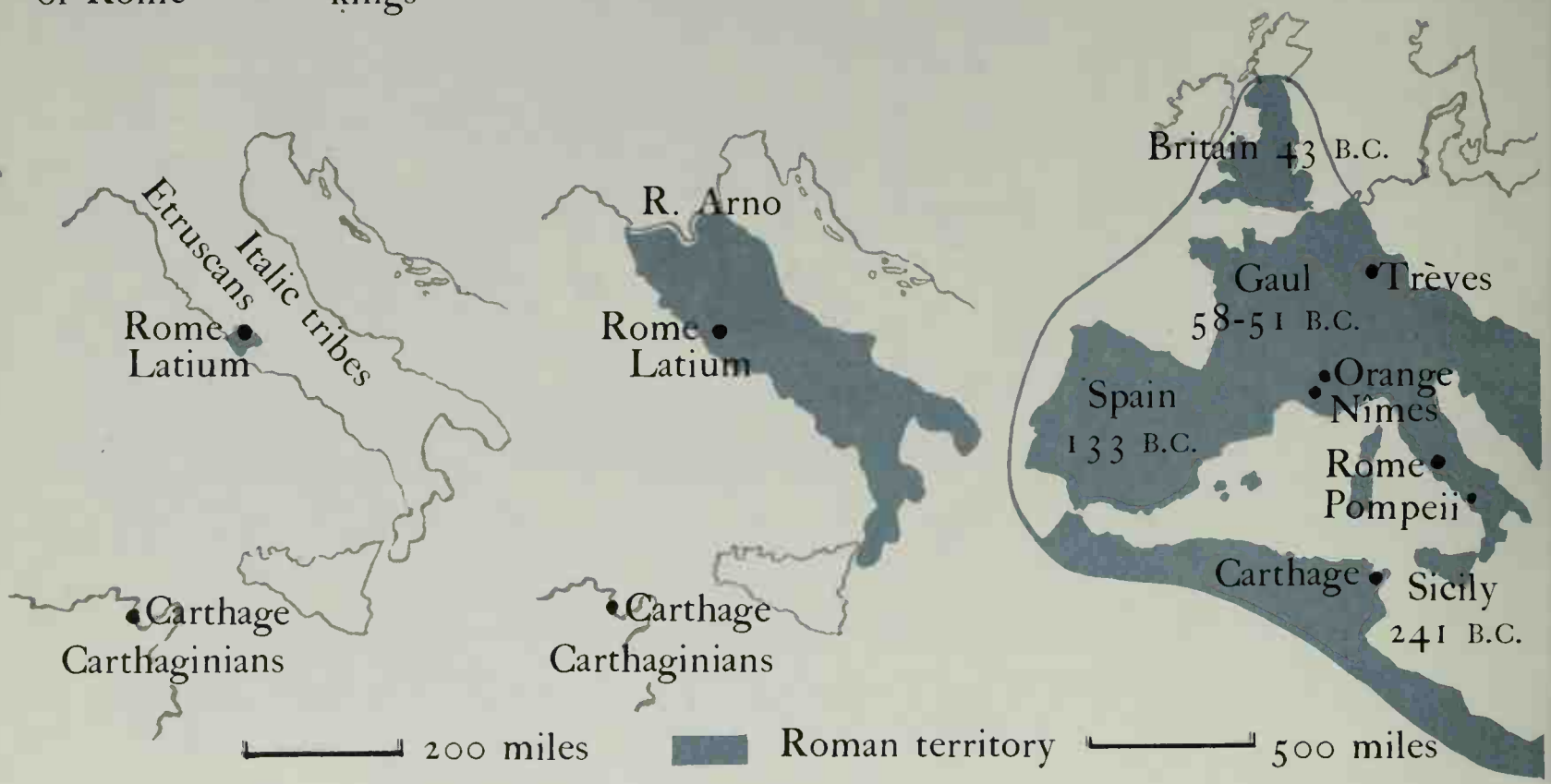
ROMAN

THE ROMAN REPUBLIC

500

*c.*753 B.C.
The foundation of Rome

Etruscan kings



Italy at the beginning of the Roman Republic, *c.*500 B.C.

The Latin conquest of Italy, 275 B.C.

The Roman Empire

Early Rome, with its Republican magistrates, town-council (senatus) and town-meetings (comitia), by a series of systematic conquests created an Empire round the Mediterranean consisting of different nationalities accepted as allies. The Roman Empire became a fusion of the practical Western idea of one universal society in which all men might live in conformity with Roman law and the Oriental conception of an Emperor-God with a throne-altar demanding a common worship and loyalty. This union between the West and the East was a continual source of weakness and led to the ultimate division of the Empire. The Romans built roads and bridges for swift communication, military camps with a simple set plan (later incorporated in many city-plans) for speed of construction, and government and civic buildings, which were both useful and symbolic of Roman law and order.

Greek Hellenic Period — Hellenistic

775/6 — 323

429/8 — Plato — 347
384 Aristotle 322
342-Epicurus-270
326?-Zeno-264? (Stoicism)

INTRODUCTION

THE ROMAN EMPIRE

29 A.D. — 284 — 324 — 394 — 476 A.D.

Julius Caesar 106——44

Augustus 27——14

Nero 59–68

Trajan 98–117

Vespasian 69–79

Hadrian 117–138

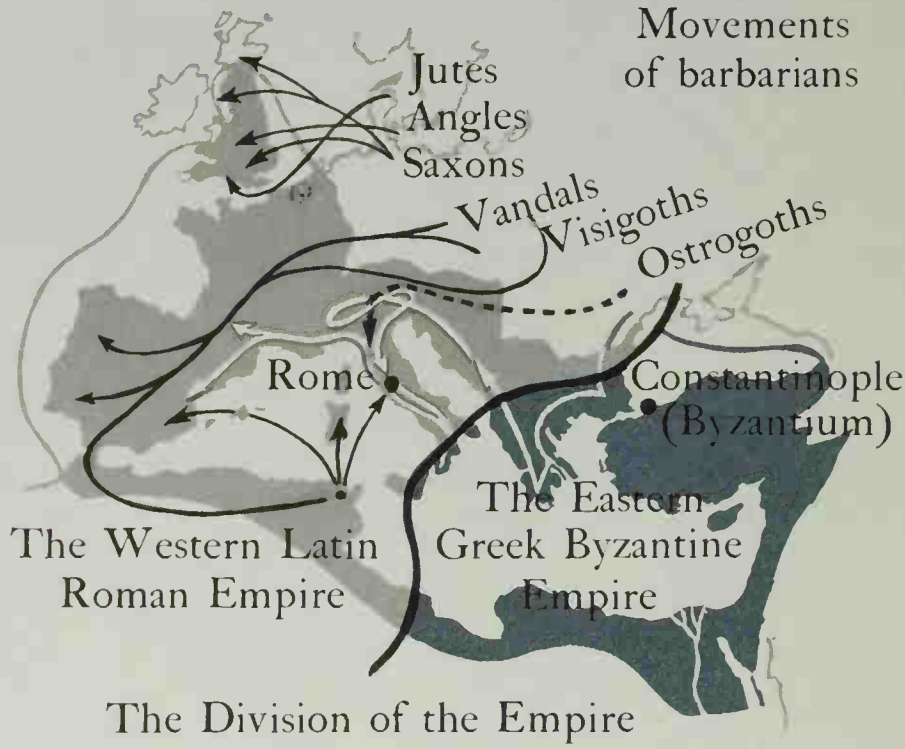
Septimus Severus 192——211

The capital, Rome, moved to Byzantium by Constantine 306——337

End of the Western Empire

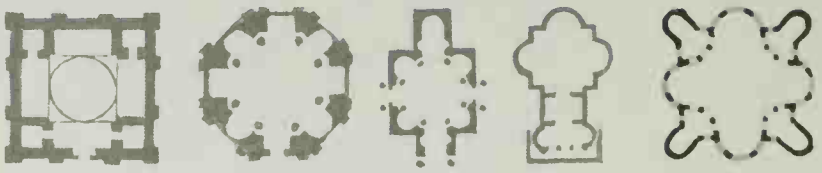
Movements of barbarians

27 B.C. — A.D. 324



The Division of the Empire
394 A.D.

During the Republic kiln-baked bricks and stone blocks with or without mortar were used in building. The invention of concrete revolutionised construction in the Empire. Concrete was used with a facing for protection and a surface finish, & there is a sharp distinction between the art of the engineer constructing arches, vaults and domes and the applied art of decoration with columns and pilasters, marbles and mosaics.



The Romans invented all possible variations in the plans of buildings which were copied by later architects. *The Ten Books on Architecture* by Marcus Vitruvius Pollio, a Roman architect and engineer who lived in the 1st century B.C. was widely read in the Renaissance and later.

A.D

31

106——43 Cicero

70——Virgil——19

65—Horace—8

59——Livy——17

46? Plutarch 120?

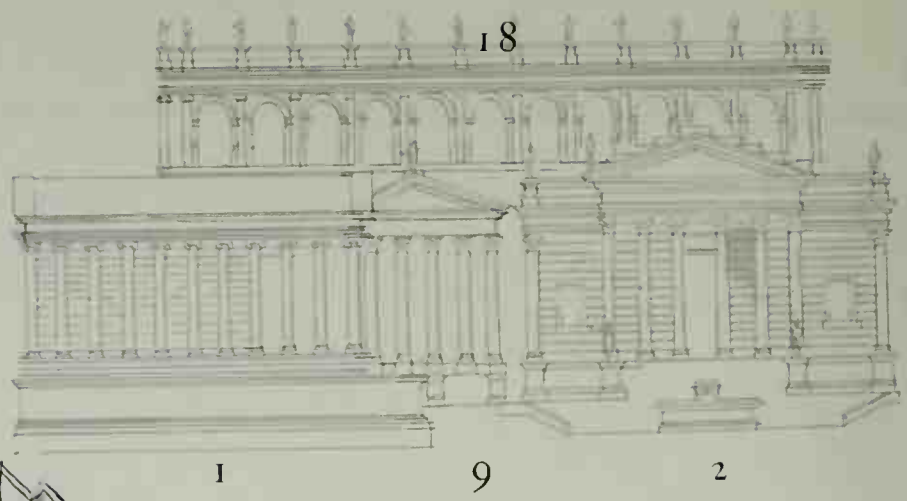
Marcus Aurelius 167——180

323 Christianity the official religion of the Empire.

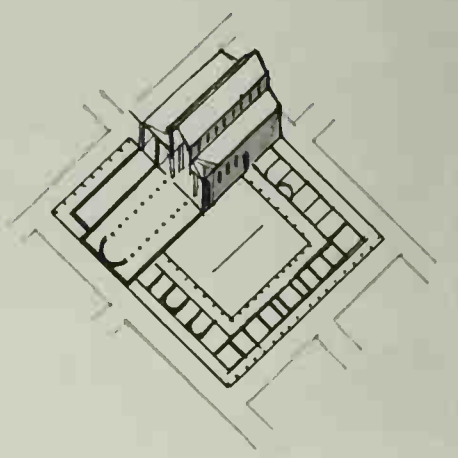
203–Plotinus–262

354 St Augustine 430

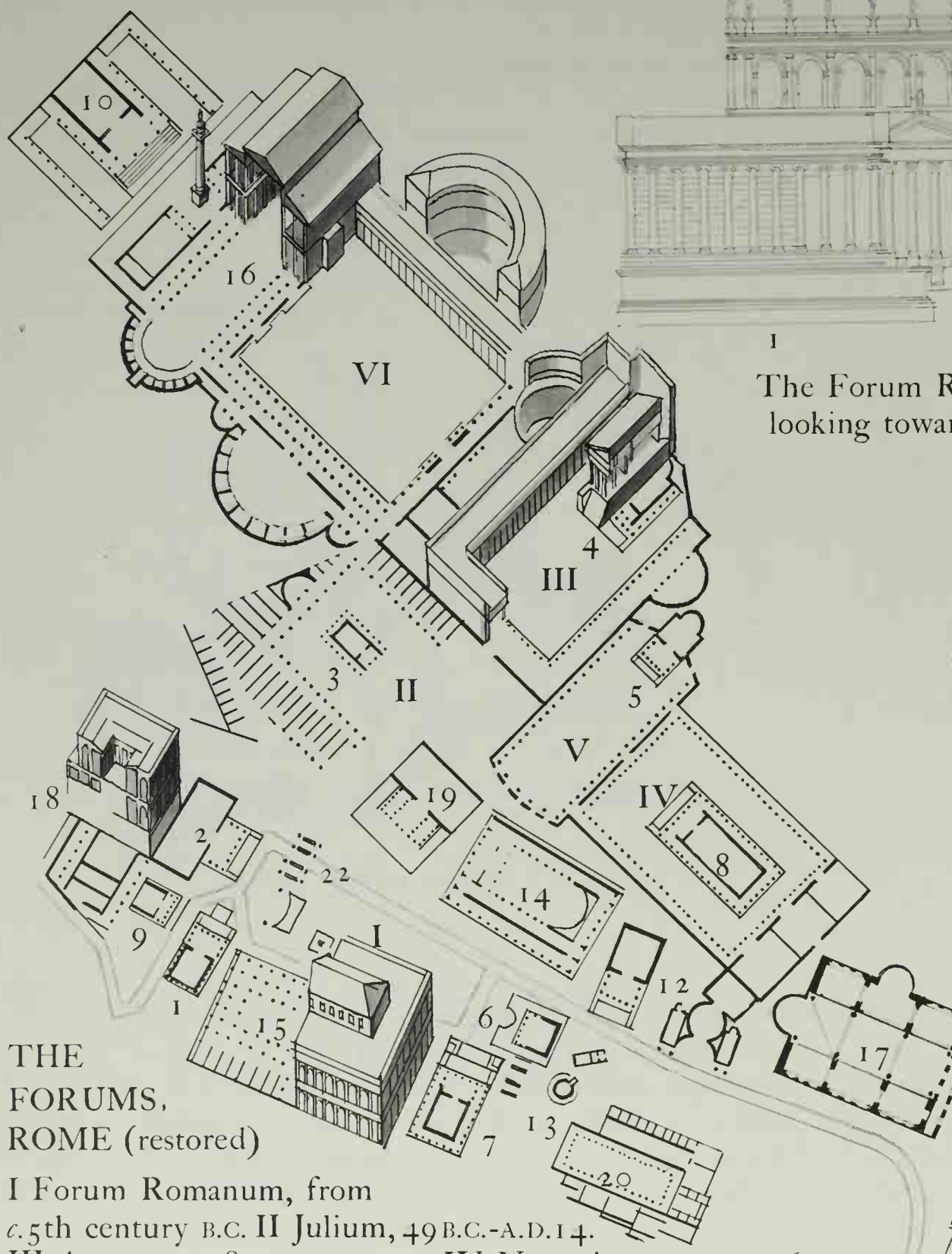
ROMAN



The Forum Romanum (restored), looking towards the Tabularium



Forum and basilica, Silchester, England, *c.*A.D. 50-100



THE FORUMS, ROME (restored)

I Forum Romanum, from *c.*5th century B.C. II Julium, 49 B.C.-A.D. 14. III Augustus, 28 B.C.-A.D. 14. IV Vespasian, A.D. 67-79. V Nerva, *c.*A.D. 97. VI Trajan, A.D. 100-117.

TEMPLES: 1 Saturn, 44 B.C. 2 Concord, 7 B.C. 3 Venus Genetrix, 49 B.C. 4 Mars Ultor, 14-2 B.C. 5 Minerva, 28 B.C.-A.D. 14. 6 Divus Julius, 8 B.C.-A.D. 14. 7 Castor and Pollux, A.D. 6. 8 Peace, A.D. 67-79. 9 Vespasian, A.D. 94. 10 Trajan, A.D. 100-117. 11 Venus and Rome, A.D. 123-135. 12 Faustina, A.D. 141. 13 Vesta, A.D. 205.

BASILICAS: 14 Aemilia, *c.*179 B.C. 15 Julia, 46 B.C. 16 Trajan, A.D. 100-117. 17 Constantine, A.D. 310-313.

BUILDINGS: 18 Tabularium, 78 B.C. 19 Curia (Senate House), 49 B.C.-A.D. 14. 20 House of the Vestal Virgins, *c.*A.D. 17. 21 Colosseum, A.D. 70-82. 22 Arch of Septimus Severus, A.D. 203.

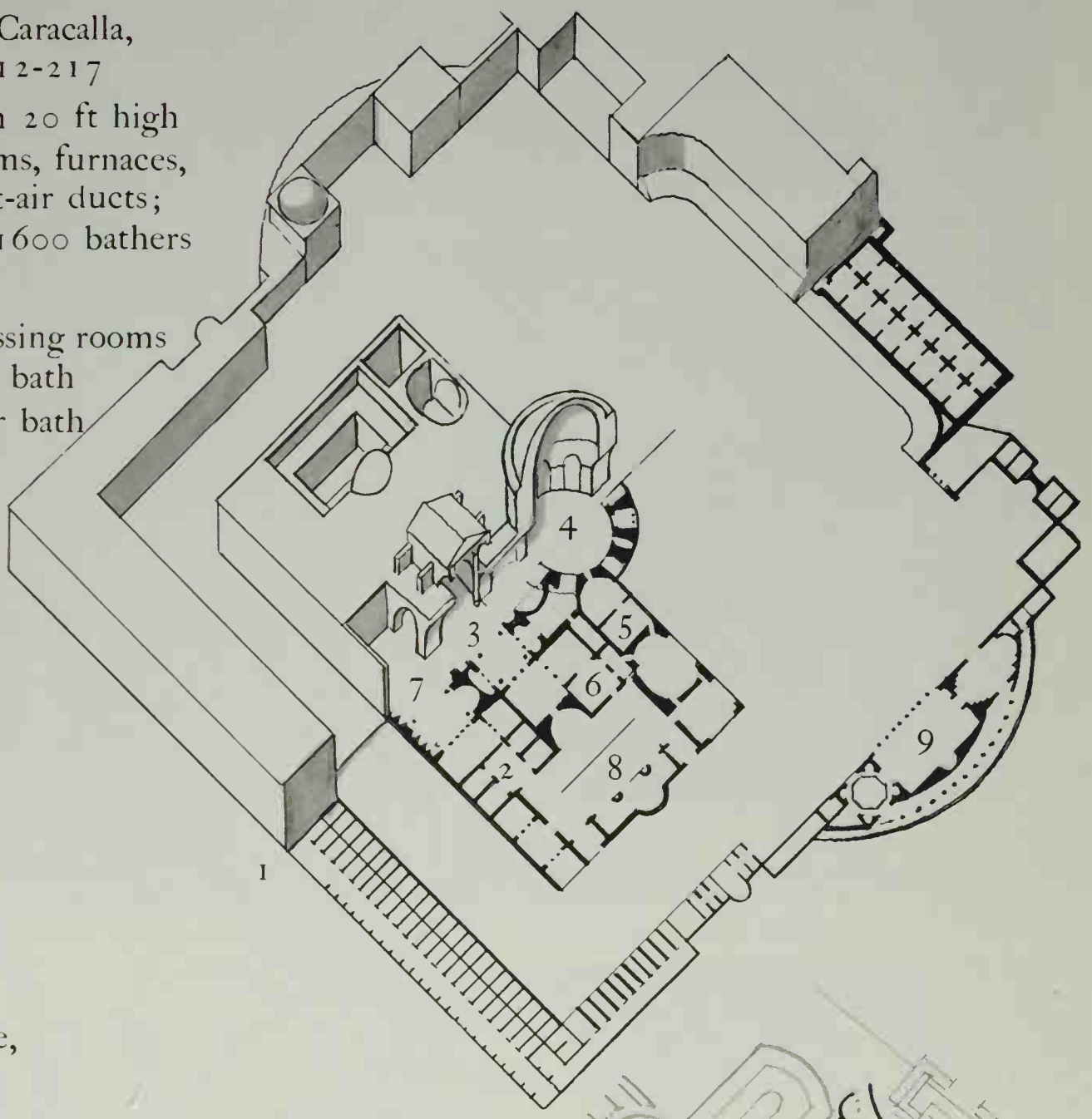
BUILDINGS AND PLANS, ROME

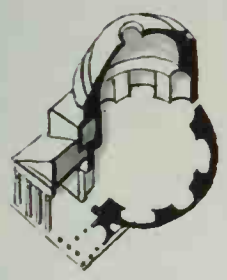
Drawn to the same scale 500

The Thermae of Caracalla,
Rome, *c.* A.D. 212-217

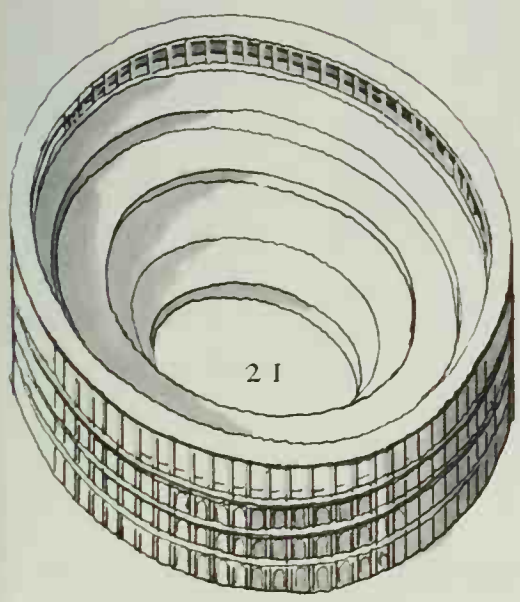
Stands on a platform 20 ft high containing store-rooms, furnaces, hypocausts and hot-air ducts; room for more than 1600 bathers

1 Main entrance
2 Apodyteria—undressing rooms
3 Tepidarium—tepid bath
4 Calidarium—hot-air bath
5 Warm baths
6 Hot baths
7 Frigidarium—
open-air cold bath
8 Palaestra, peristyles
9 Lecture halls and
libraries



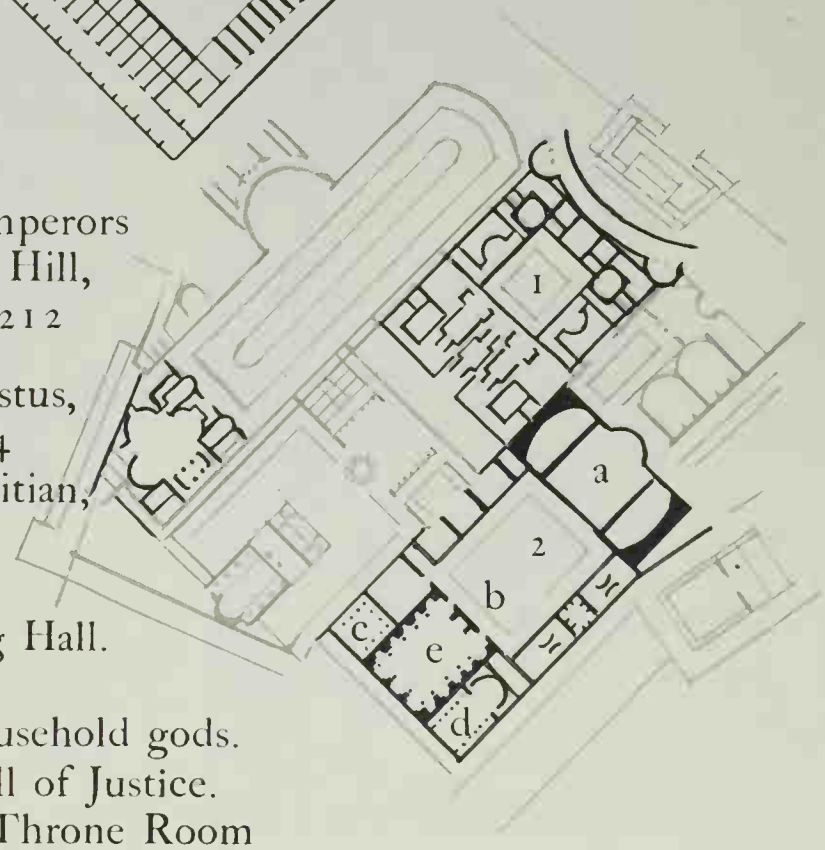


The Pantheon, Rome,
A.D. 120-124

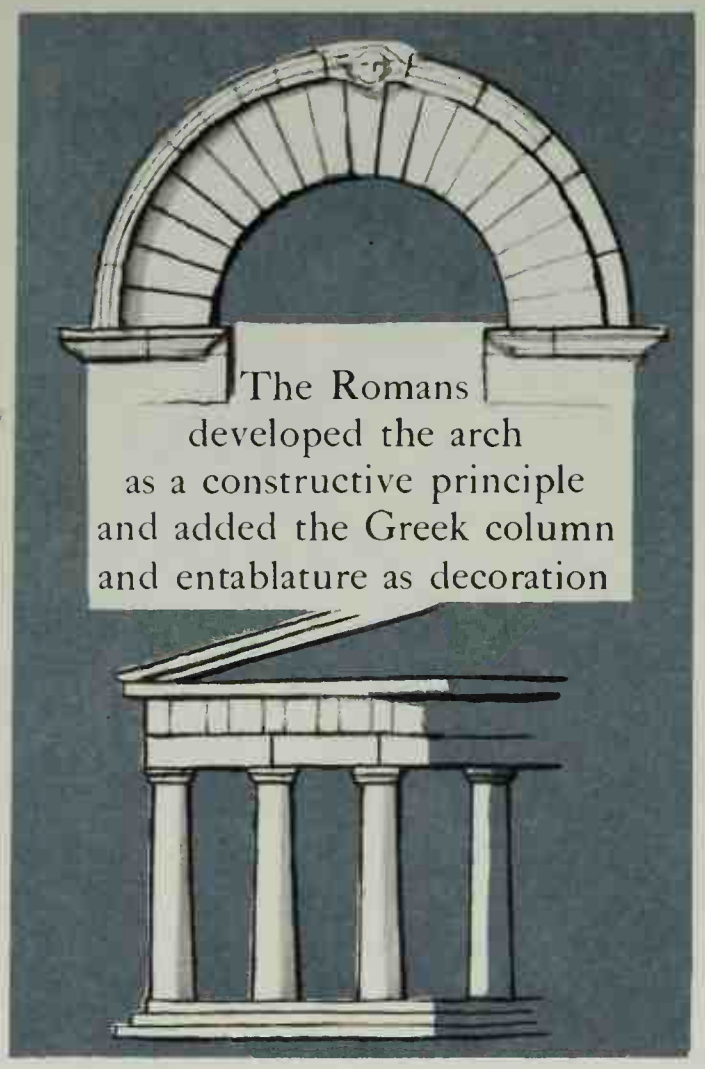


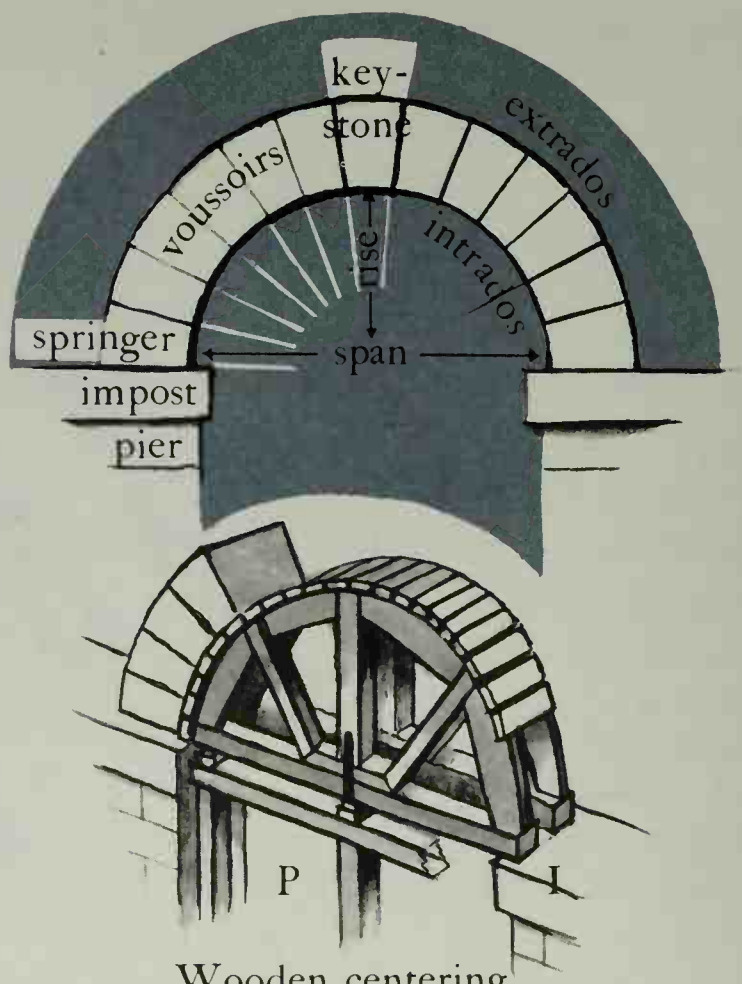
Palaces of the Emperors
on the Palatine Hill,
Rome, A.D. 3-212

1 Palace of Augustus,
21 B.C.-A.D. 14
2 Palace of Domitian,
A.D. 81-96
a. Triclinium
or Banqueting Hall.
b. Peristyle.
c. Temple of household gods.
d. Basilica or Hall of Justice.
e. Tablinum or Throne Room

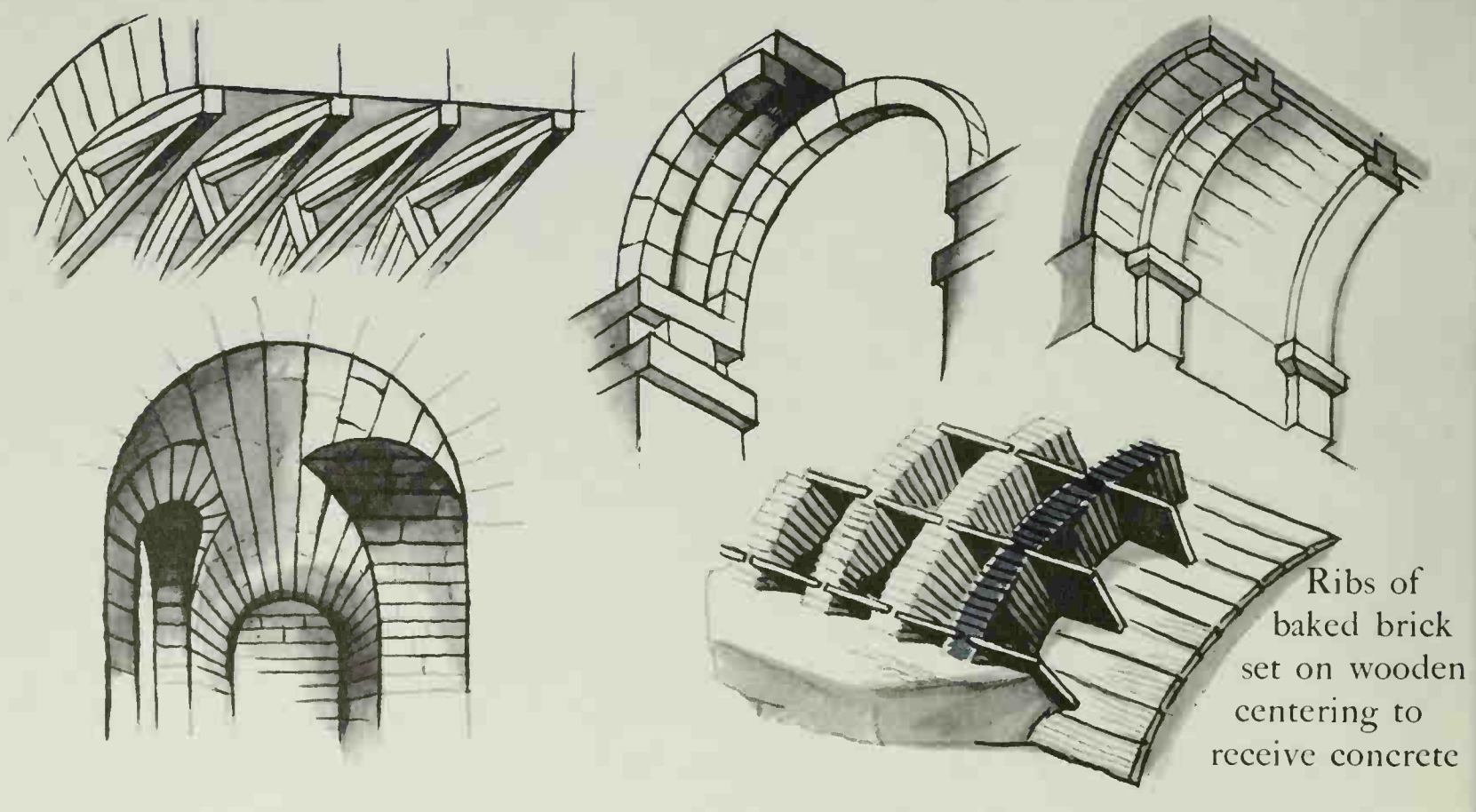


ROMAN





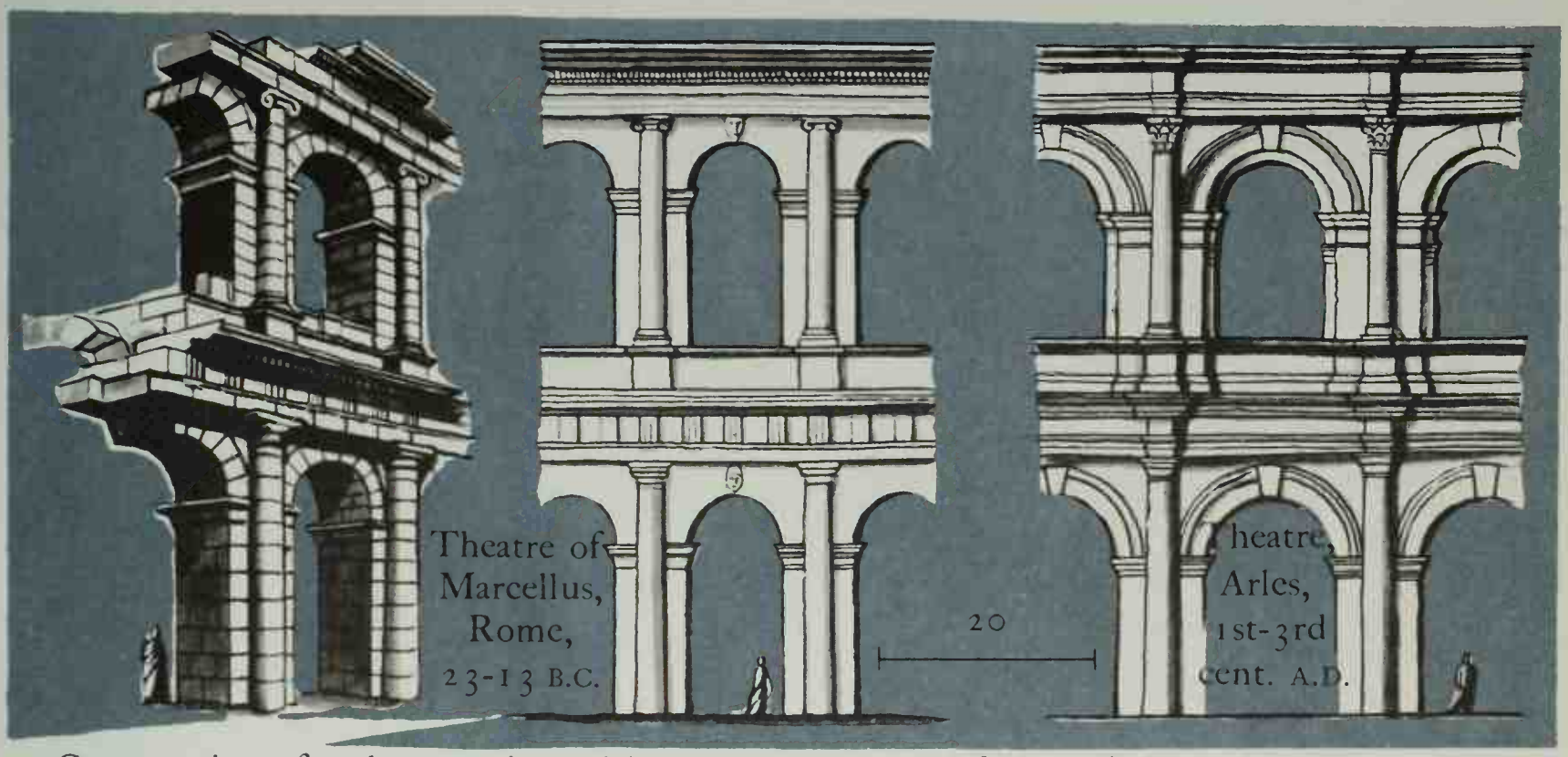
Wooden centering
supported on piles P or on the impost I



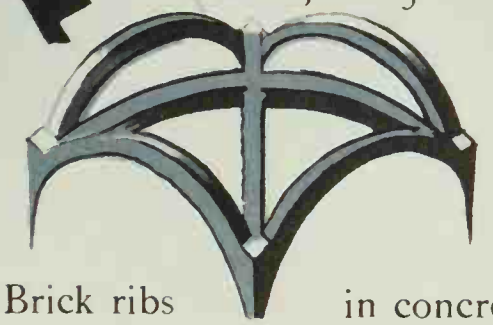
Methods of constructing stone and concrete vaults

THE ARCH

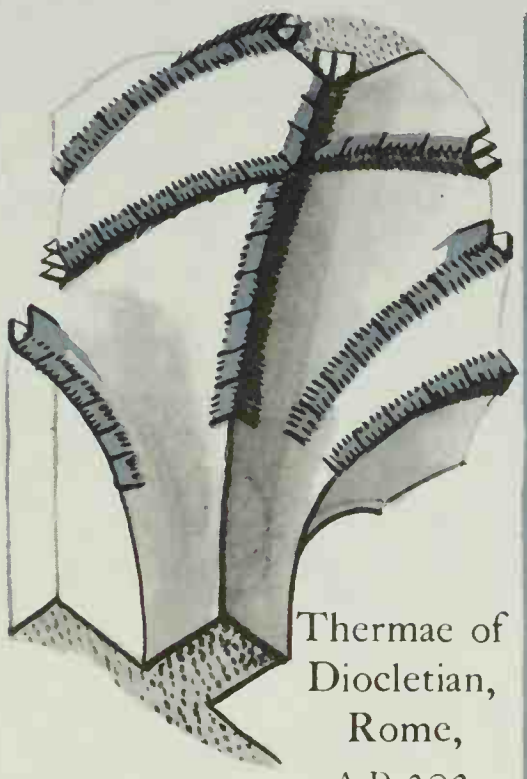
Arches supported on piers: Aqueduct, Pont du Gard, Nîmes, *c.*A.D. 150

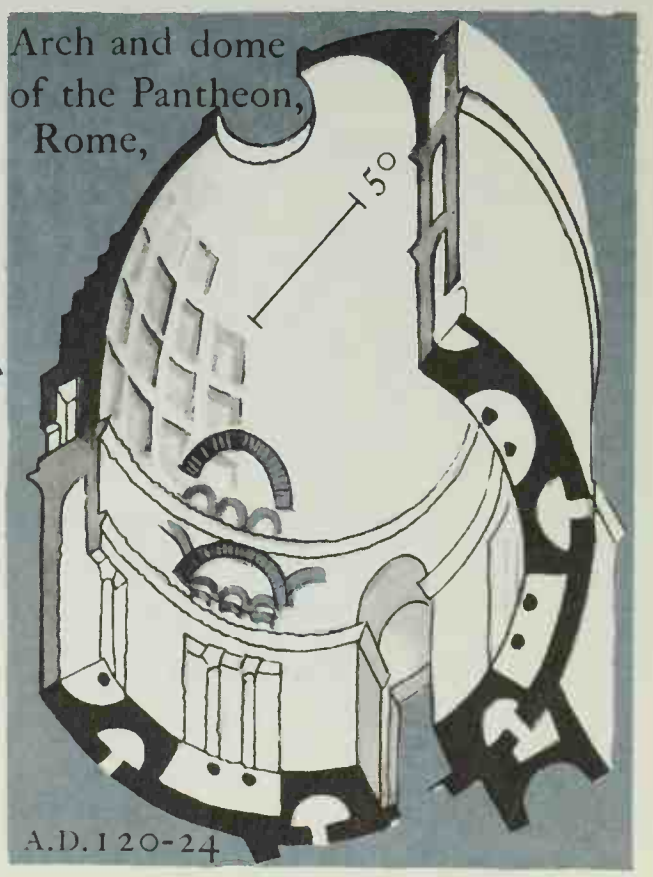


Construction of arches on piers with non-constructional facing of columns and entablature



Brick ribs in concrete cross-vaults

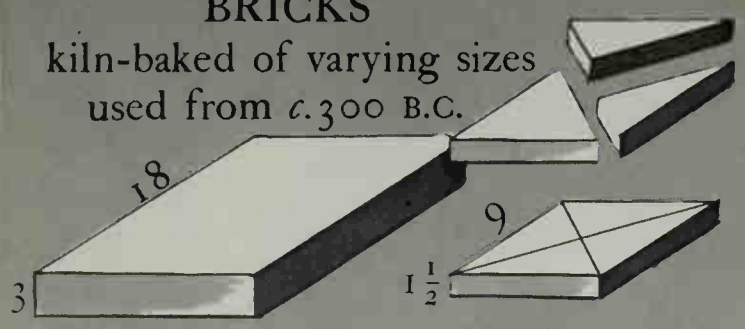




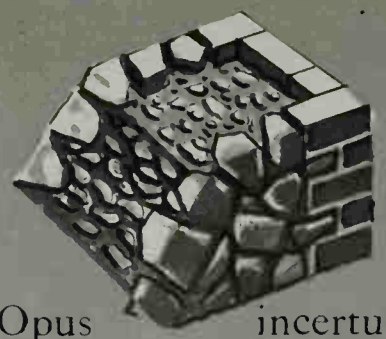
ROMAN

BRICKS

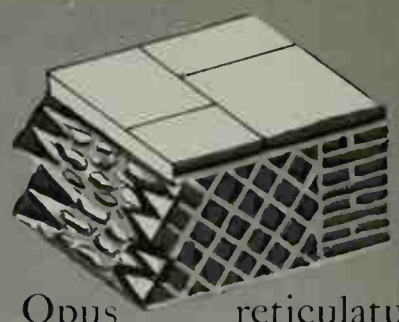
kiln-baked of varying sizes
used from *c.*300 B.C.



12 inches 9 inches



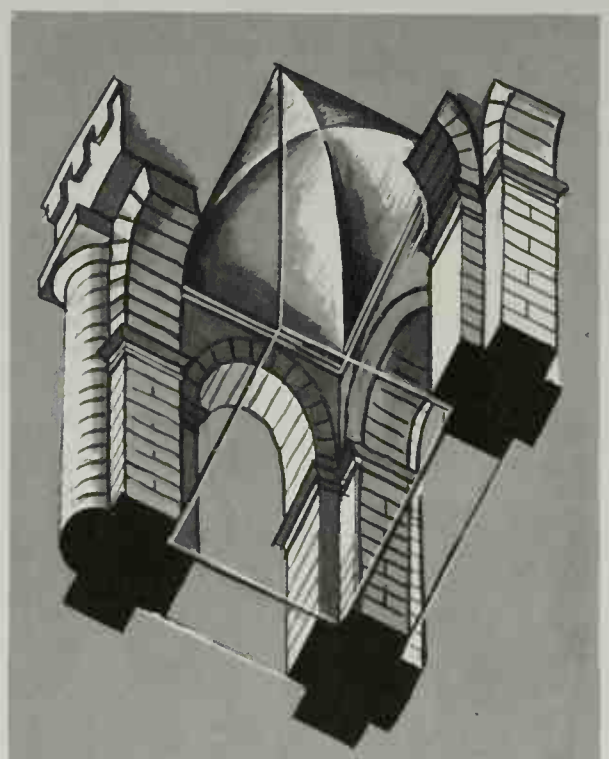
Opus incertum
from *c.*200 B.C.



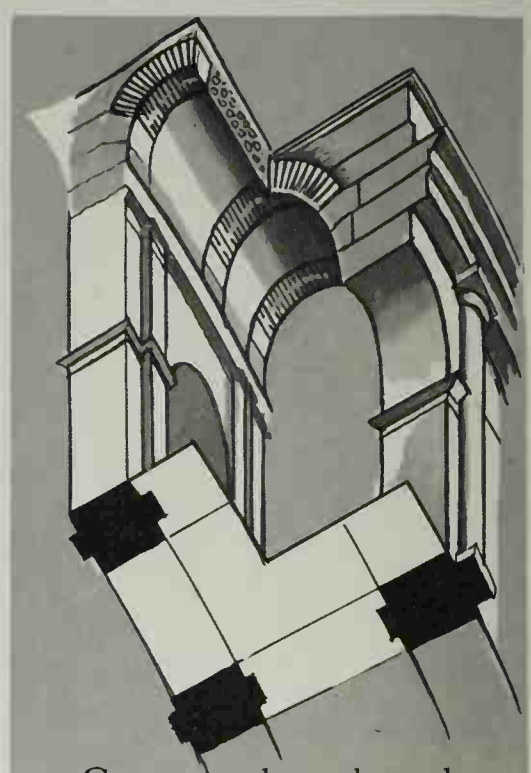
Opus reticulatum
Concrete walls faced

CONCRETE

used by the Romans from the 2nd century B.C., consisting of sand, gravel, pebbles, chippings of stone, mixed with a cement of lime and water and spread over a temporary wooden or permanent brick centering, to solidify into the required shape –arch, vault or dome. The dead weight rested upon supporting walls or piers without exerting an outward thrust. Pozzolana, a volcanic rock found near Rome, made a concrete of great hardness and durability. Concrete surfaces were faced with stucco, brick or marble for protection and finish.

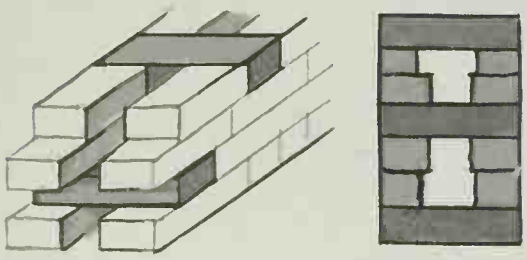


Cloister vault of concrete
supported on cruciform piers
Tabularium, Rome, 78 B.C.

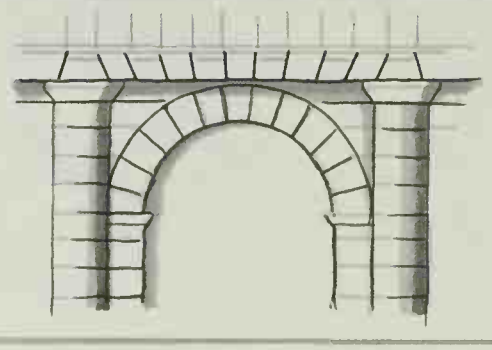


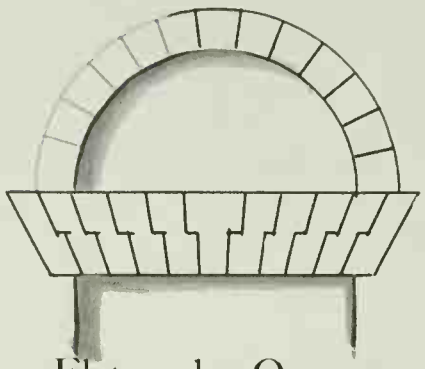
Concrete barrel vault
The Colosseum, Rome,
A.D. 70-82

MASONRY

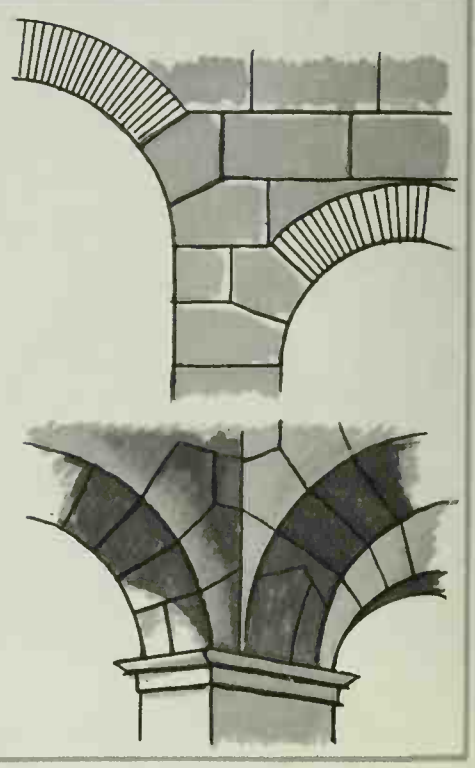


The Romans copied the Greek technique, building courses of dressed blocks, held by through stones laid dry without mortar or with iron cramps and dowels set in molten lead. The space between the courses was left empty or filled with undressed stones, earth or concrete.

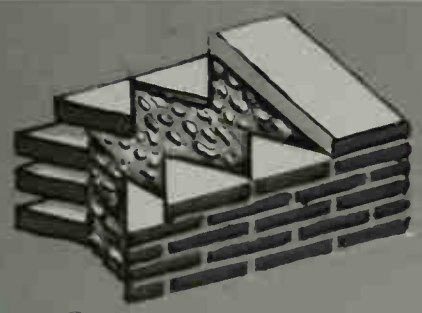




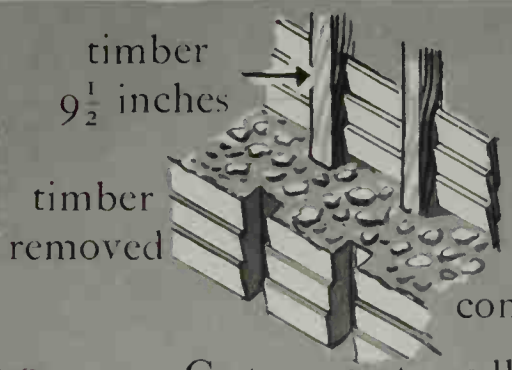
Flat arch : Orange



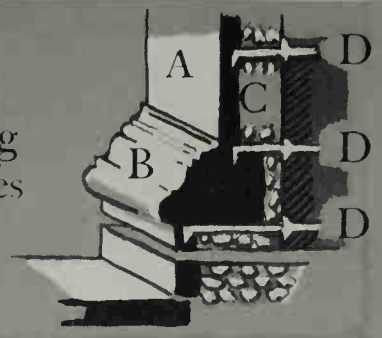
MATERIALS & METHODS



Opus testaceum
with brick from *c.*78 B.C.



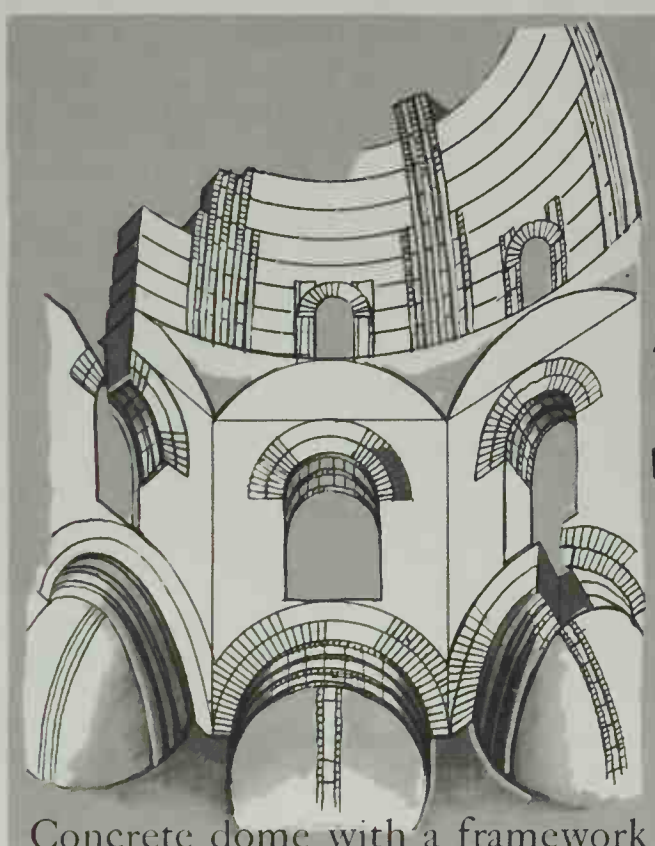
Cast concrete wall



A marble slab
B plinth
C cement
D iron clamps

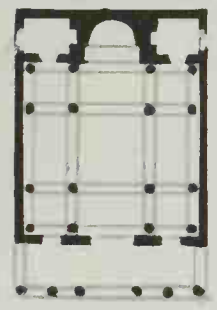
Method of fixing marble facing

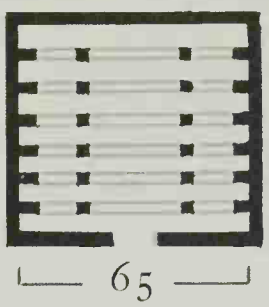
Cross-vault
built of brick ribs
and filled in with concrete
Villa Sette Bassi, near
Rome, *c.* A.D. 123-134



Concrete dome with a framework of brick ribs
Temple of Minerva Medica, Rome, *c.* A.D. 260

The
Pretorium,
Musmiyeh,
c. A.D. 180



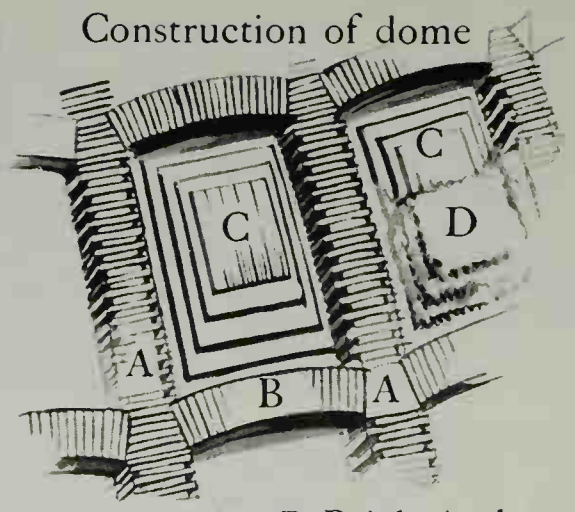


The Basilica,
Shakka,
c. A.D. 175-200

Syria:
buildings of dressed stone
continued in the period of
Early Christian architecture in
the 5th to 7th centuries

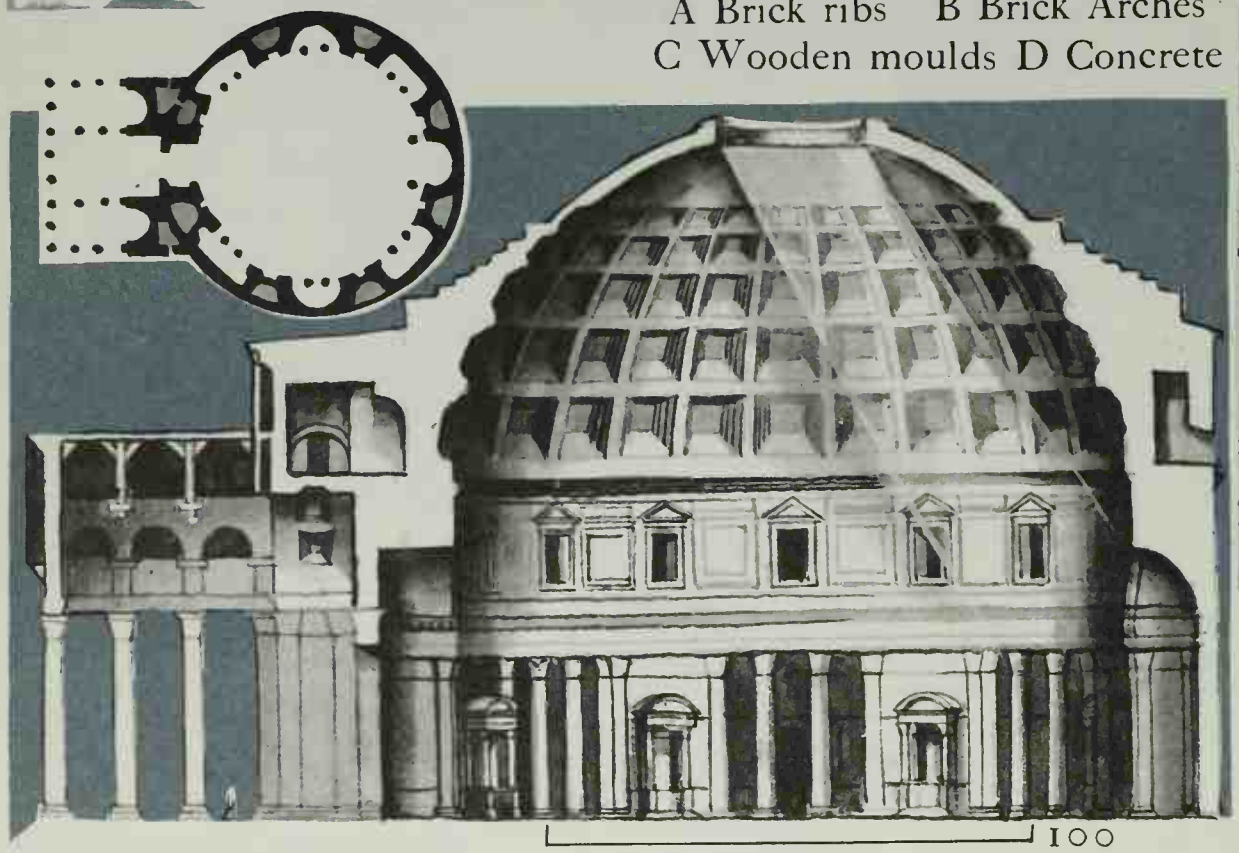
ROMAN

Construction of dome

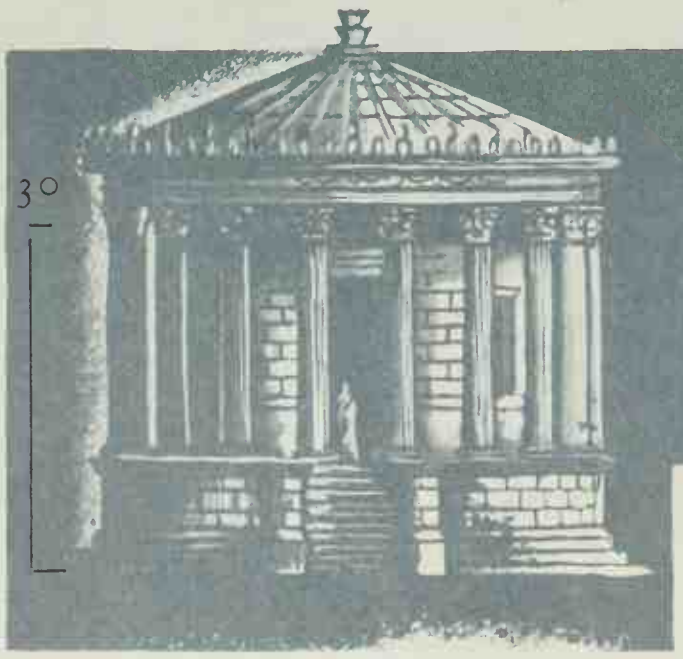


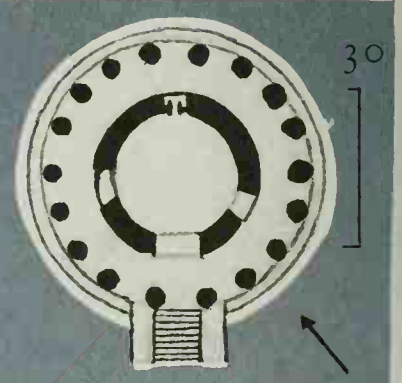
A Brick ribs B Brick Arches
C Wooden moulds D Concrete

Concealed brick arches link together 8 massive brick piers supporting the dome



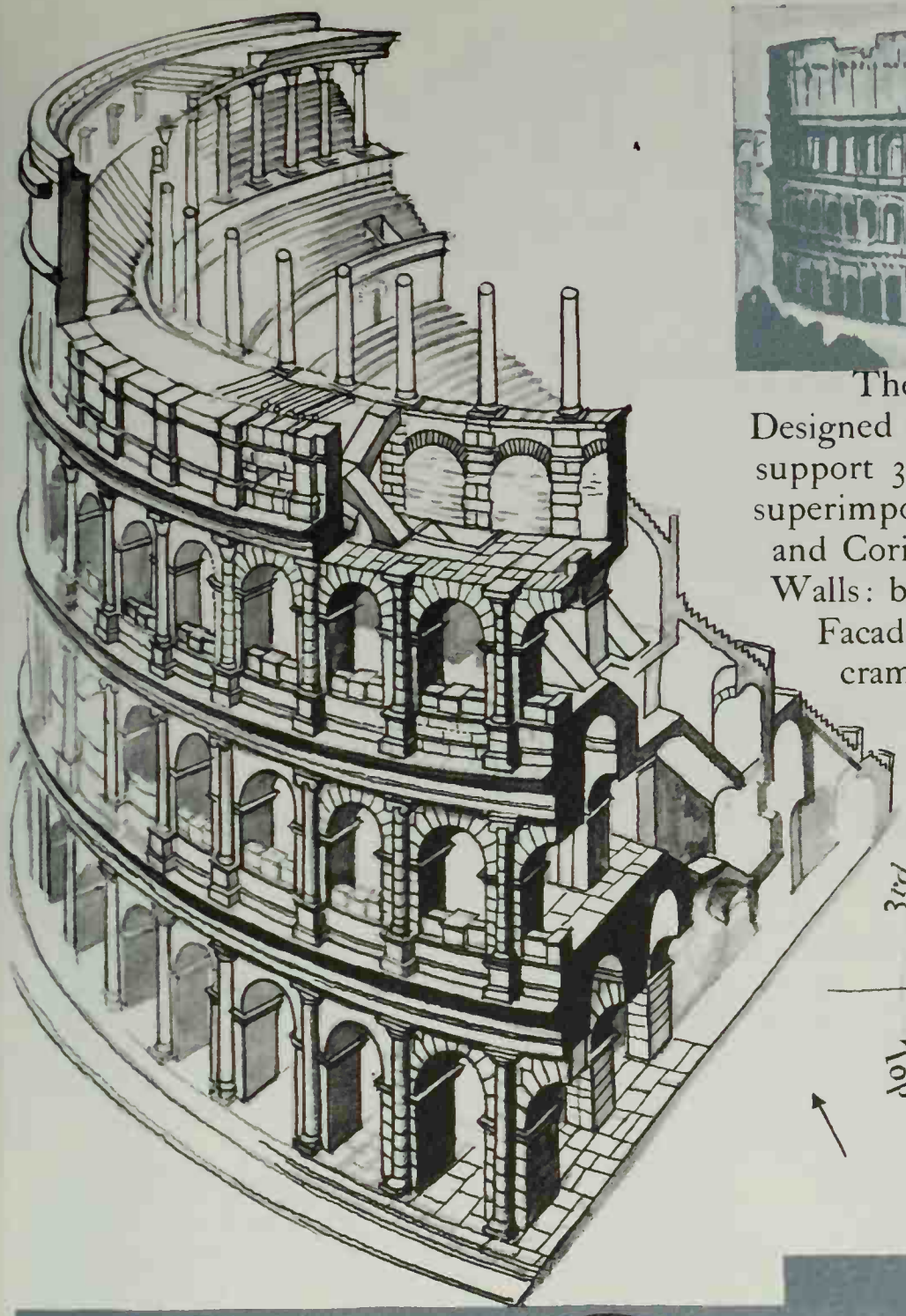
The Pantheon, Rome, A.D. 120-24. Erected by Hadrian



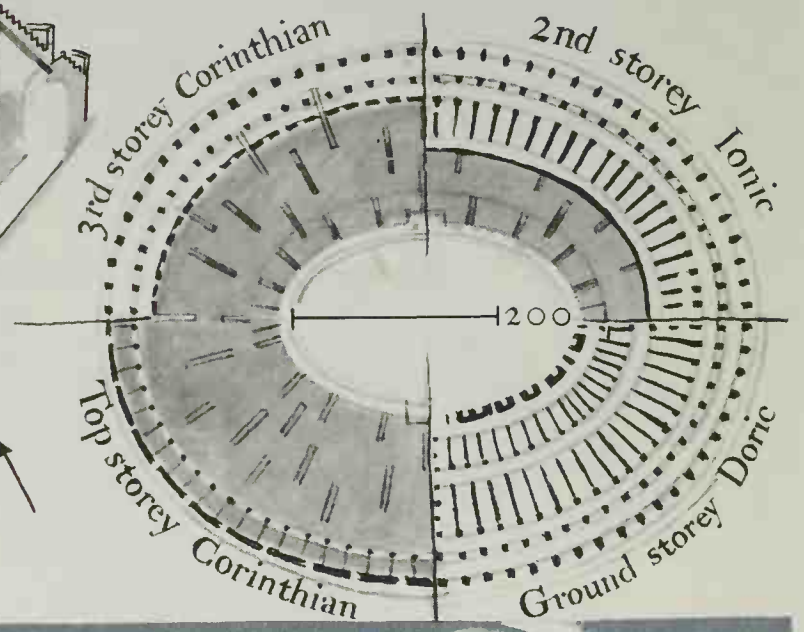


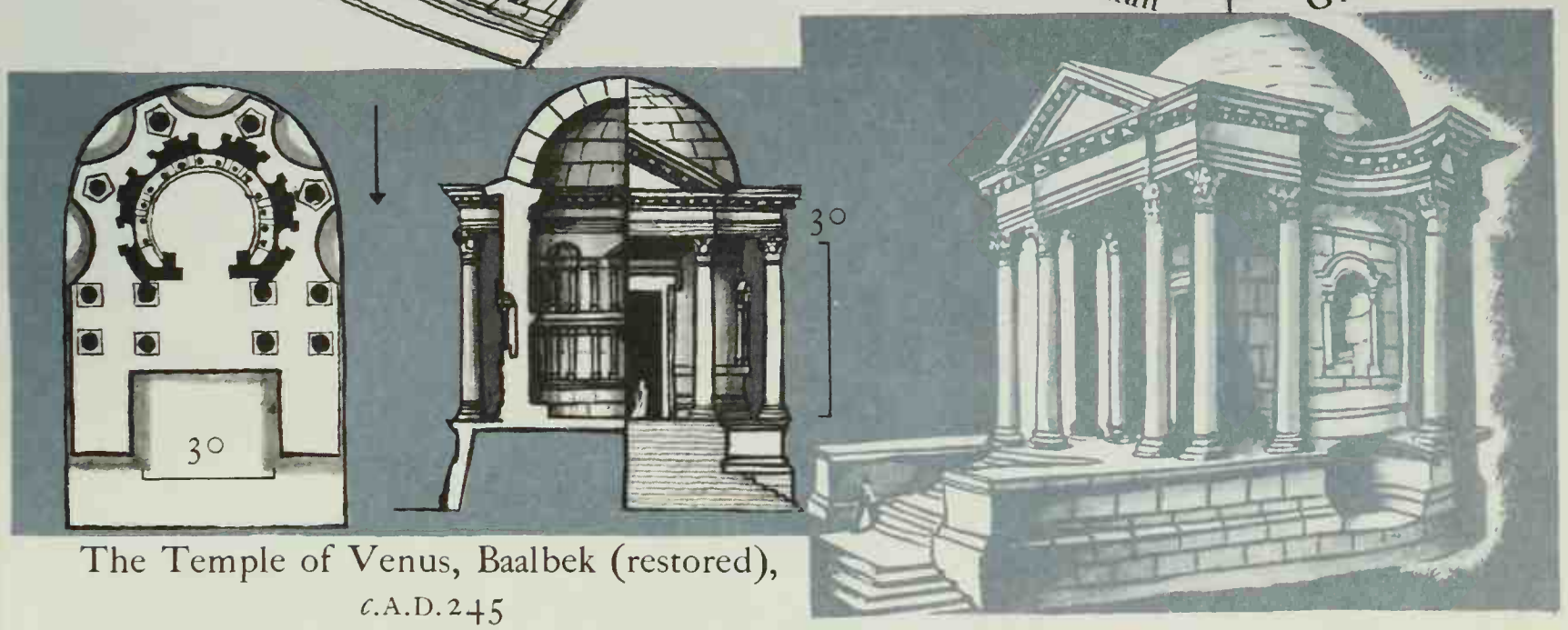
The Temple of Vesta, Tivoli (restored), 27 B.C.-A.D. 14
Foundations: tufa. Podium and walls: concrete. Columns and door: travertine. Roof: probably a low concrete dome

CIRCULAR & OVAL BUILDINGS



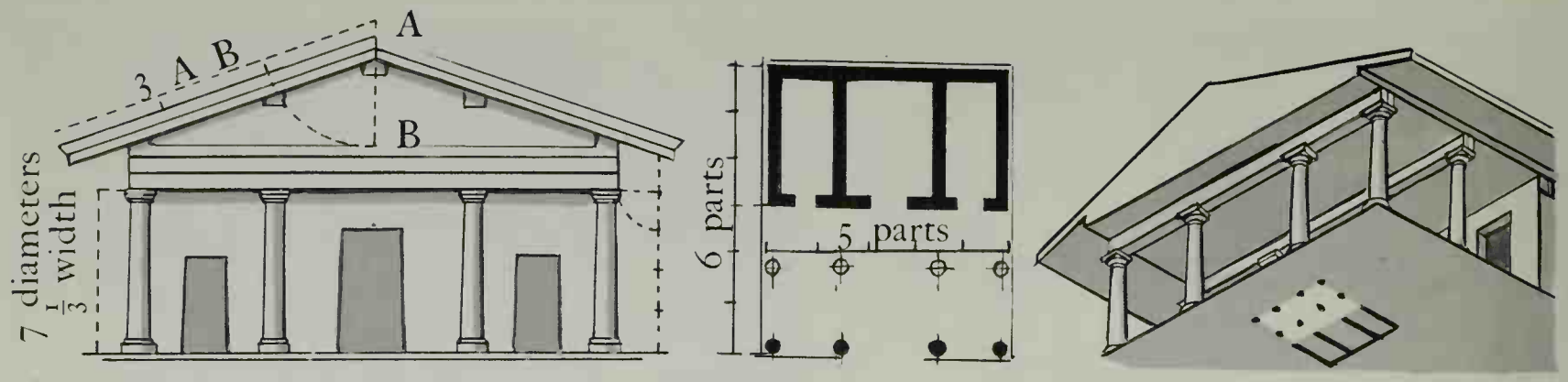
The Colosseum, Rome, A.D.70-82
Designed for about 45,000 spectators. 80 piers support 3 tiers of arcading. Decorative use of superimposed orders of ¾ external Doric, Ionic and Corinthian columns. Foundations: lava. Walls: brick and tufa. Vaults: pumice-stone. Facade: travertine blocks held by metal cramps. Columns and seats: marble



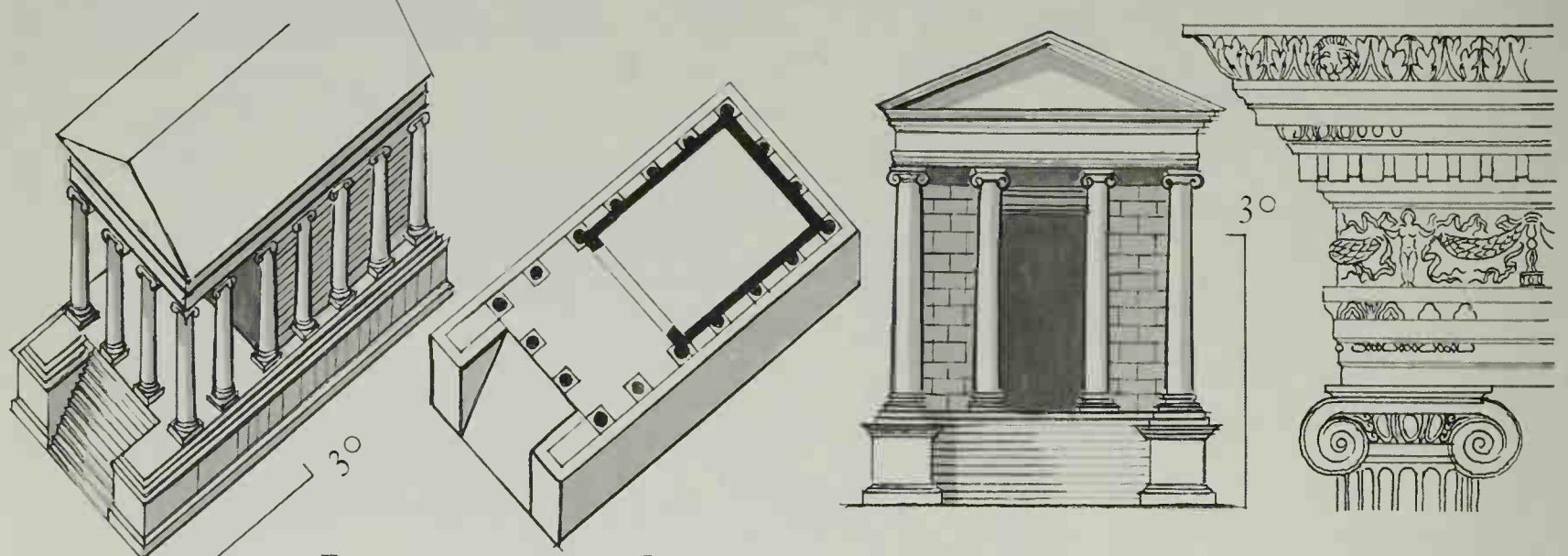


The Temple of Venus, Baalbek (restored),
*c.*A.D.245

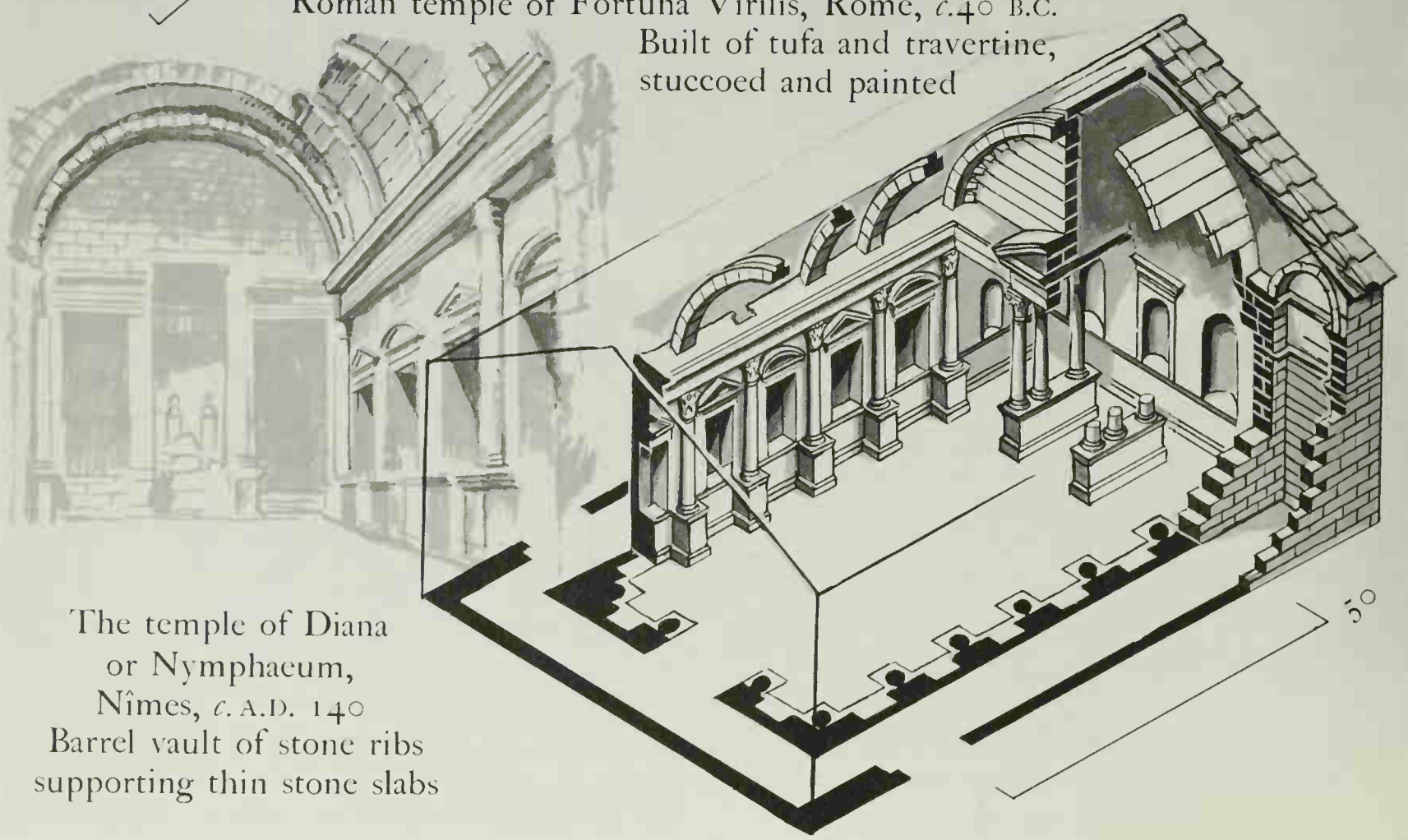
ROMAN



Etruscan (Tuscan) temple according to Vitruvius (IV, 7)



Roman temple of Fortuna Virilis, Rome, *c.*40 B.C.
Built of tufa and travertine,
stuccoed and painted



The temple of Diana
or Nymphaeum,
Nîmes, *c.* A.D. 140
Barrel vault of stone ribs
supporting thin stone slabs

TEMPLES

Temple of Bacchus,
c. A.D. 120-200

Temple of Jupiter,
from *c.* A.D. 10

Court, *c.* A.D. 200

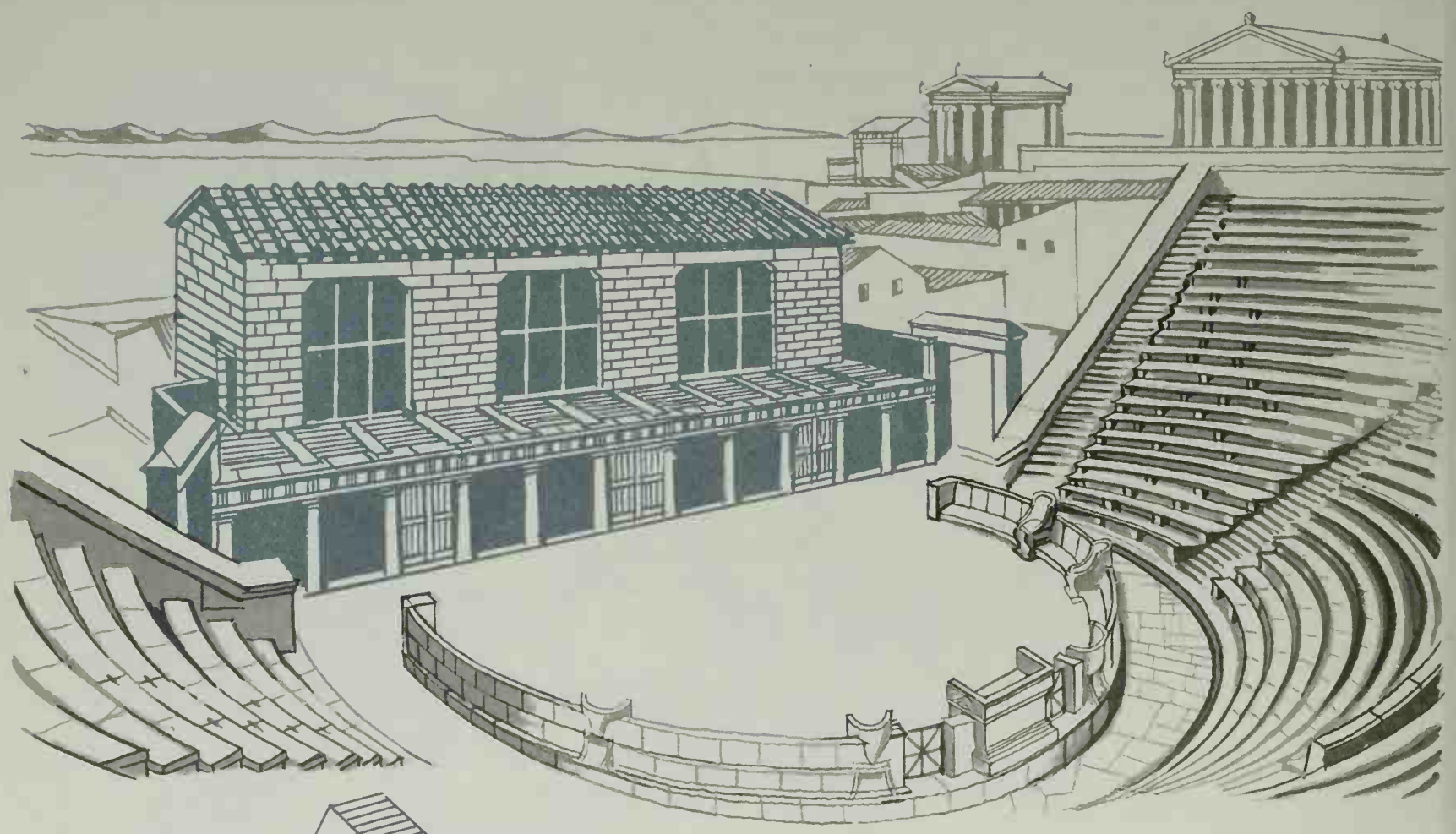
340

Temple of Bacchus: interior

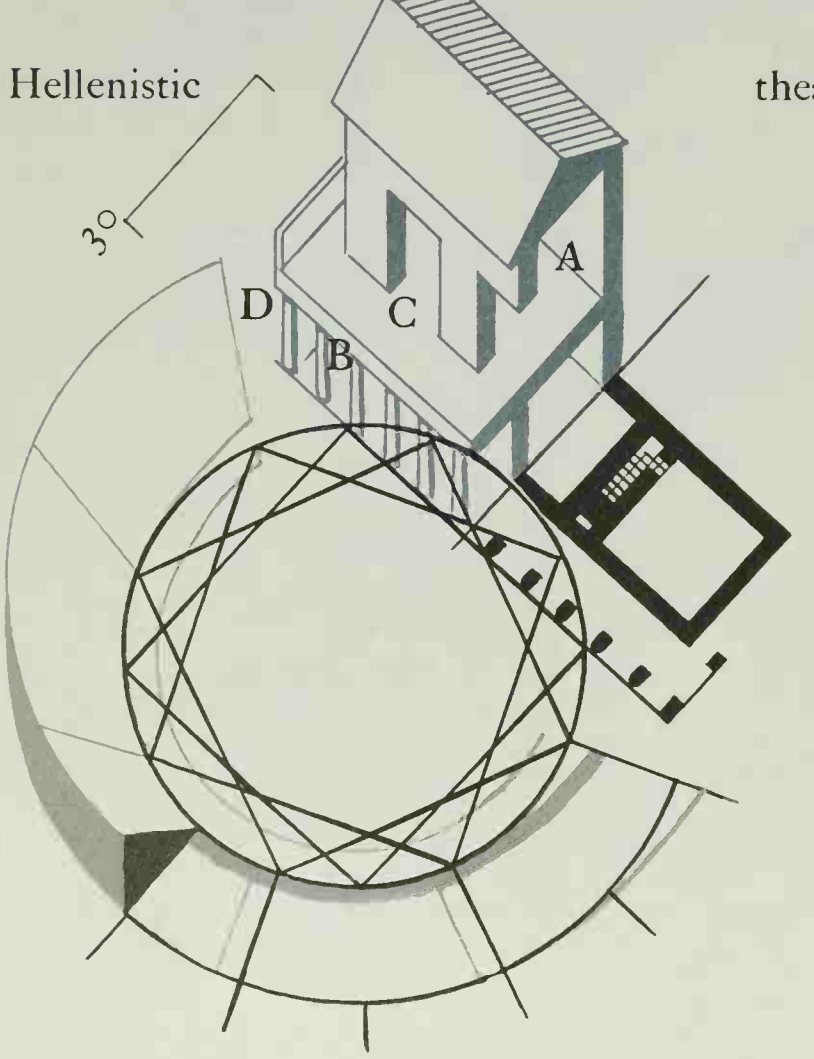
TEMPLES, BAALBEK, SYRIA
(restored), *c.* 1st-2nd
centuries A.D.;
built of hard
local sandstone

Temple of Bacchus

GREEK THEATRE



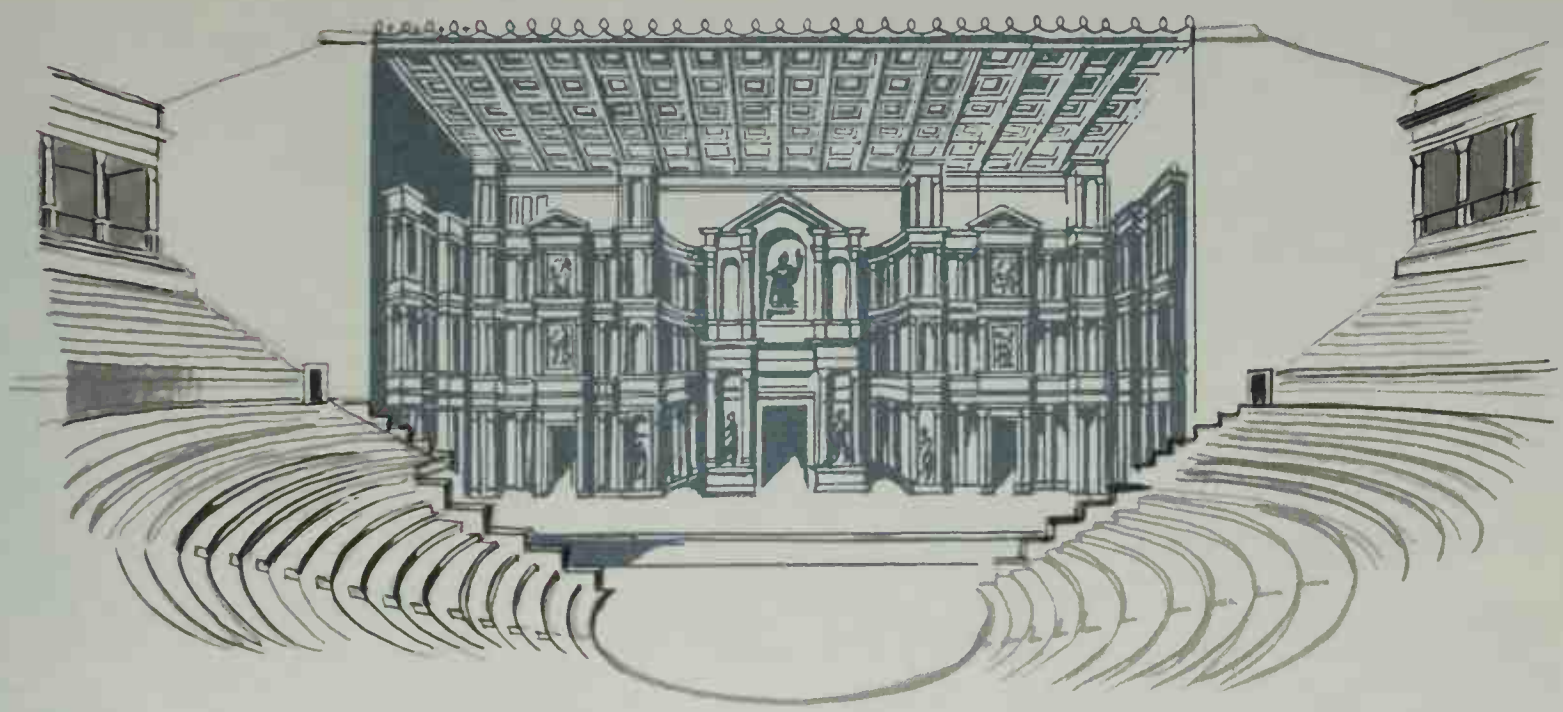
Hellenistic theatre, Priene, Asia Minor (restored), *c.*50 B.C.



Plan of a Greek theatre based on 3 squares within the orchestra circle (Vitruvius, V.7)

The early Greek theatre consisted of an auditorium (simply a hill slope with stone seats), a semi-circular orchestra where the chorus sang and danced, and a wooden stage from which a single actor would hold a dialogue with the chorus. The number of actors was raised to two or three by Aeschylus (525-456 B.C.) and Sophocles (495-406 B.C.), who also introduced painted scenery and a dressing hut or skene. In the 4th century B.C. a wooden skene A was erected with a proscenium B having a row of columns, usually Doric, 8-12 ft from the skene wall supporting a stage of planks called the logeion or speaking-place C. Three doors in the skene wall were for entrances and exits of actors. At the two ends of the proscenium were the parodoi or open passage-ways D.

ROMAN THEATRE

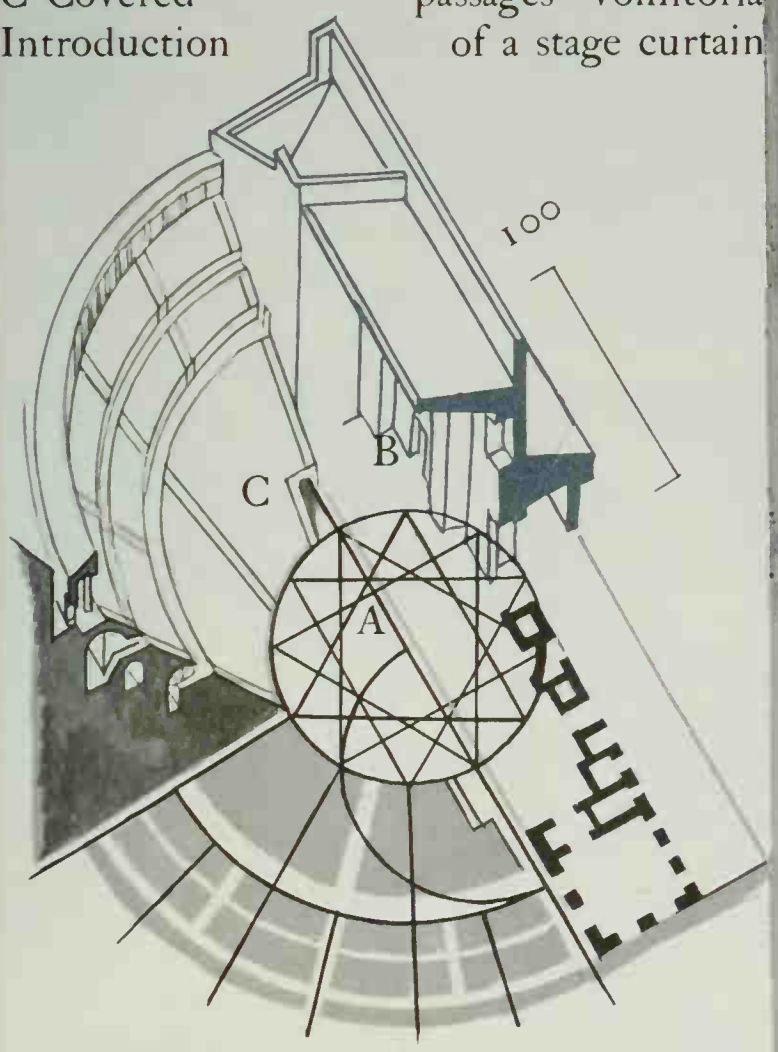


The Theatre, Orange (restored), *c.*A.D.50. Designed to seat 7000. Stage 5 ft high, 23 ft deep. Built up on stone and concrete piers.

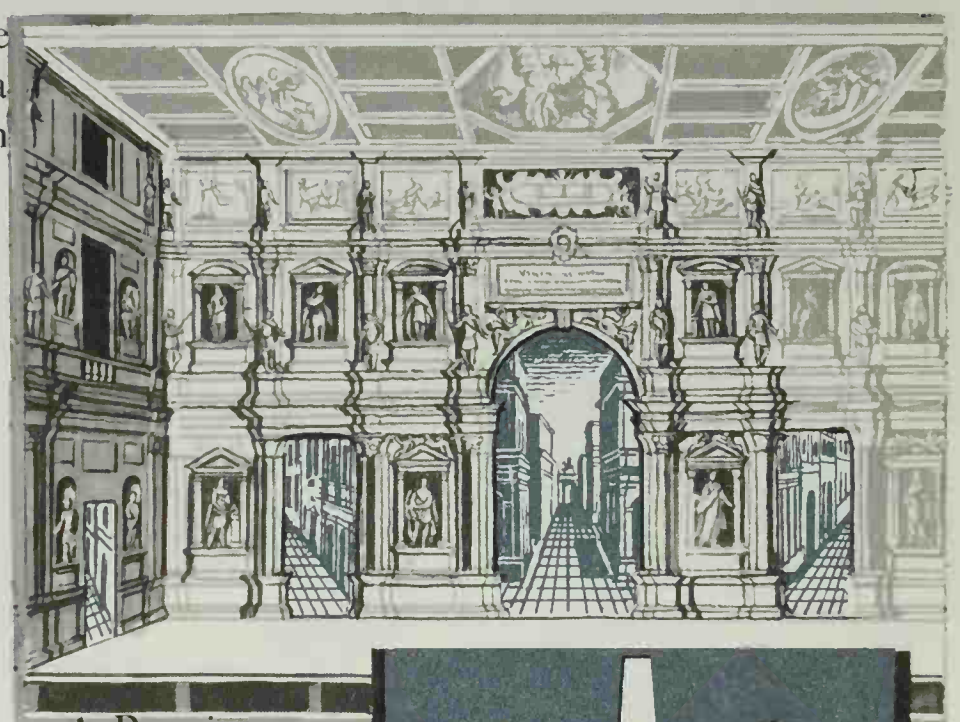
A Semi-circular cavea or auditorium
B Proscenium replaced by a frons scaenae
C Covered passages—vomitoria

Introduction

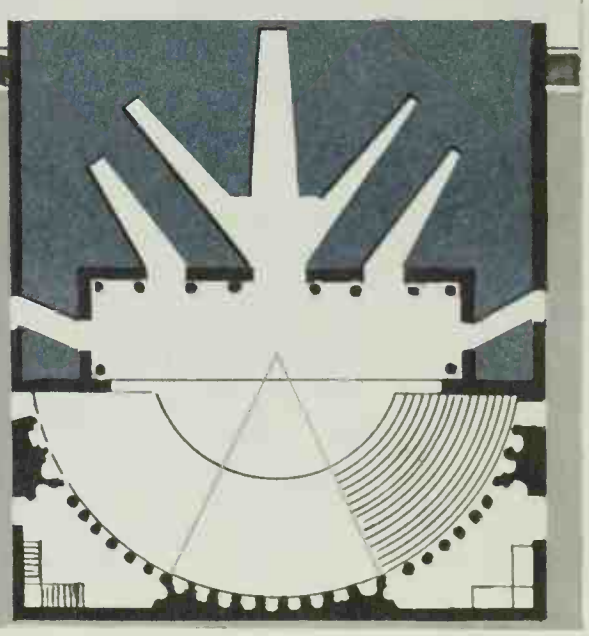
of a stage curtain



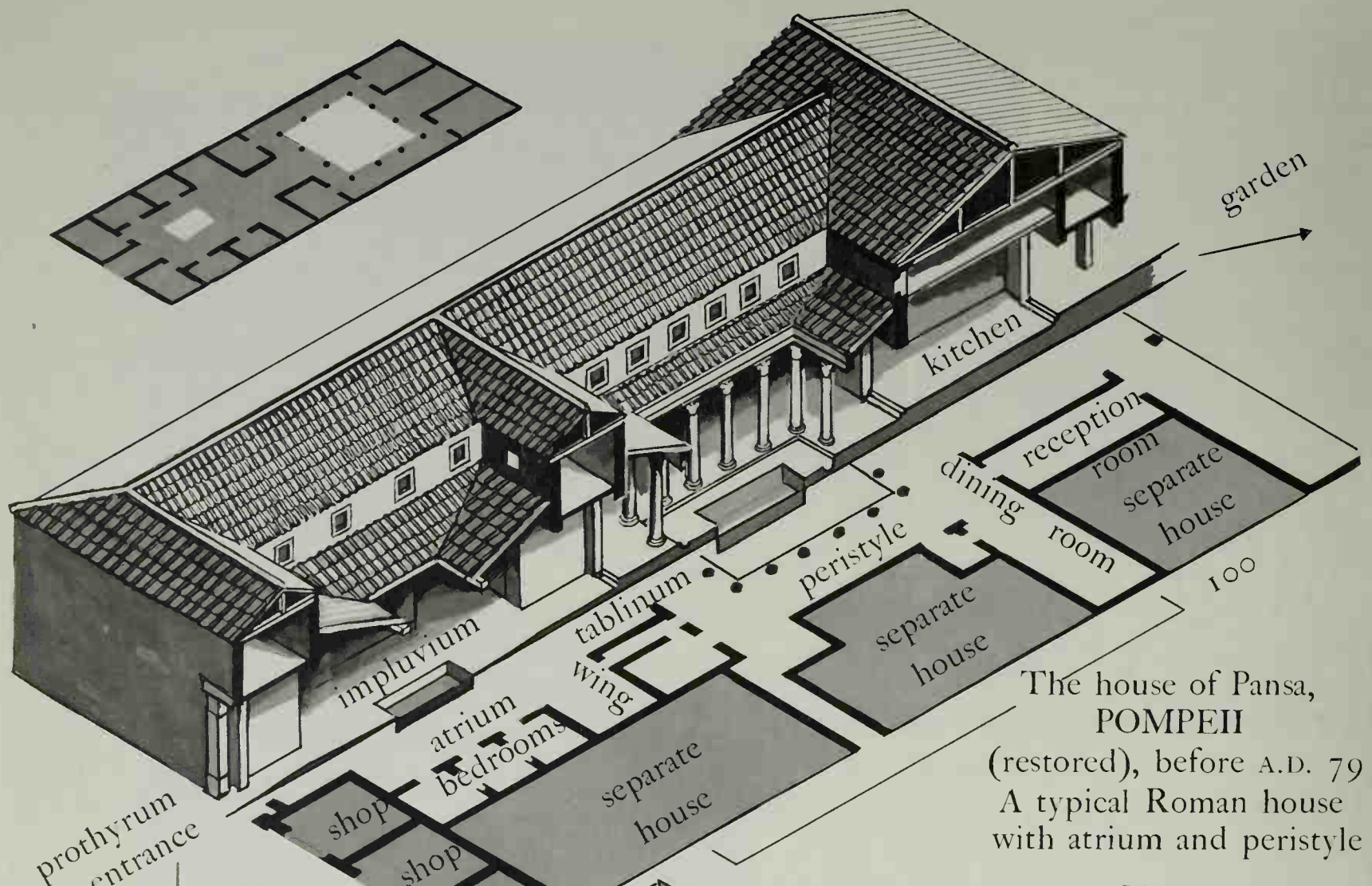
Plan of a Roman theatre based on 4 equilateral triangles in a circle (Vitruvius v,6)



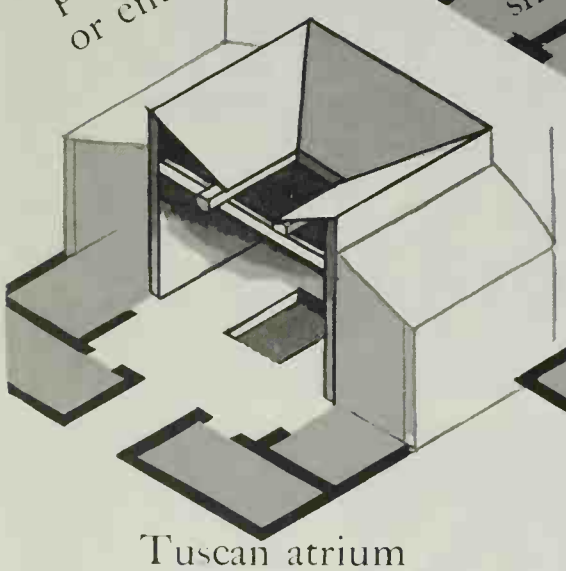
A Renaissance adaptation of a Roman theatre. The Teatro Olympico, Vicenza, Italy, designed by Palladio and completed by Scamozzi, A.D. 1584



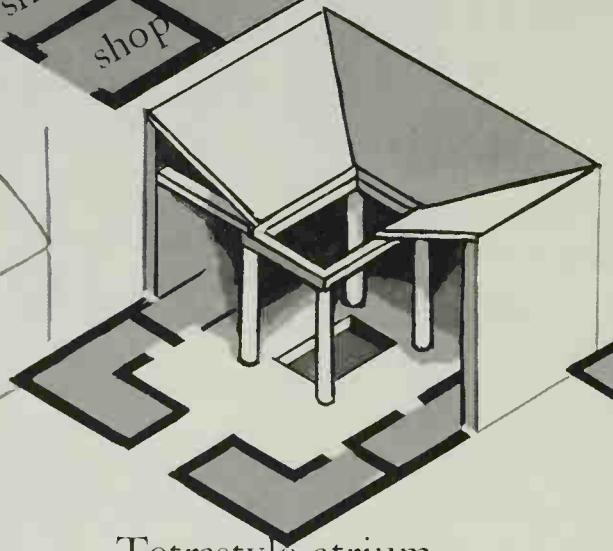
ROMAN



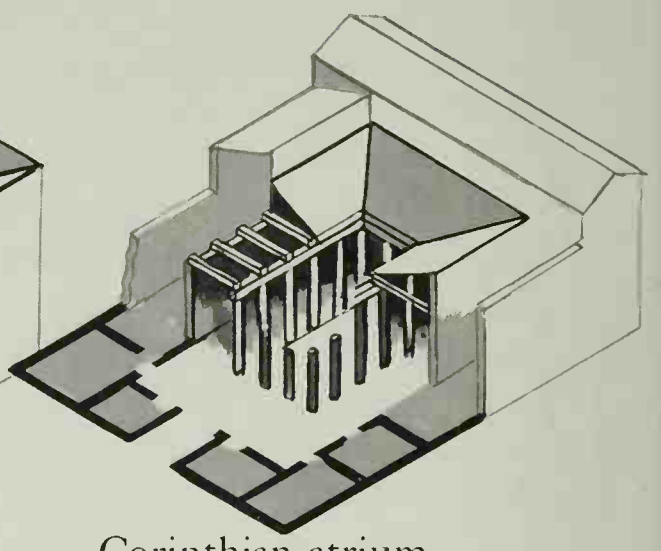
The house of Pansa, POMPEII (restored), before A.D. 79
A typical Roman house with atrium and peristyle



Tuscan atrium

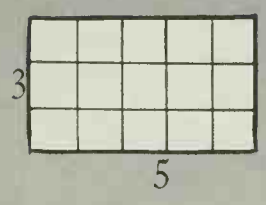


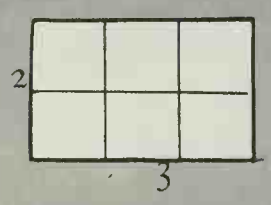
Tetrastyle atrium

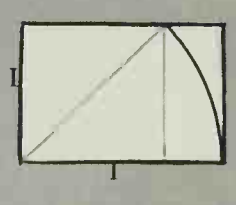


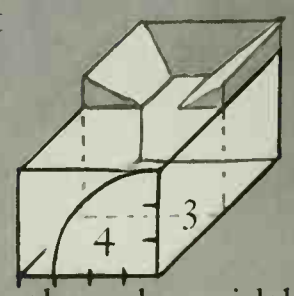
Corinthian atrium

Vitruvius (VI, 3) gives measurements for the symmetrical proportions of the parts of a Roman house so that the beholder might feel the 'eurythmy' of the effect





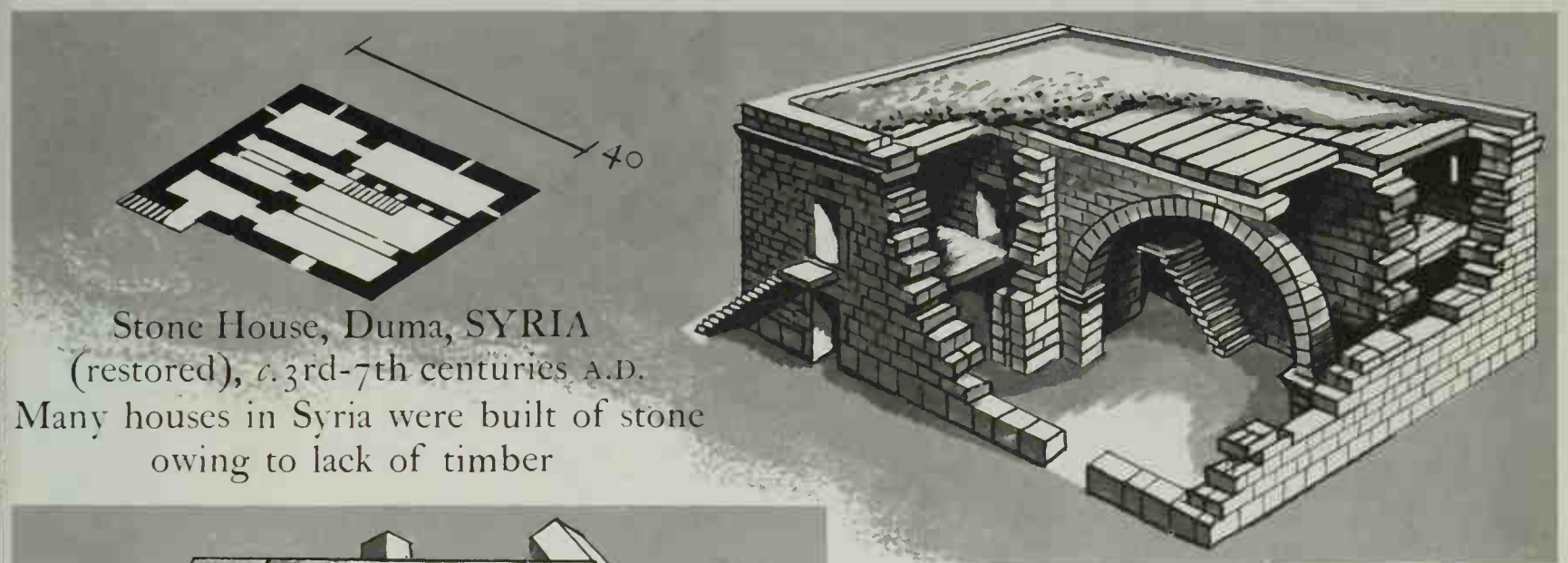




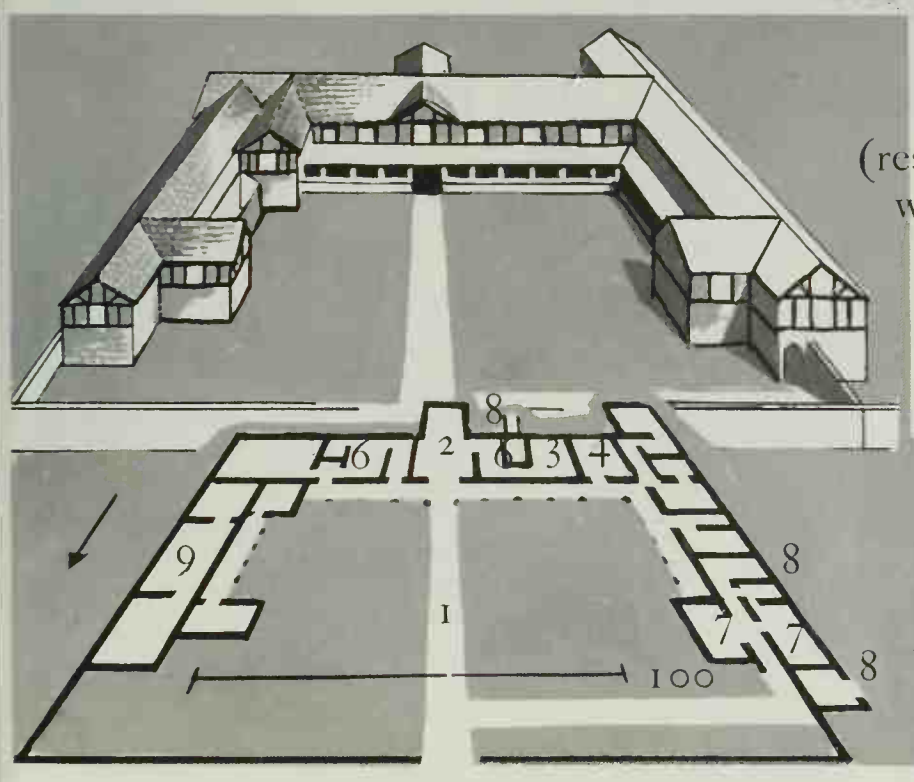
The atrium is divided into three classes, the height being one fourth less than the width

THE ROMAN HOUSE

Insula or Block of Flats, OSTIA, near Rome (restored)
In Ostia and Rome 4- or 5-storey flats were limited to 65 feet in height by Augustus (30 B.C.-A.D. 14) and to 58 feet by Trajan (A.D. 98-117). They were mostly brick-faced, occasionally stuccoed, the windows glazed with mica or glass.

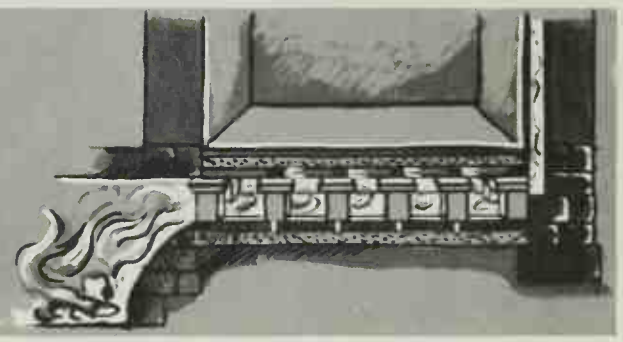


Stone House, Duma, SYRIA (restored), *c.* 3rd-7th centuries A.D.
Many houses in Syria were built of stone owing to lack of timber



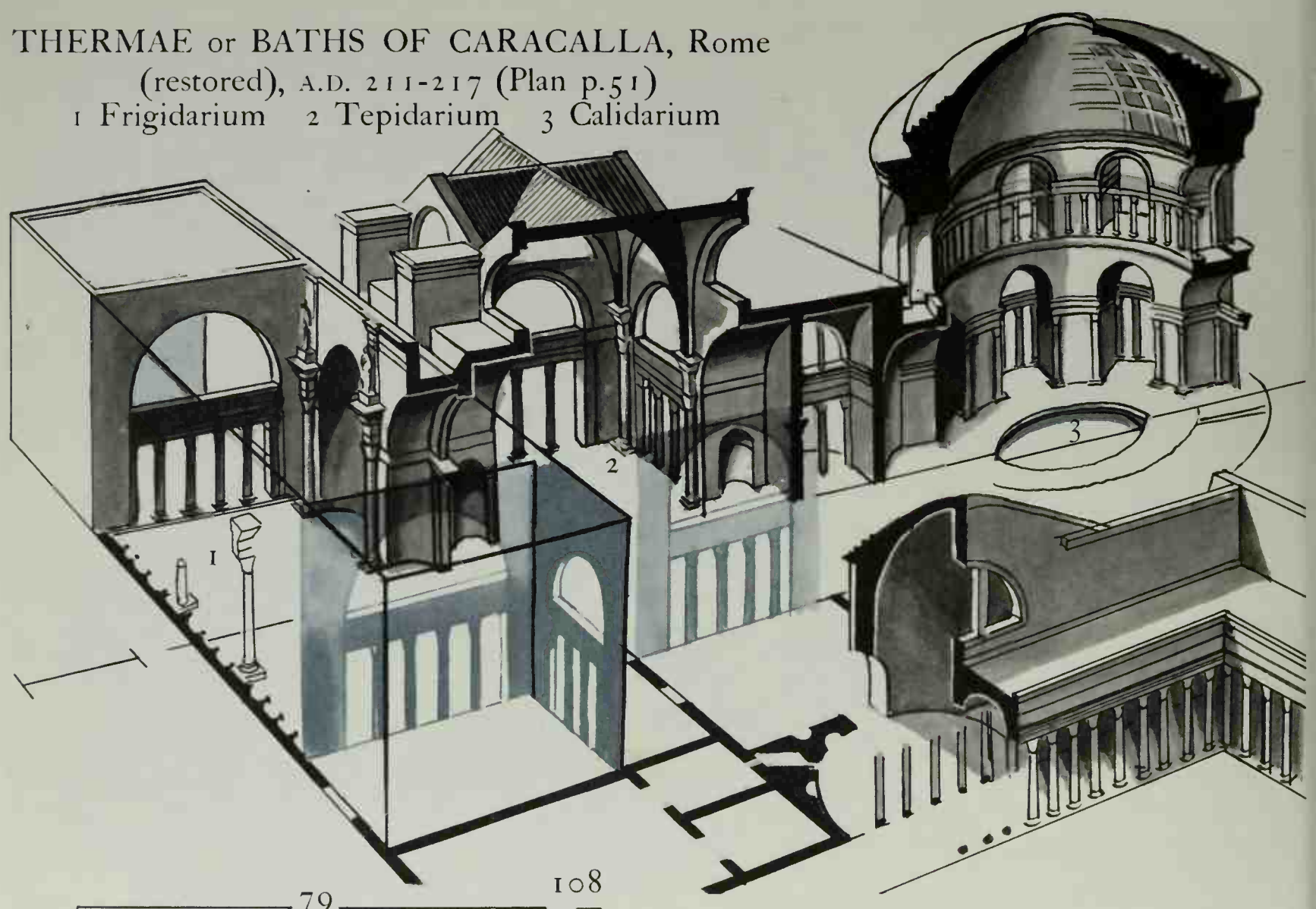
BRITAIN: Villa, Spooney Wood, Glos. (restored); walls, stone and timber-framework with wattle and daud and stucco, slate roofs.
1 Courtyard 2 Tablinum 3 Dining-room
4 Kitchen 5 Larder and stores
6 Reception-rooms 7 Baths
8 Furnaces 9 Slave quarters

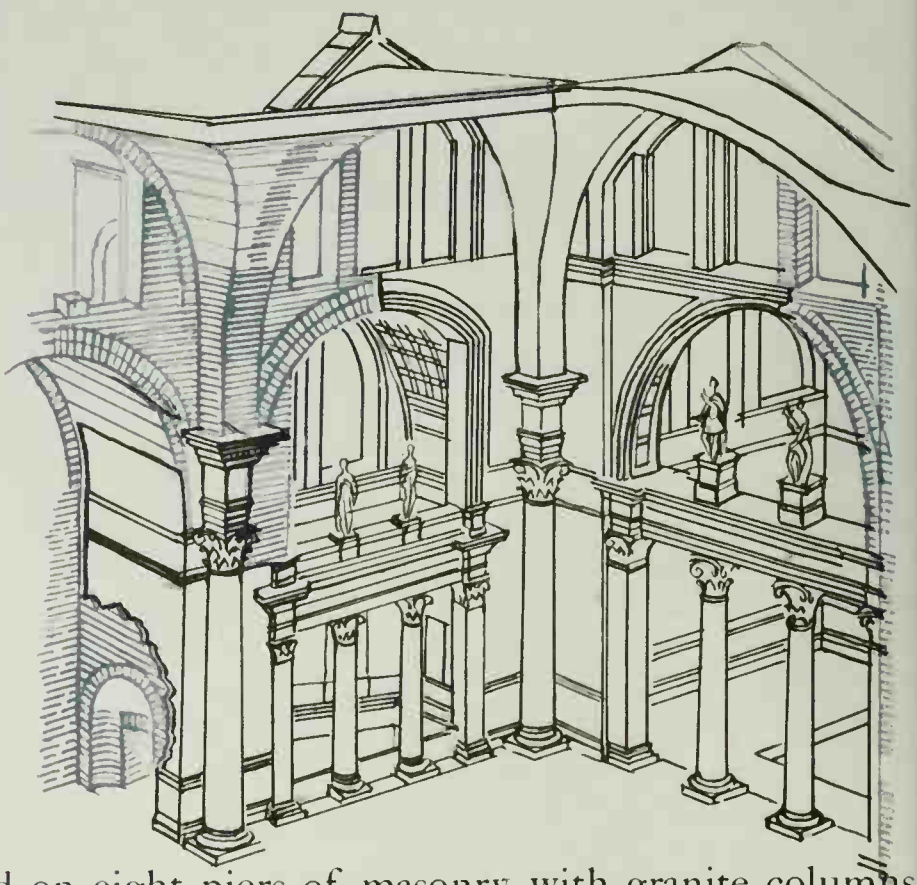
Method of heating rooms by hypocaust



ROMAN THERMAE

THERMAE or BATHS OF CARACALLA, Rome (restored), A.D. 211-217 (Plan p.51)
1 Frigidarium 2 Tepidarium 3 Calidarium





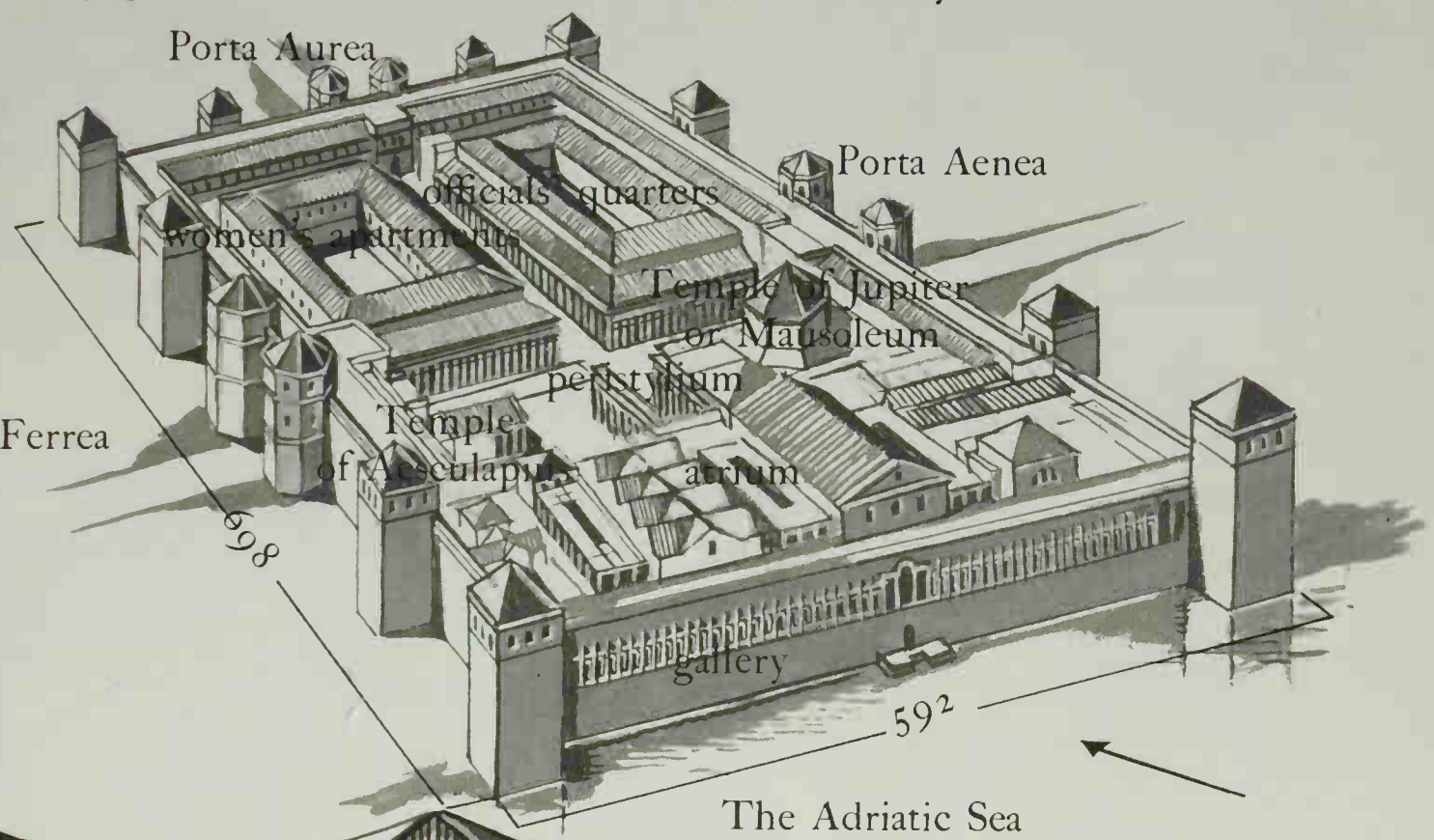
The Tepidarium: the concrete vault rested on eight piers of masonry with granite columns

PALACE

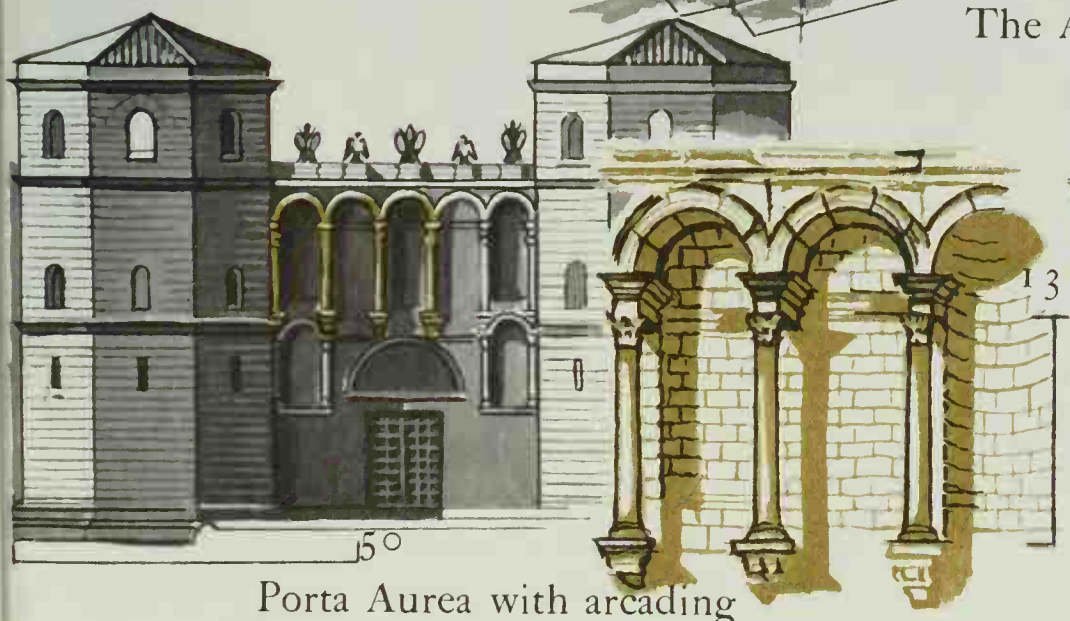
Arches
spring from capitals
without entablature

THE PALACE
OF
DIOCLETIAN,
Spalatro (Split),
Dalmatia
(restored), *c.* A.D. 300

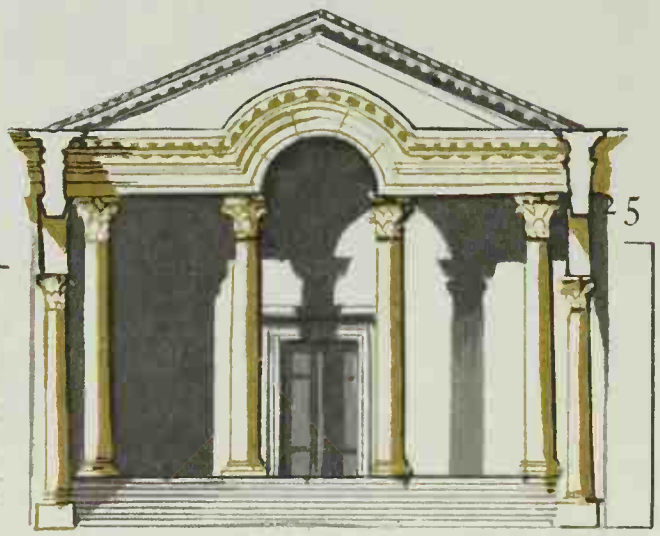
The Temple of Jupiter or Mausoleum of Diocletian, and Peristylium



The Adriatic Sea



Porta Aurea with arcading

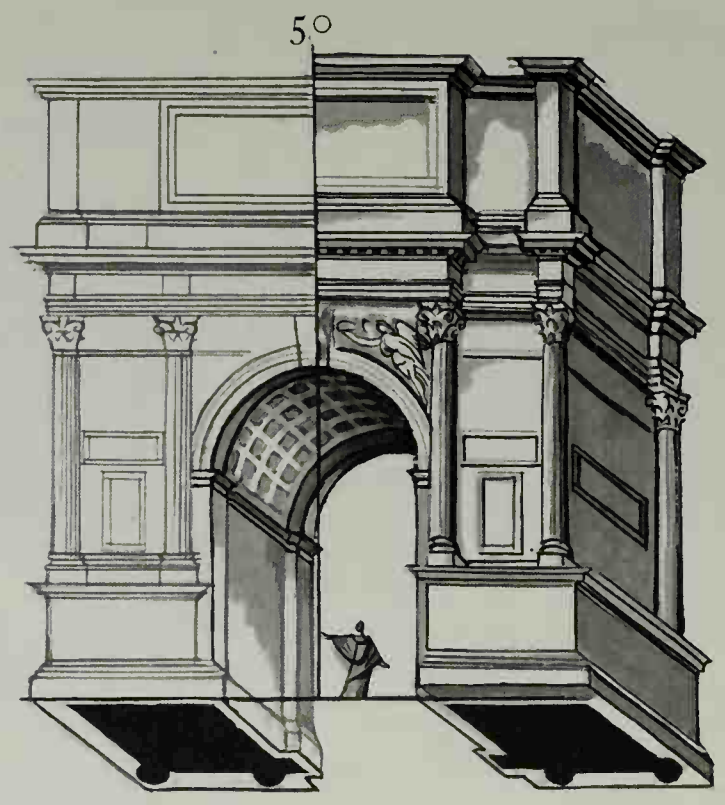


Peristylium: arched entablature

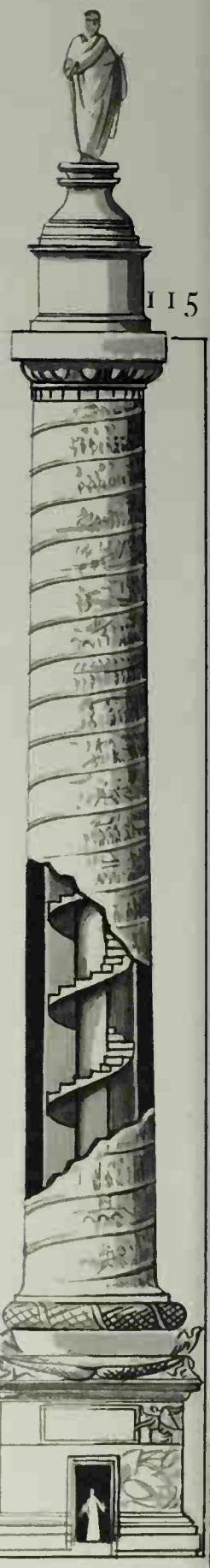
ROMAN

Triumphal Arches with one opening

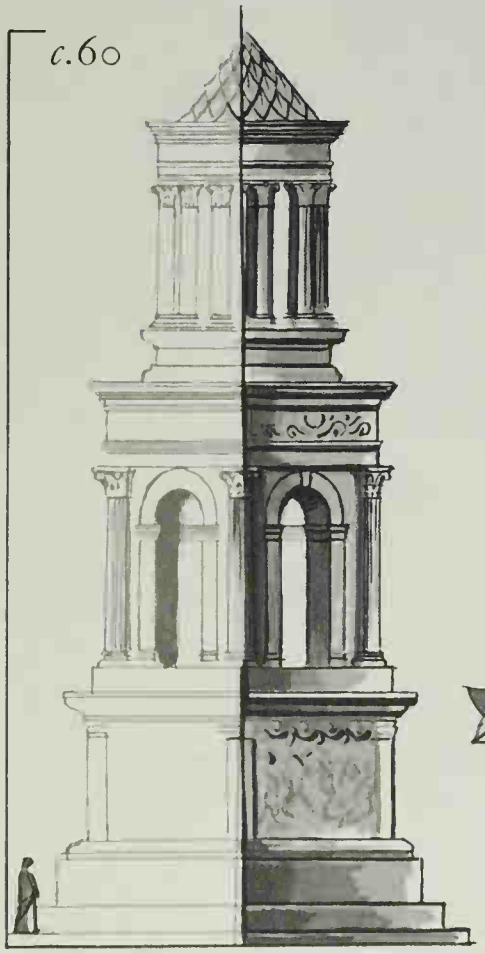
Arch of Augustus, Susa,
Piedmont, *c.* A.D. 8



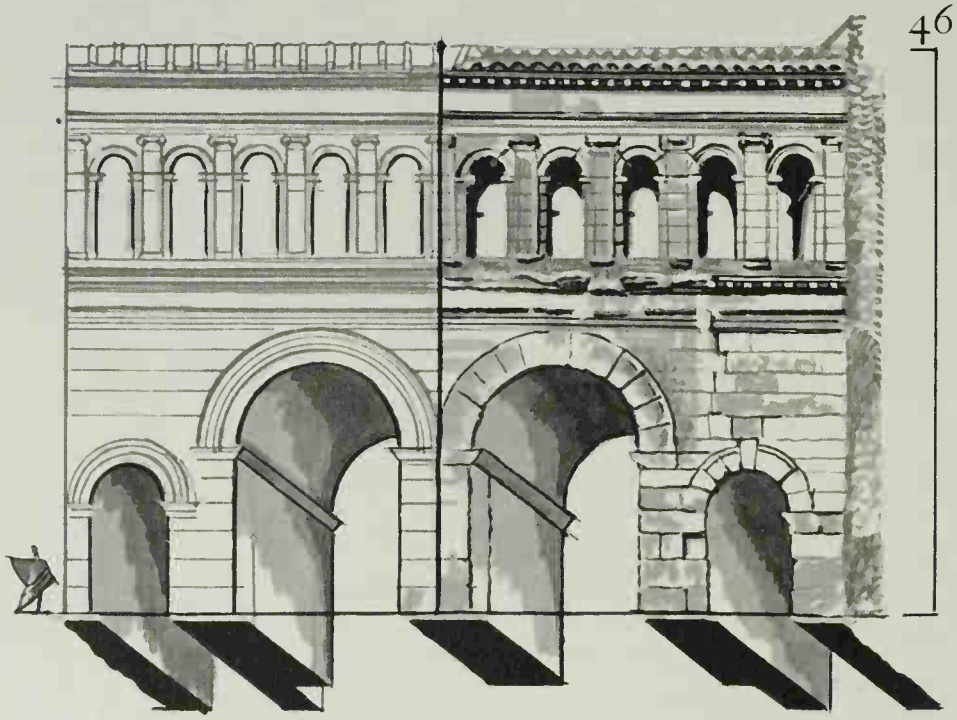
Arch of Titus, Rome, A.D. 70
Earliest use of the Composite order.



Trajan's
Column,
Rome,
A.D. 114.

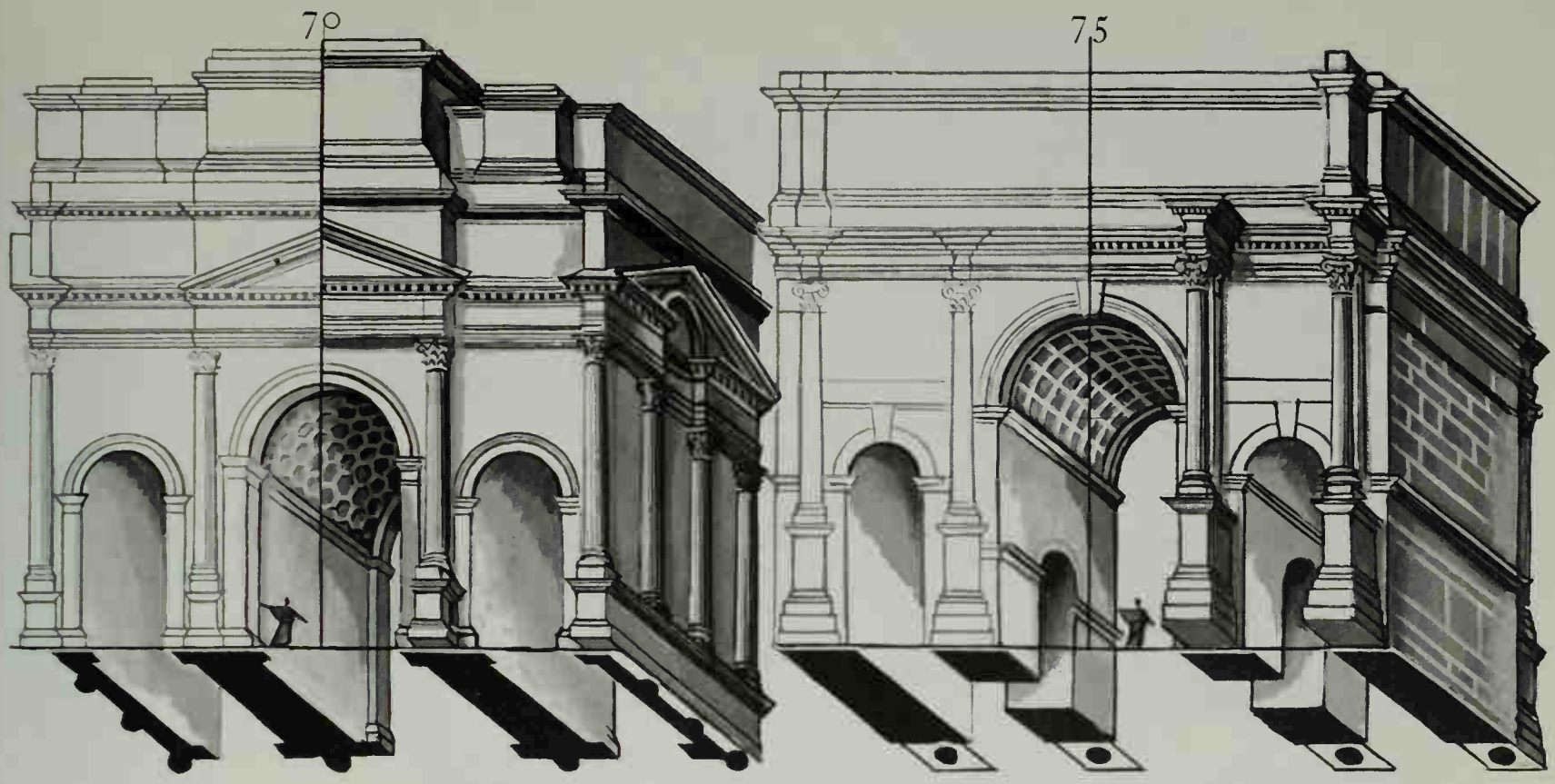


Tomb of the Julii,
Provence, S. Remy,
c. 30 B.C.-A.D. 14



Town gateway with four archways
The Porte S. André, Augustodonum (Autun).
An arcaded gallery with Ionic pilasters creates
an antiphonal response with the rise and fall
of the large and small arches below

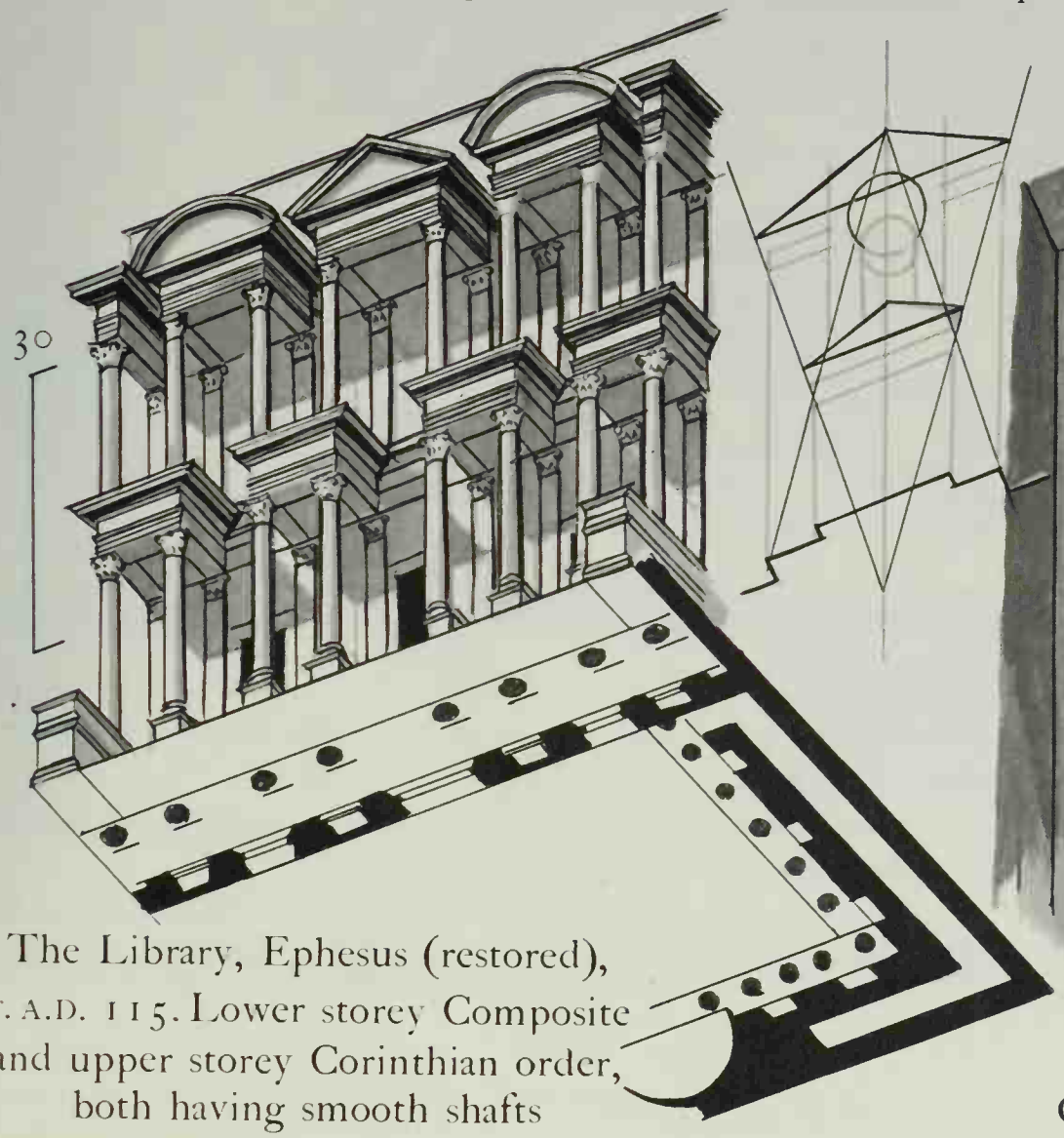
ARCHES AND MONUMENTS



Triumphal Arches with three openings.

Arch of Tiberius, Orange, *c.* A.D. 21

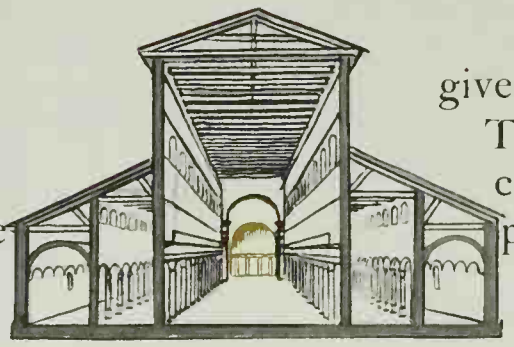
Arch of Septimus Severus, Rome, A.D. 200



The Library, Ephesus (restored), *c.* A.D. 115. Lower storey Composite and upper storey Corinthian order, both having smooth shafts

Rock-cut tomb of Khazna, Petra, *c.* A.D. 120. One of the 25 rock-cut façades

EARLY CHRISTIAN AND

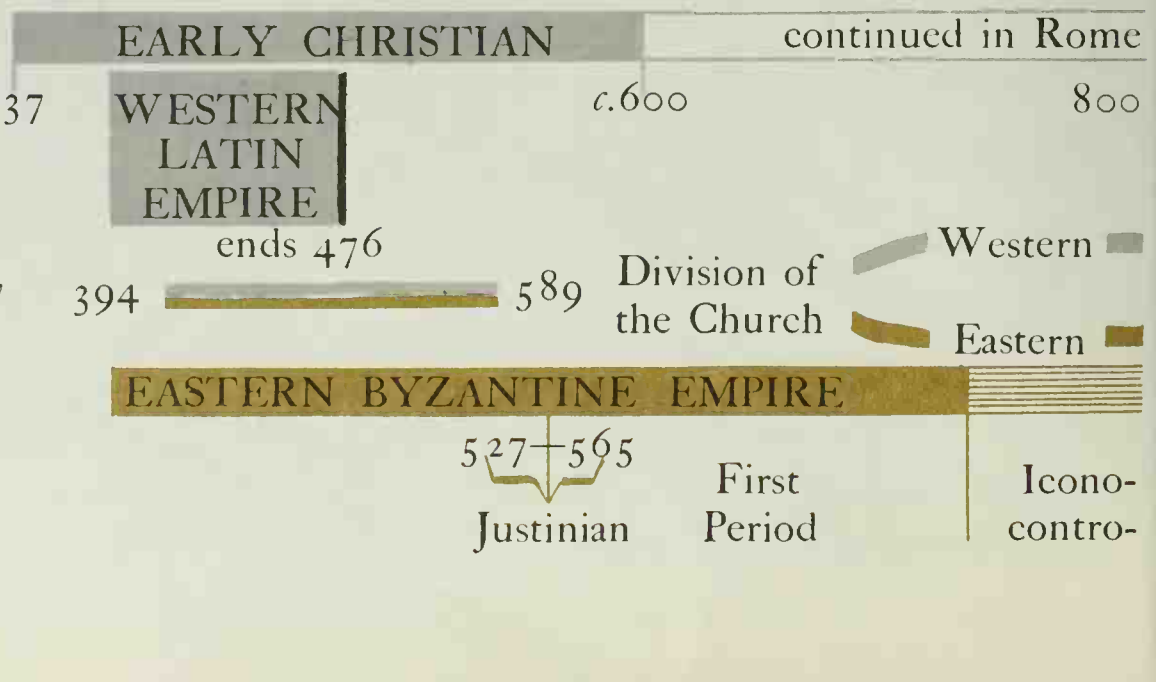


Christianity accepted as the state religion in A.D. 337. Basilican churches were built throughout the Roman Empire to house large congregations. In contrast to Classical temples little regard was given to their external appearance. The term 'basilica' was used for churches from the 4th century, plans being similar to those of Roman basilicas or Halls of Justice.

Architectural periods:

CHRISTIANITY made the State religion of the ROMAN EMPIRE A.D. 337
The capital of the Empire moved from Rome to Byzantium A.D. 326

Architectural periods:

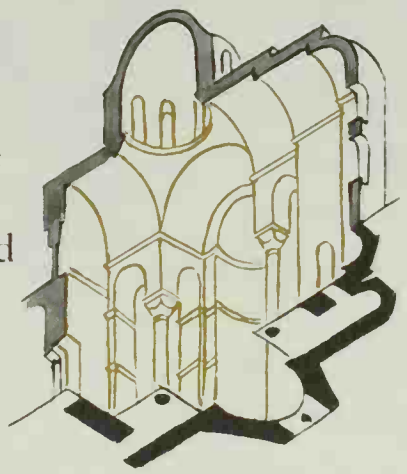


BYZANTINE INTRODUCTION

The Byzantine Empire under Justinian, A.D. 527-565

500 miles

Churches in the Eastern Byzantine Empire were built with a central dome erected over a square-planned space by means of pendentives



Byzantine churches were plain without and resplendent inside with coloured marbles, mosaics and wall-paintings

and many Italian cities

800 1000 1200 1500

ROMANESQUE GOTHIC

Western Latin Catholic Church

The Great Schism 1041

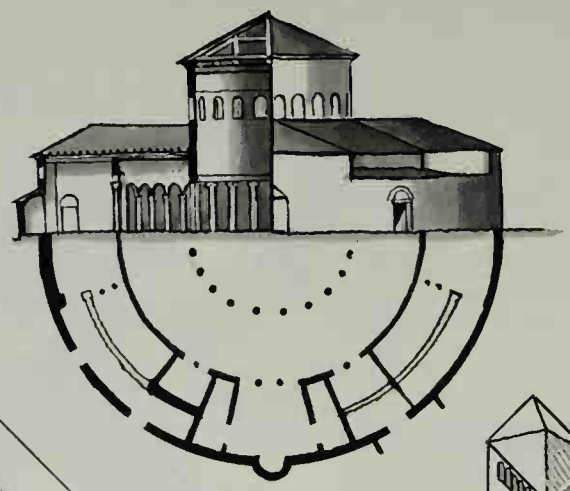
Eastern Greek Orthodox Church

The Byzantine Empire ends

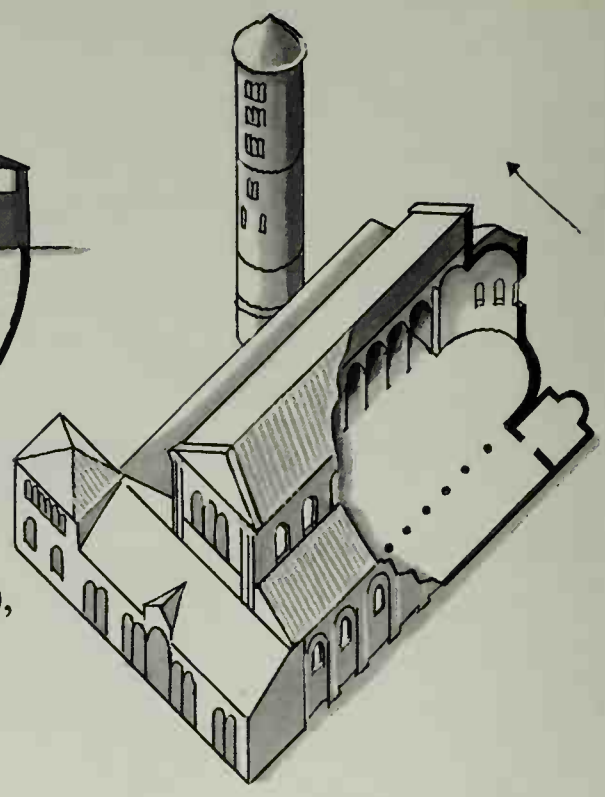
1204 1261 1453

clastic versy | Second 'Golden' Period | Latin occupation | Third Period

EARLY CHRISTIAN



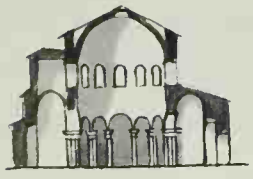
S. Stephano Rotondo
Rome (restored),
A.D. 470

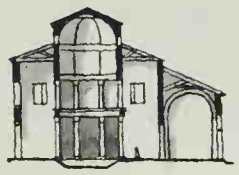


S. Apollinare in Classe, Ravenna,
A.D. 534-539

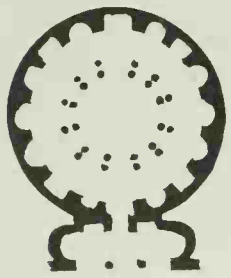
Basilican church
of S. Peter, Rome
(restored),
A.D. 330.
Pulled down in
the 15th century

Church, Roueiha (restored),
c. 6th century A.D.

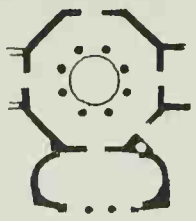




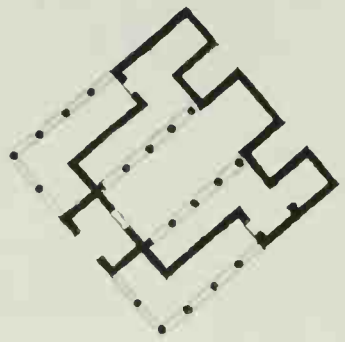
Syria,
5th-6th centuries:
churches built of large
stone blocks and
timber roofs

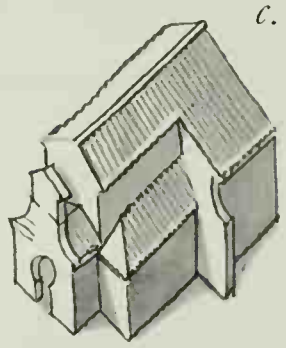


S. Costanza,
Rome,
A.D. 330



Baptistery of
Constantine,
Rome,
A.D. 430-440

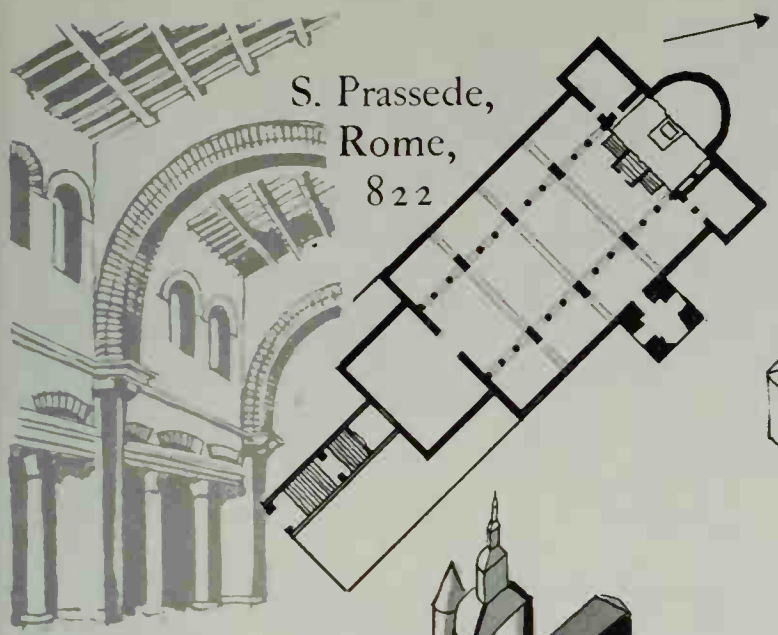




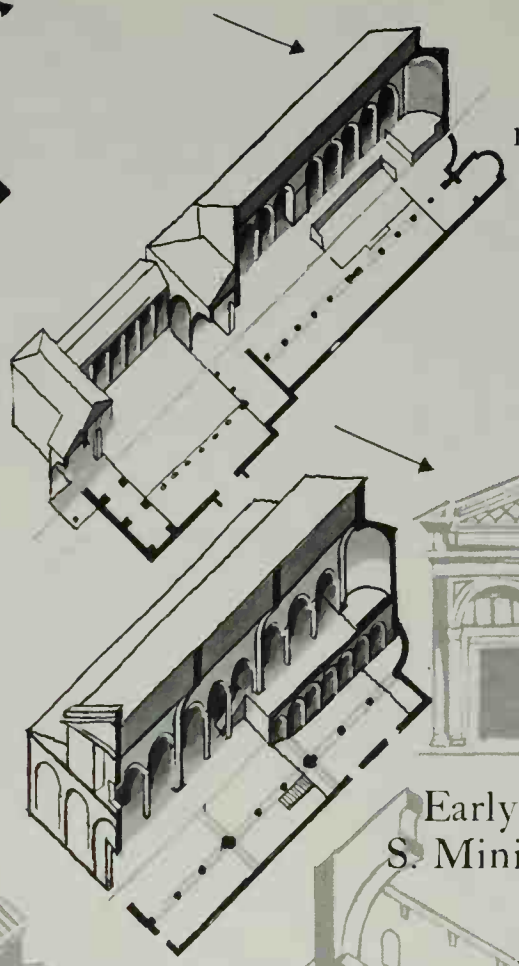
Visigothic before the Moslem invasion, with horse-shoe arch:
S. Juan de Baños, Cerrato, Spain, *c.* A.D. 500-713

COMPARATIVE PLANS

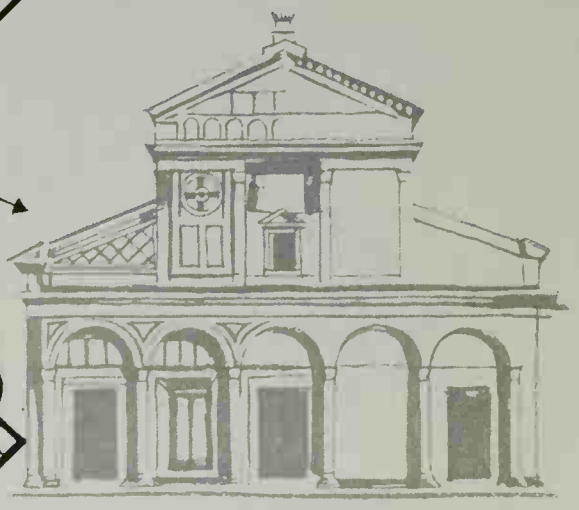
plans and sections in black to the same scale 150



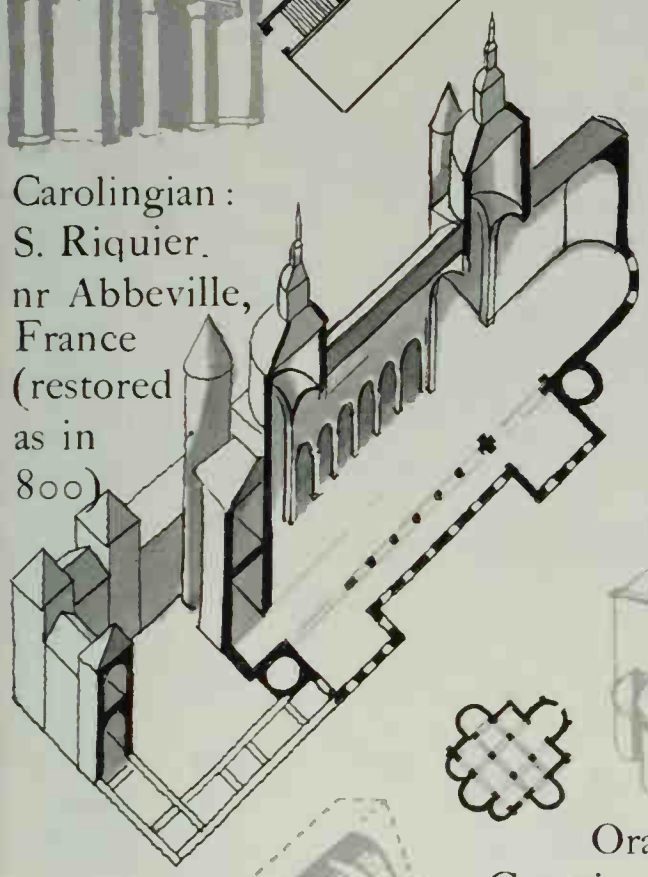
S. Prassede, Rome, 822



S. Clemente, Rome, rebuilt 1084-1108 over a 4th-century church

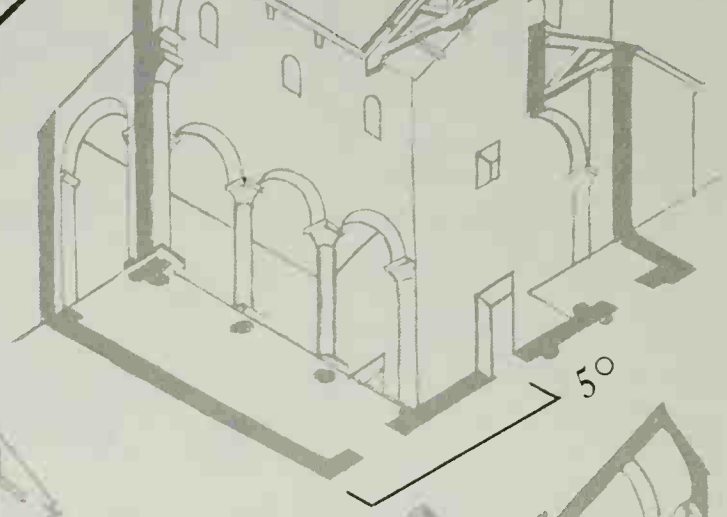


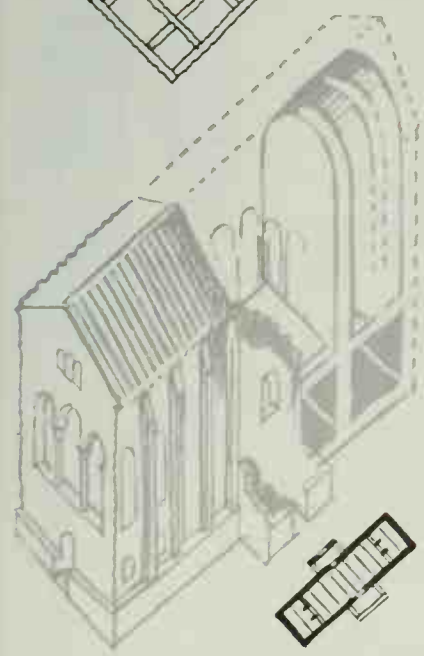
Early Christian-Romanesque: S. Miniato, Florence, A.D. 1013



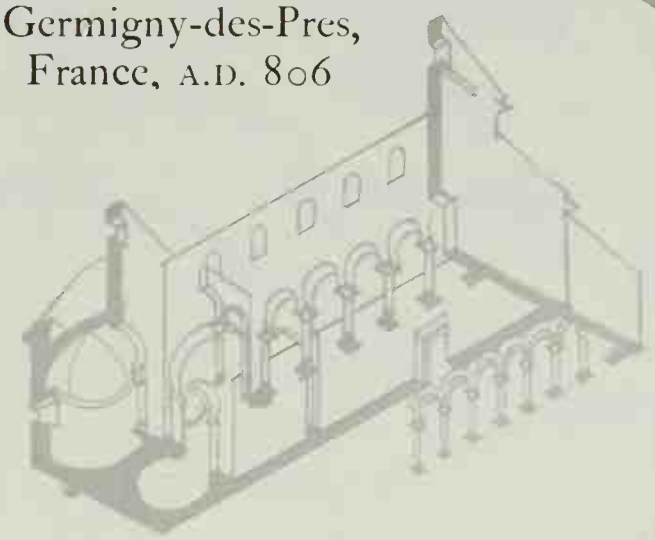
Carolingian: S. Riquier, nr Abbeville, France (restored as in 800)

Oratory, Germigny-des-Pres, France, A.D. 806

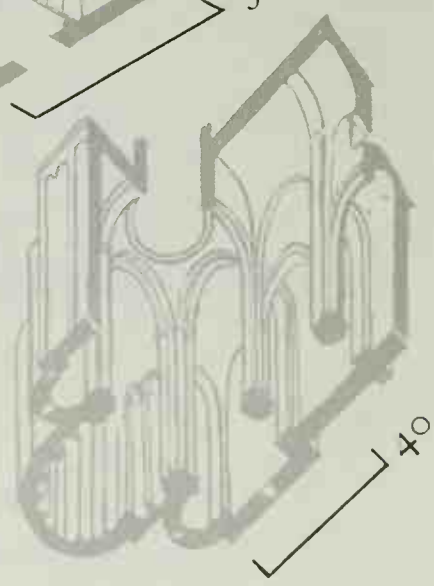




S. Maria de Naranco Asturia, Spain, A.D. 824-840

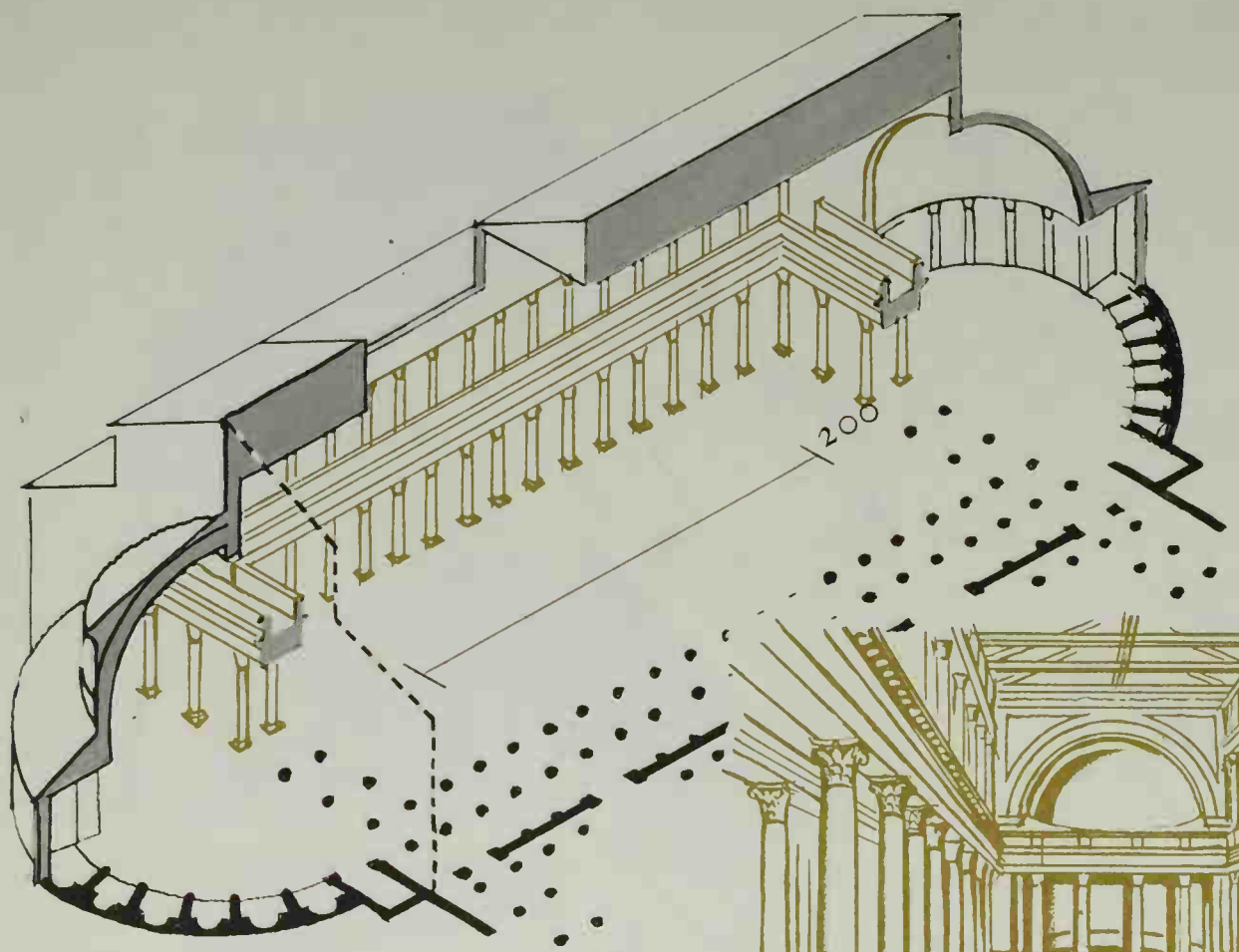


Mozarabic, 'Arabized Spanish': S. Miguel de Escalada, León, A.D. 913

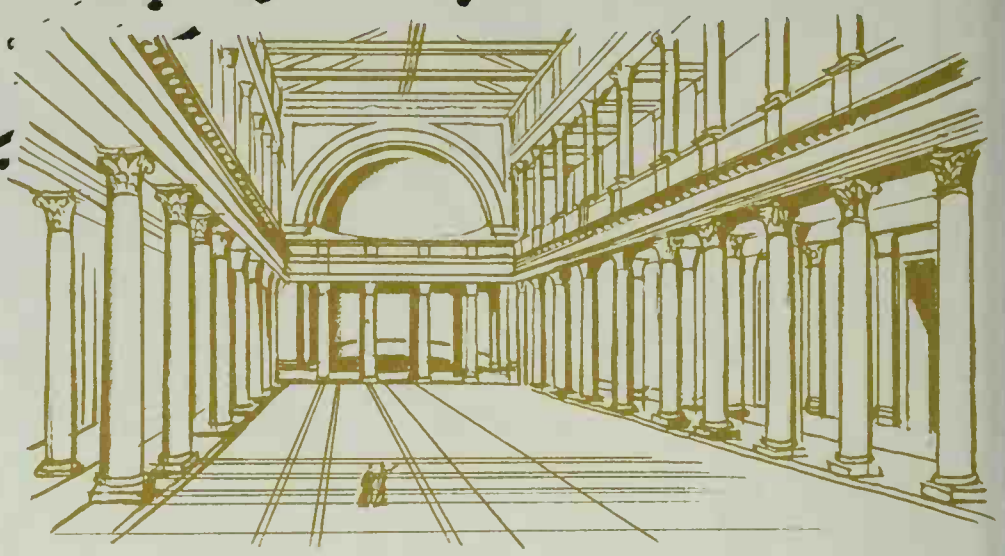


Spanish-Romanesque: S. Vicente de Cardona, Catalonia, *c.* 1024-1040

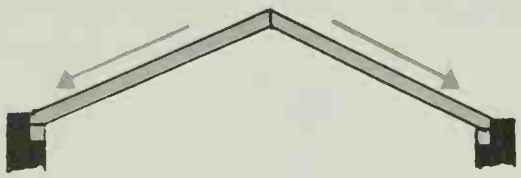
ROMAN BASILICA EARLY



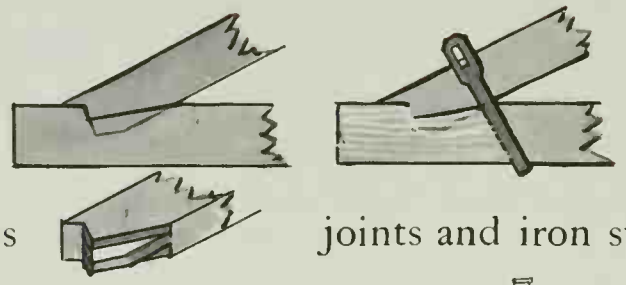
Basilica of Ulpia,
Rome, *c.* A.D. 98-112:
a part of
Trajan's Forum
built by the
Hellenistic architect,
Apollodorus
of Damascus



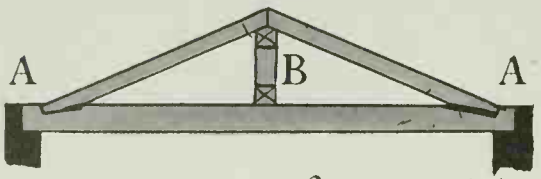
TIMBER ROOFS



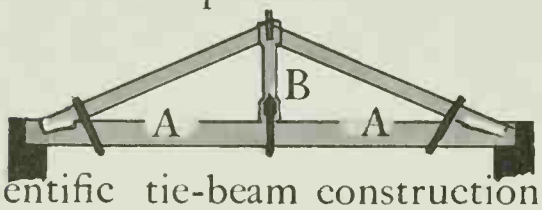
Rafters tend to push walls outwards



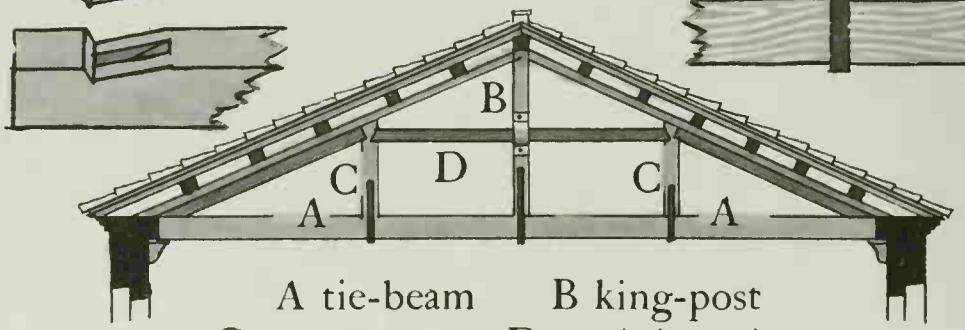
joints and iron straps



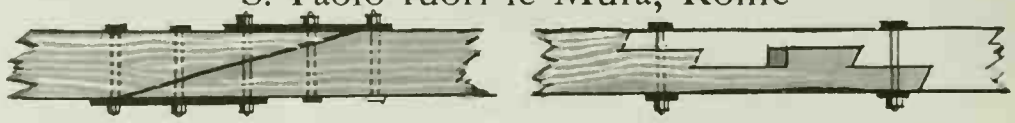
A beam supports rafters at AA
and a post at B



Scientific tie-beam construction:
king-post or suspensory tie B
holds up the tie-beam AA

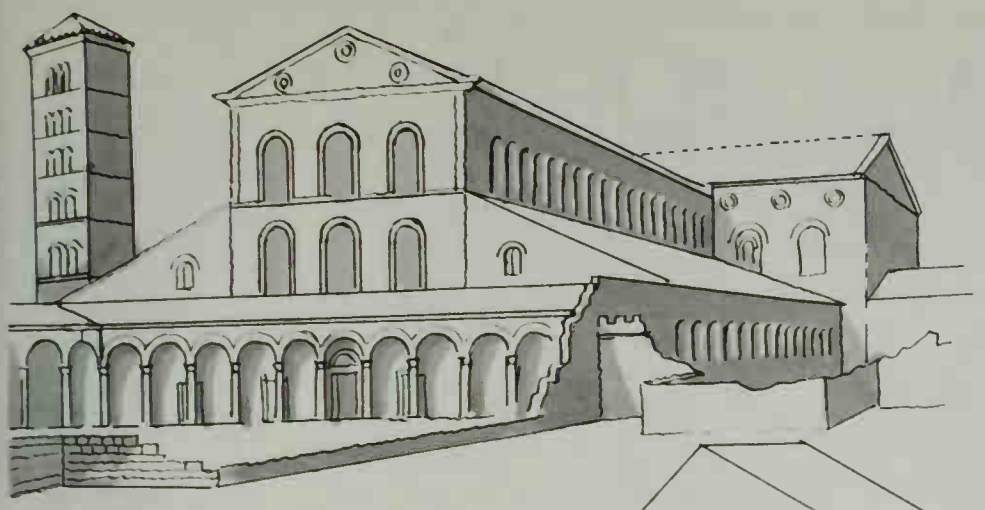


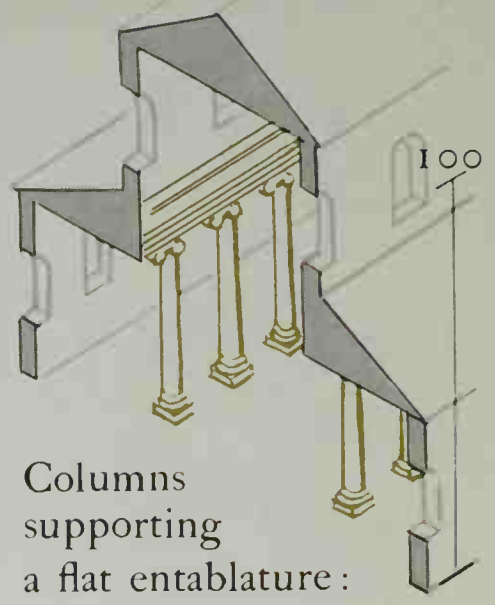
A tie-beam B king-post
C queen-posts D straining-piece
S. Paolo fuori le Mura, Rome



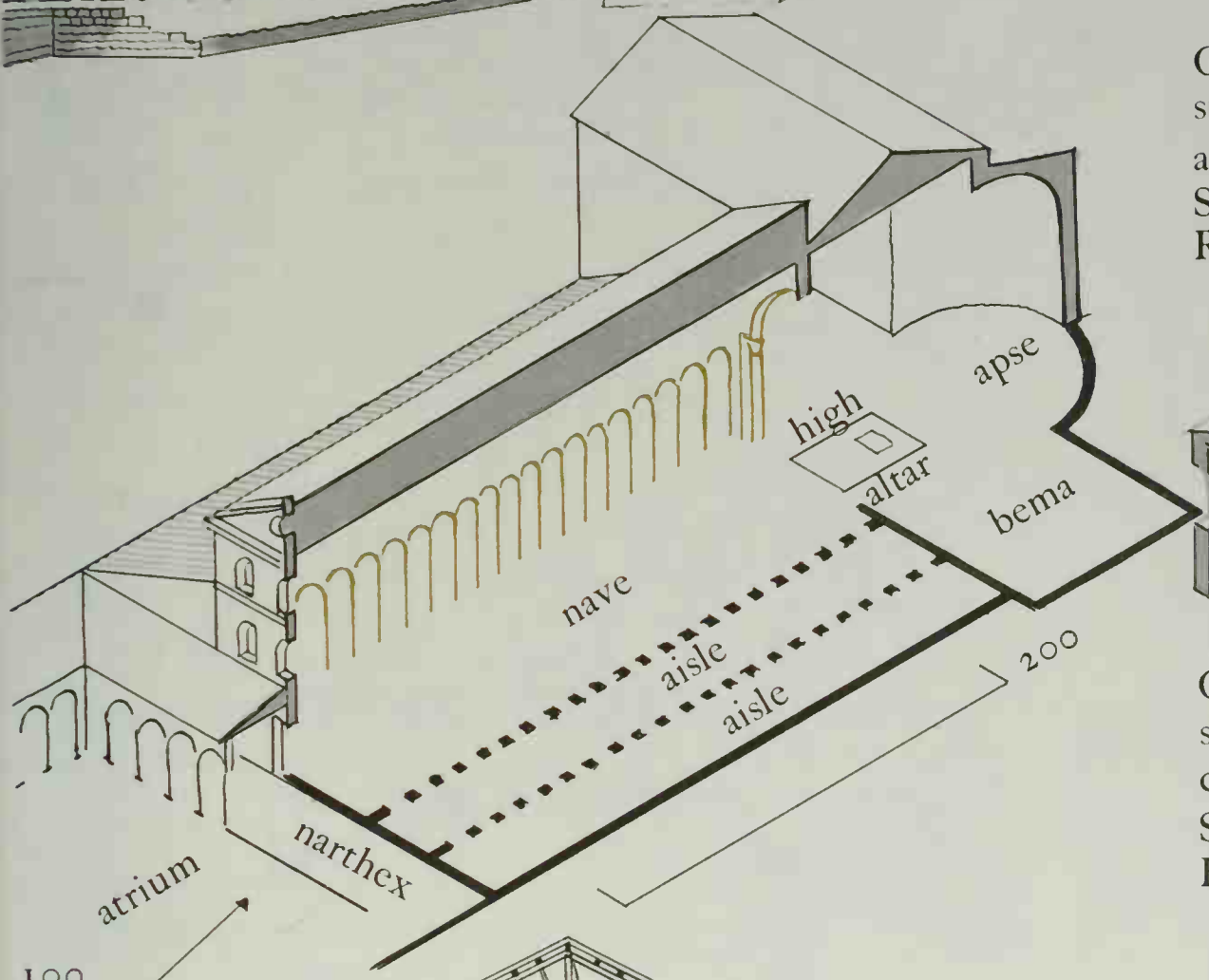
Tie-beams lengthened by scarf-joints and iron bolts

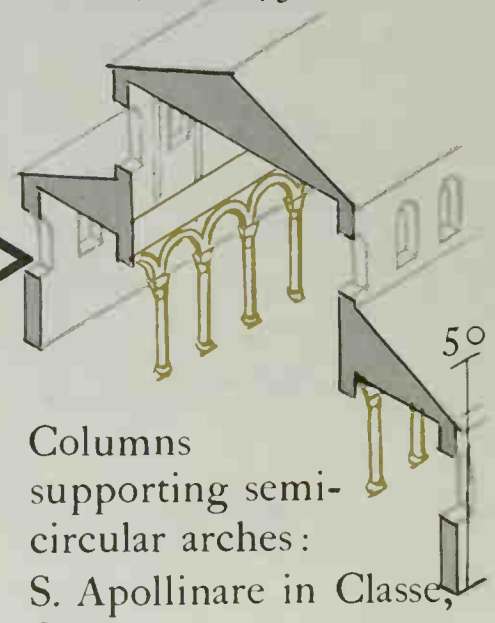
CHRISTIAN CHURCHES



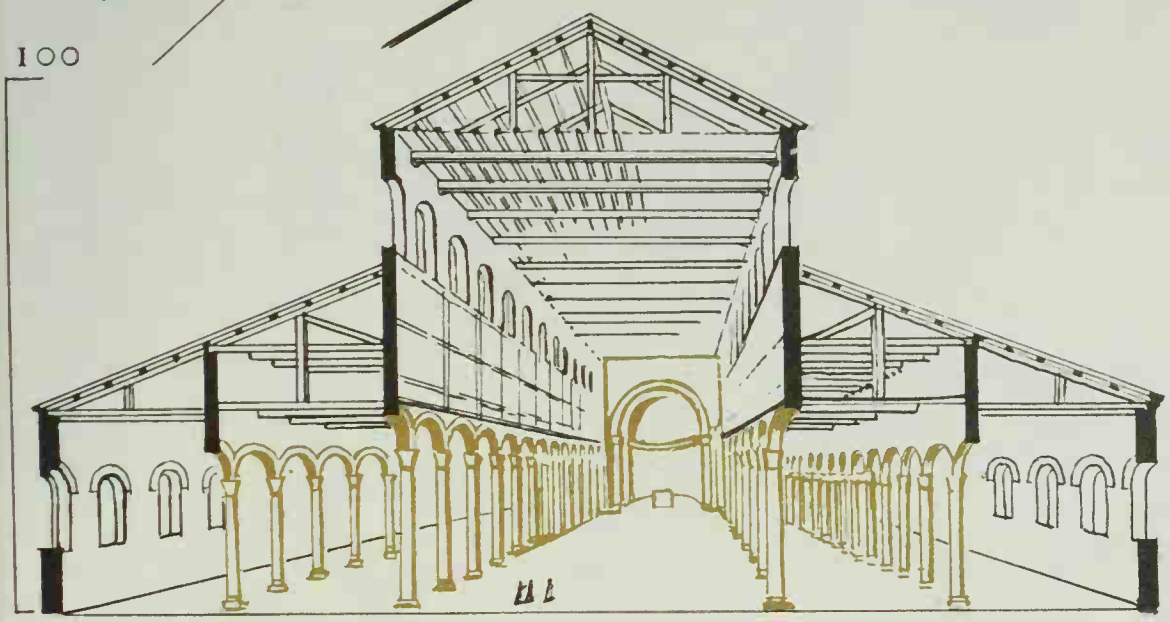


Columns
supporting
a flat entablature:
S. Maria Maggiore,
Rome, A.D. 432

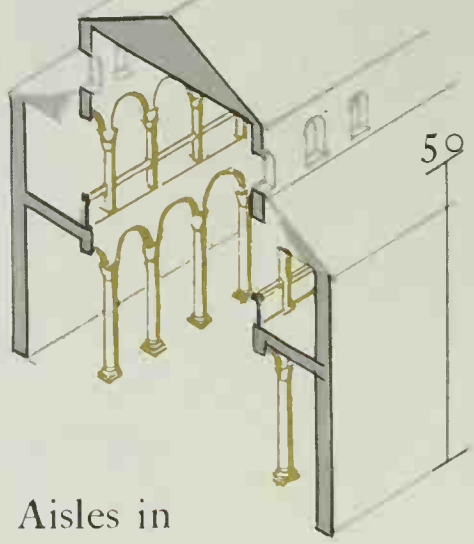




Columns
supporting semi-
circular arches:
S. Apollinare in Classe,
Ravenna, A.D. 534-539



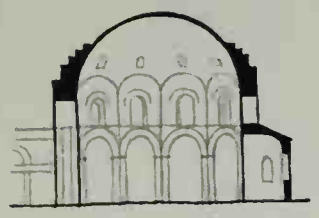
Basilican church of S. Paolo fuori le Mura, Rome, A.D. 320;
burnt down in 1832 and rebuilt to the original design

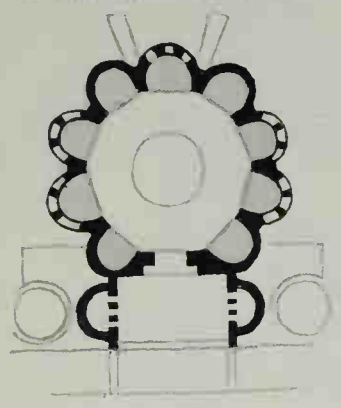


Aisles in
two storeys:
S. Agnese fuori le Mura,
Rome, A.D. 625-638

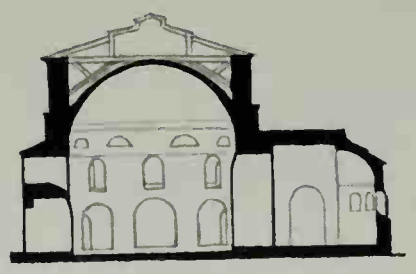
BYZANTINE

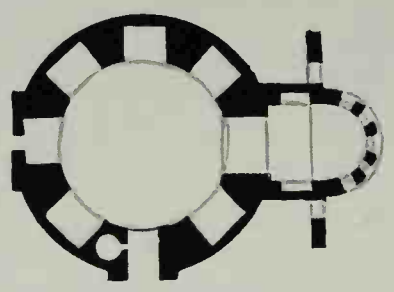
ROMAN



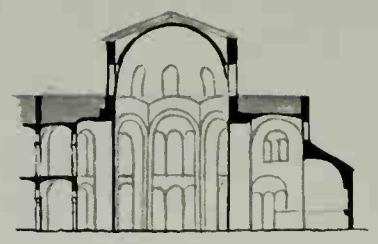


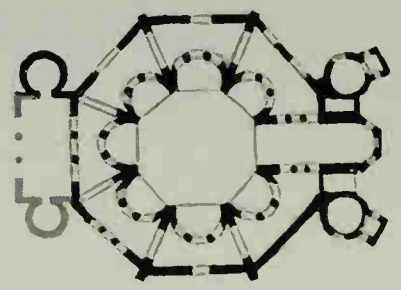
The Minerva Medica,
Rome, *c.* A.D. 260



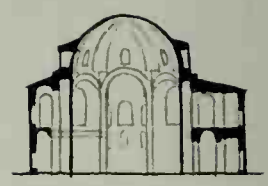


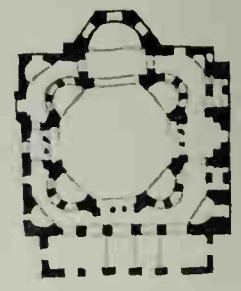
S. George, Salonika,
c. A.D. 400



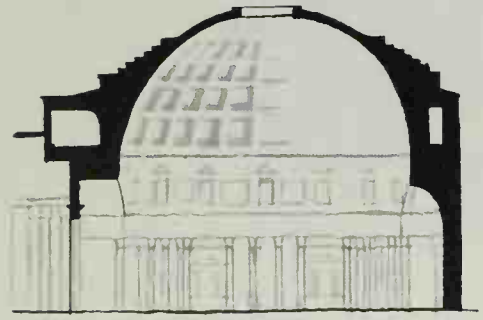


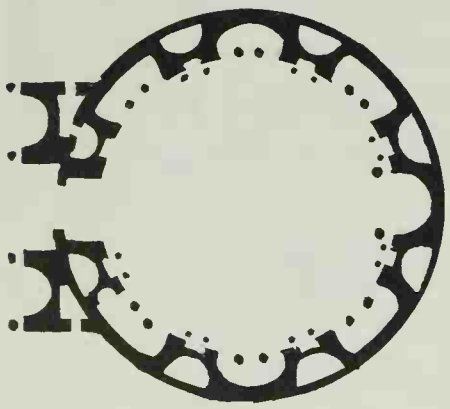
S. Vitale, Ravenna,
A.D. 526-547



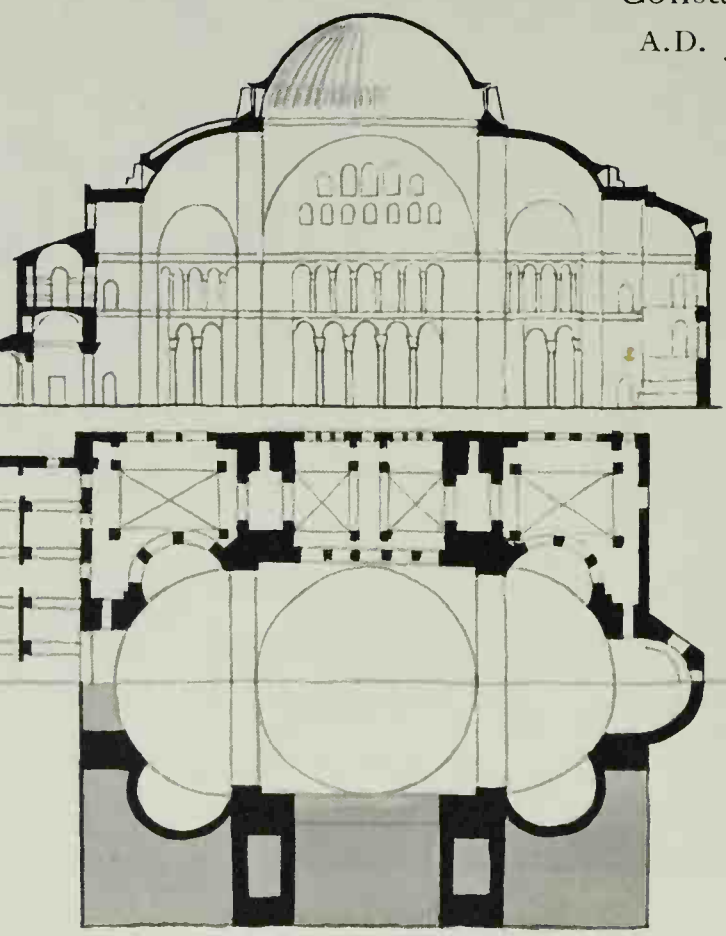


SS. Sergius
and Bacchus,
Constantinople,
A.D. 527-553



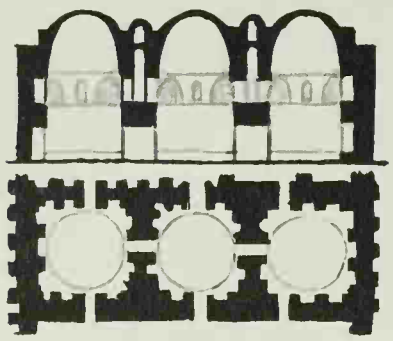


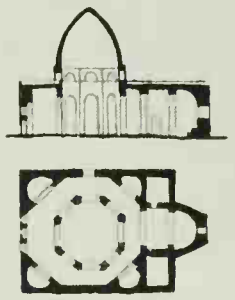
The Pantheon, Rome,
A.D. 120-124



S. Sophia, Constantinople, A.D. 532-537

PERSIA:
detail of Palace,
Feruz-abad,
A.D. 450

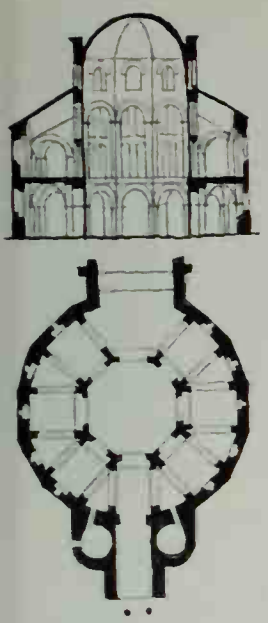




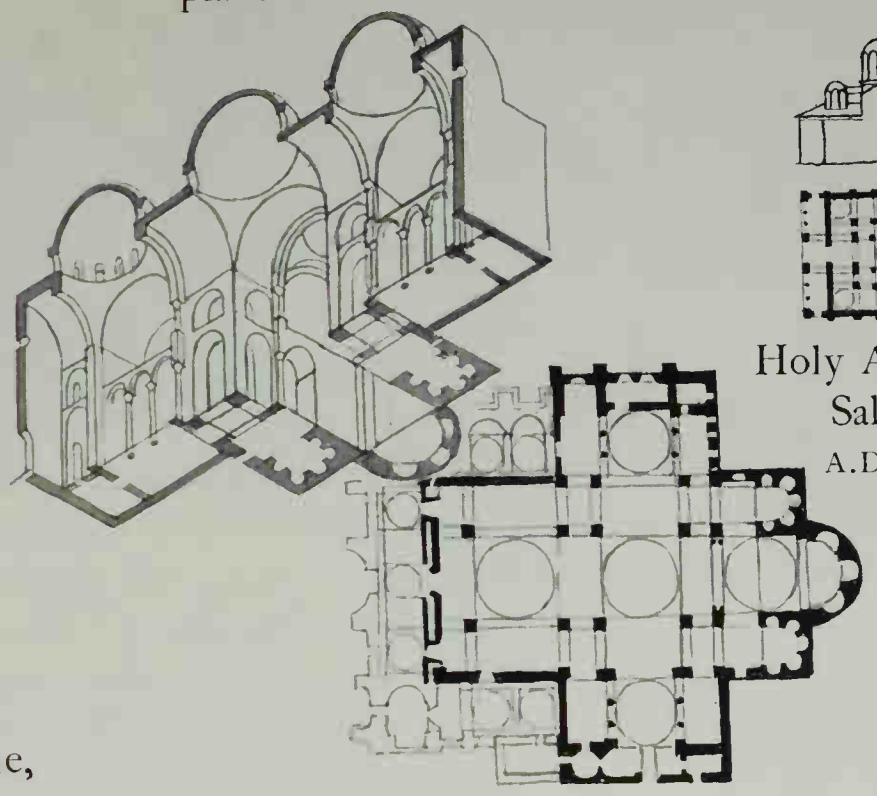
SYRIA:
S. George,
Ezra,
c. A.D. 510

COMPARATIVE PLANS

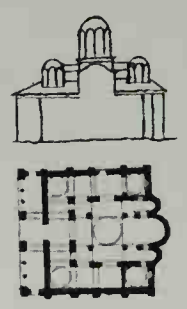
plans and sections in black to the same scale 150



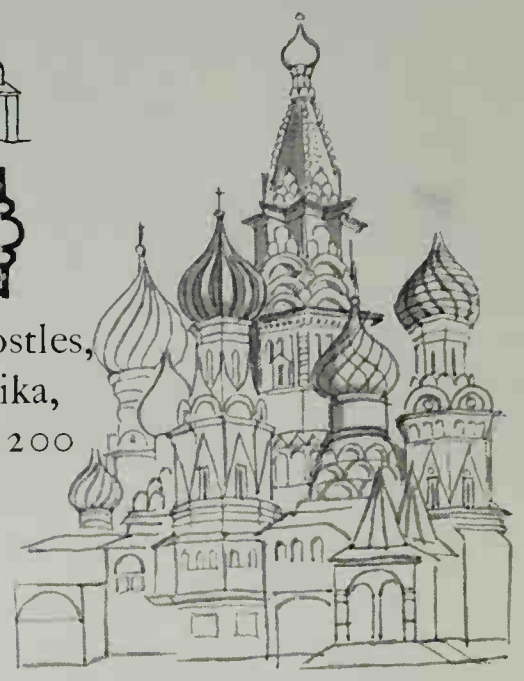
Carolingian cathedral, Aix-la-Chapelle, A.D. 796-804

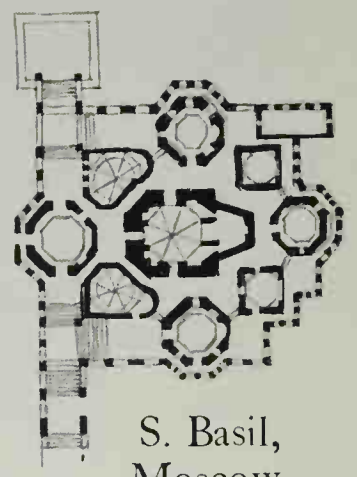


S. Mark, Venice, A.D. 1042-1085

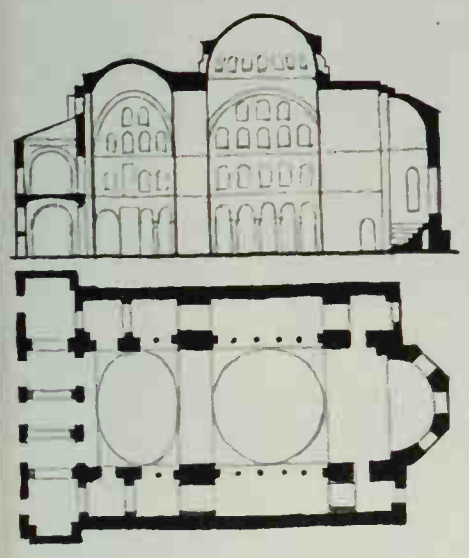


Holy Apostles, Salonika, A.D. 1200

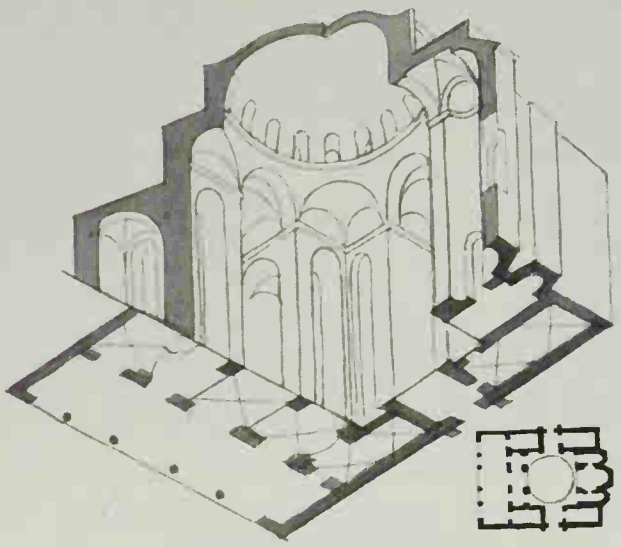




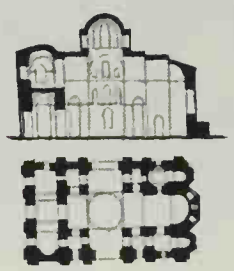
S. Basil, Moscow, A.D. 1554-1560



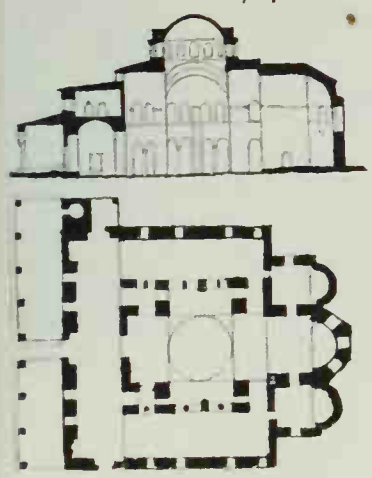
S. Irene, Constantinople, A.D. 740



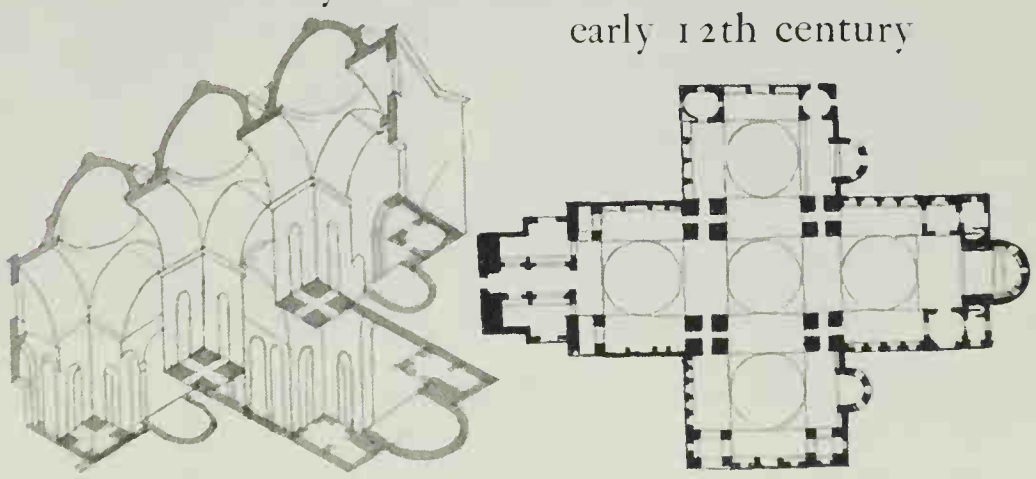
Church, Daphni, nr Athens, *c.* 11th century A.D.



S. Saviour Pantepoptes, Constantinople, early 12th century



S. Sophia, Salonika, *c.* 6th century A.D.

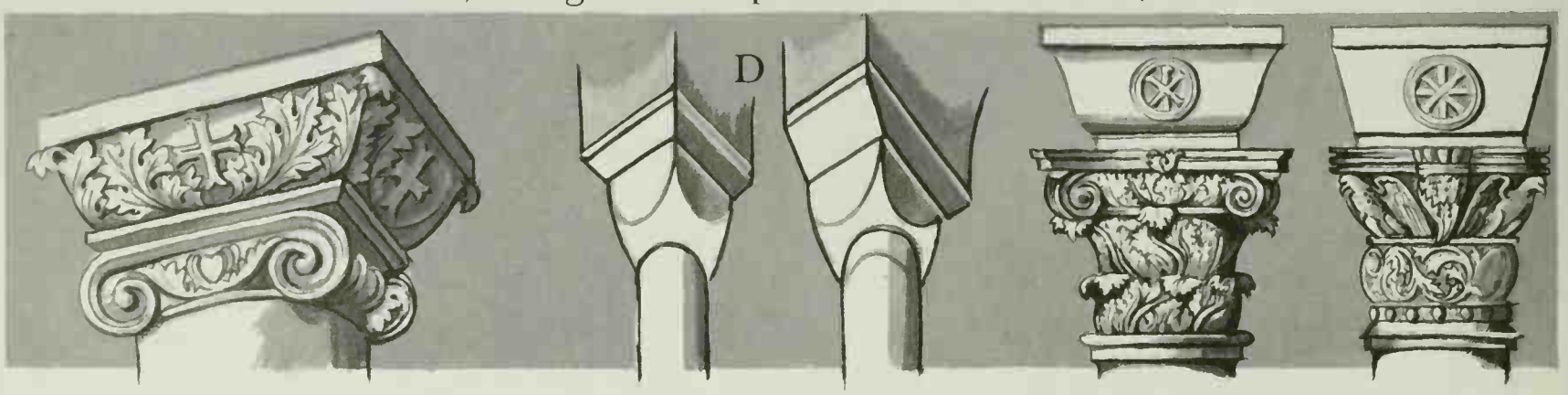


S. Front, Perigueux, France, A.D. 1120

EARLY CHRISTIAN

The Mausoleum of S. Costanza, Rome, built by Constantine, *c.* A.D. 324-329.
The dome constructed of concrete with brick ribs and set on a drum supported upon 12 coupled granite columns, the thrust neutralized by the barrel vault of the circular aisle

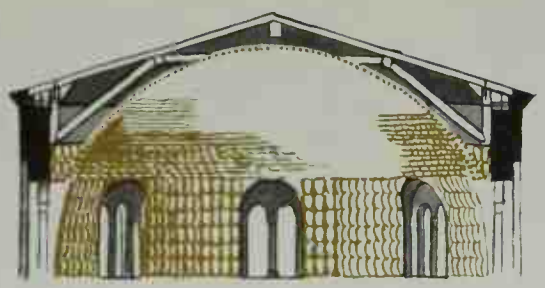
The Tomb of Galla Placidia, Ravenna, *c.* A.D. 420
An early cruciform plan with a dome and pendentives forming the same hemisphere, of concentric courses of brick; filling-in of amphorae set in mortar A; mosaics line the interior

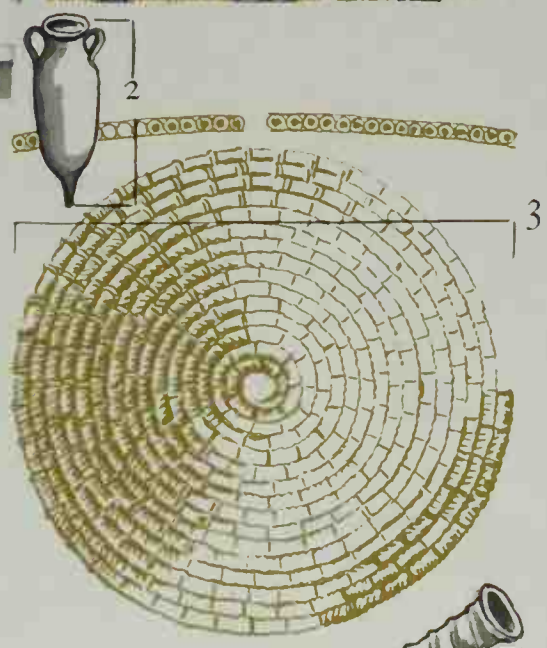


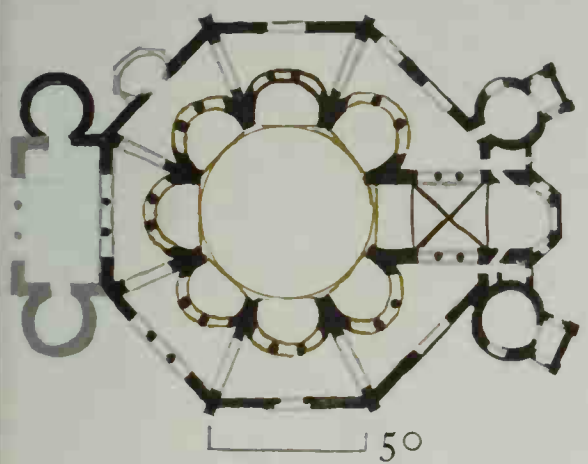
Capitals: S. Demetrius, Salonika, 5th century A.D.

For capitals Roman Ionic, Corinthian and Composite types were used, and a cubiform type was evolved, carrying a dosseret block D to support wide voussoirs of arches or thick walls

BYZANTINE DOMES

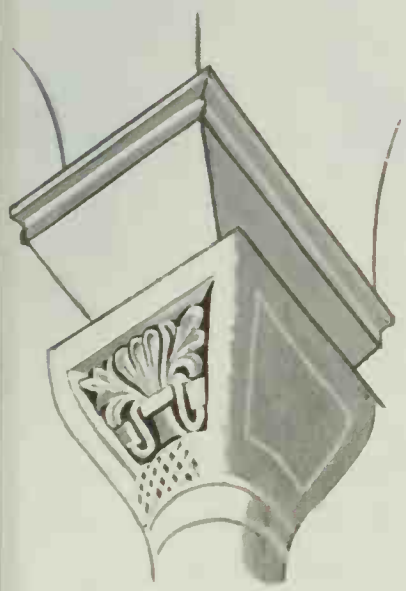


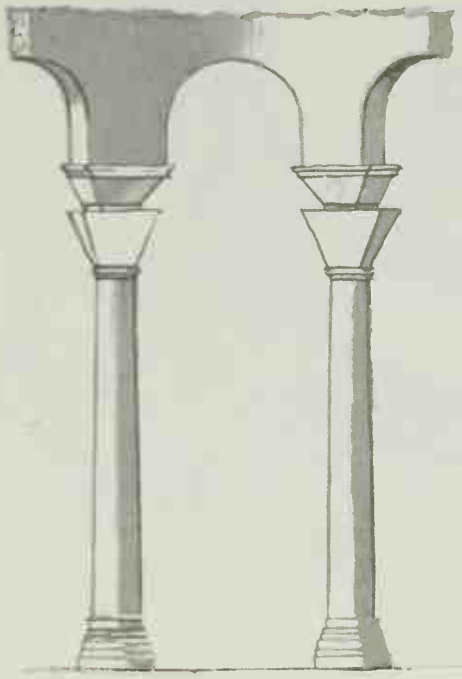


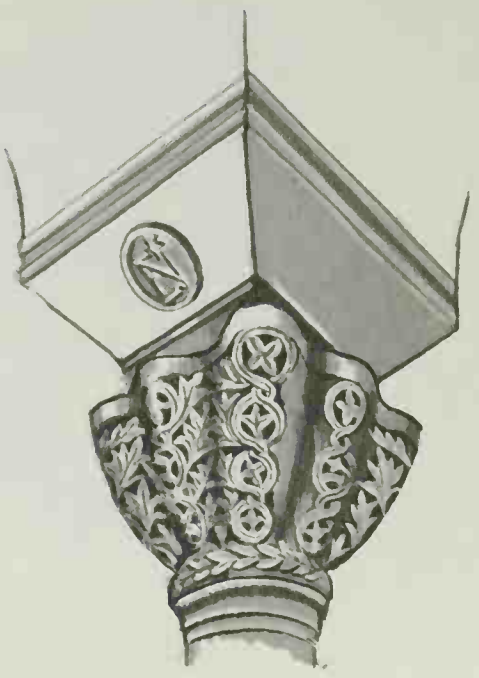


S. Vitale, Ravenna, A.D. 526-547

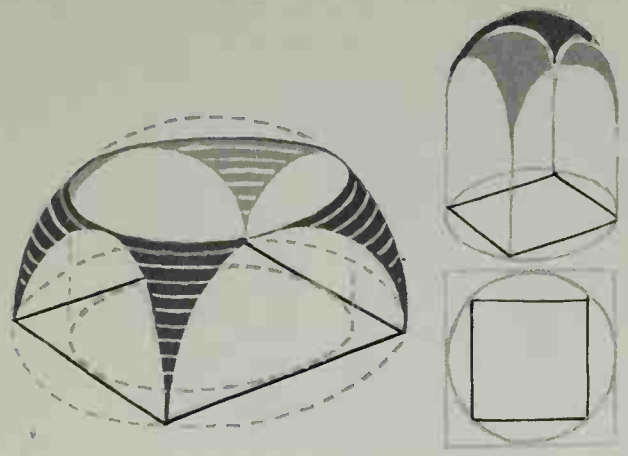
Founded by Justinian to commemorate the recovery of Ravenna. Built of brick; the dome constructed of terracotta jars embedded in mortar which produced a lightness of structure. The transition of the octagonal space into the circular dome was made by angle-niches A; the lateral thrust of the dome was resisted by the 7 semicircular recesses, the cross-vault of the choir and the butresses on the external walls. The only mosaics not destroyed are in the choir and apse



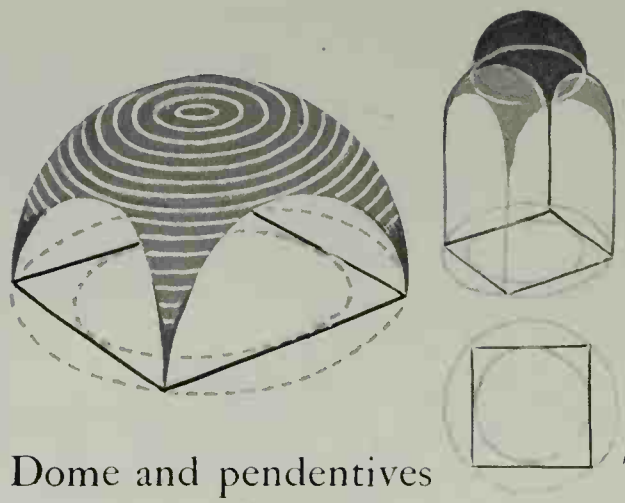




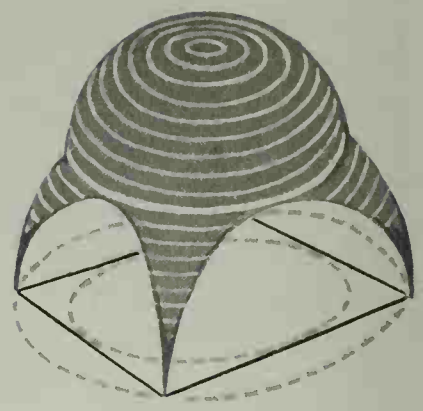
BYZANTINE



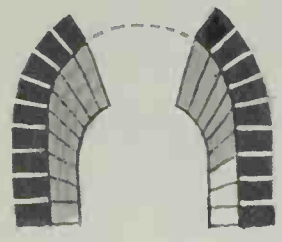
Pendentives



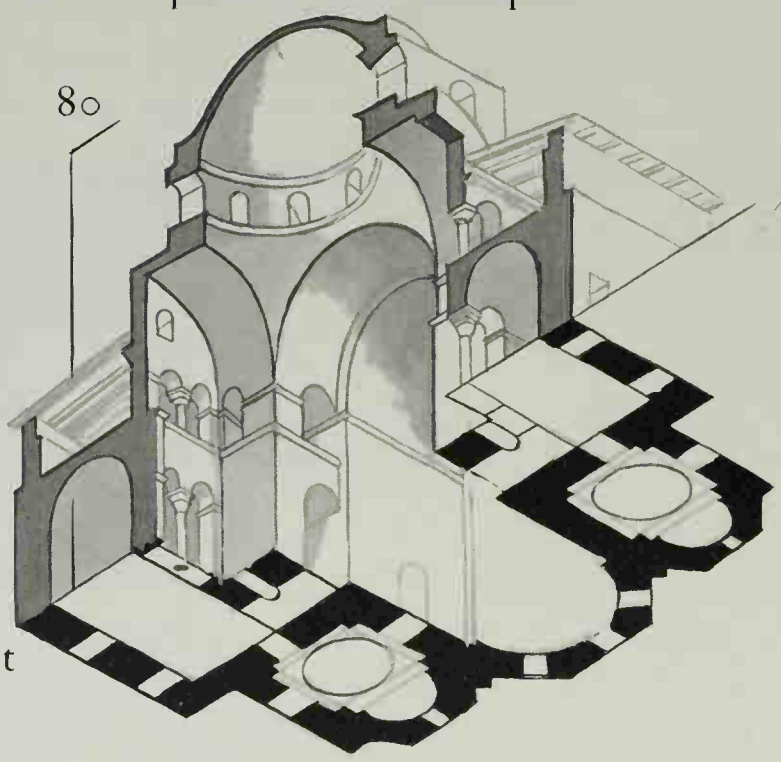
Dome and pendentives
parts of one hemisphere



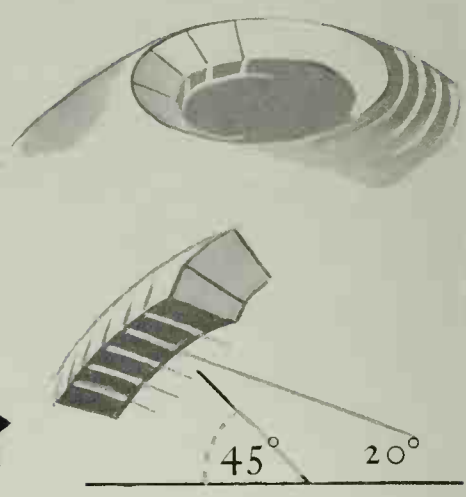
The dome a hemisphere
set above pendentives



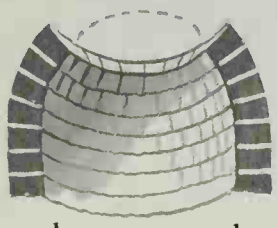
To build an arch
centering is necessary,



S. Sophia, Salonika, *c.* A.D. 495



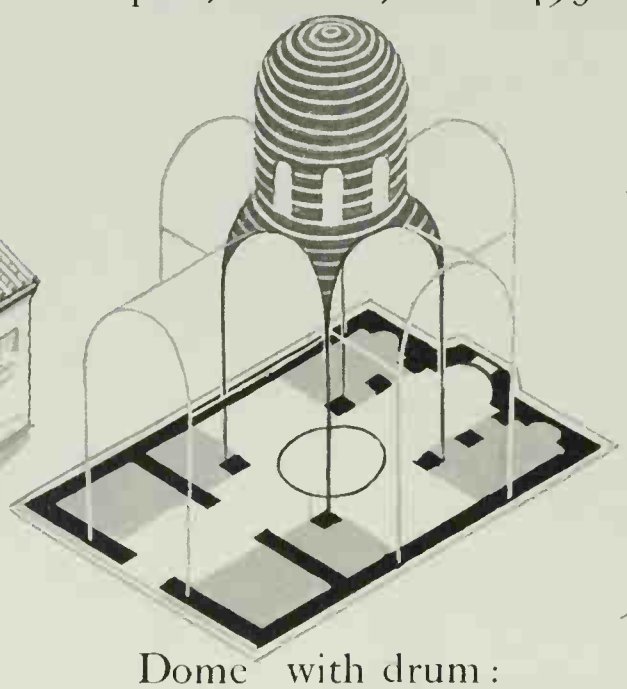
Domes on pendentives
built with bricks
not radiating
from centre



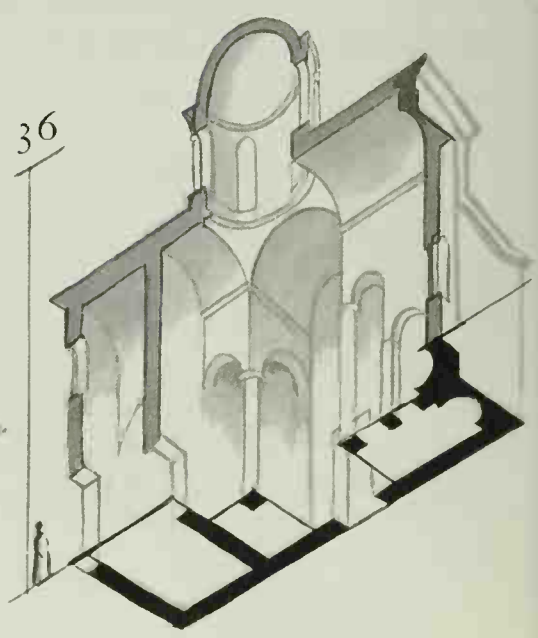
but a dome can be built
in successive rings
of horizontal arches
without centering

Little
Cathedral,

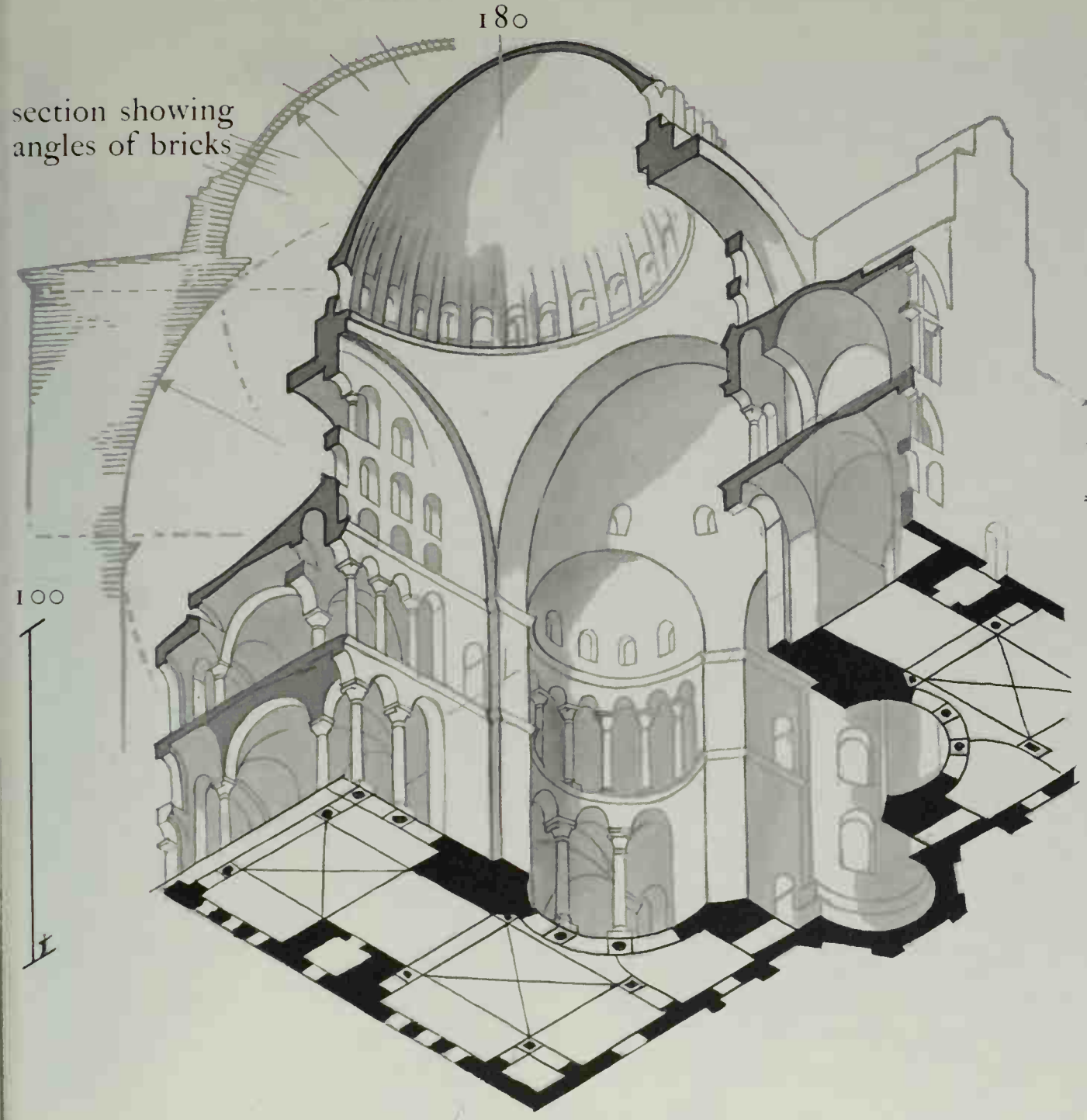
Metropole
Athens, A.D. 1250

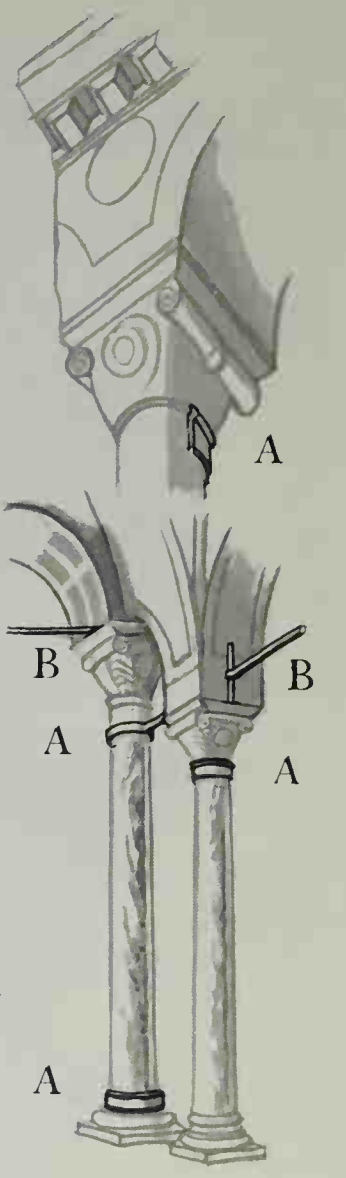


Dome with drum:
cross-in-square plan



DOMES ON PENDENTIVES

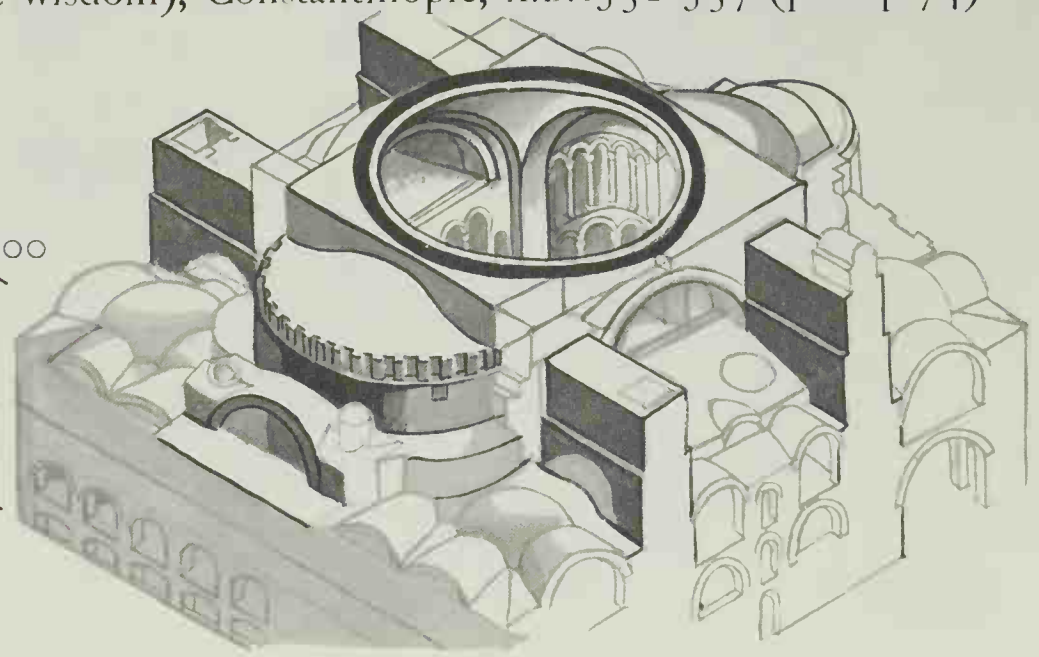




Bronze rings A, tie-rods B to resist pressure

S. Sophia (Hagia Sophia = divine wisdom), Constantinople, A.D. 532-537 (plan p.74)

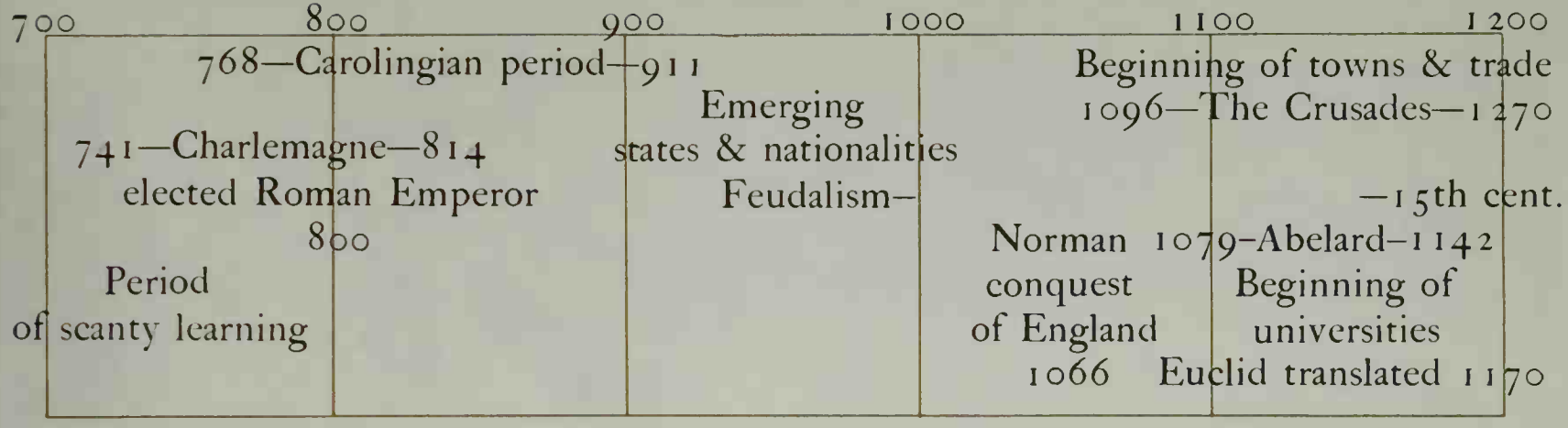
Built for Justinian by two Greek architects, Anthemius of Tralles and Isodorus of Miletus. Built of brick; the dome probably erected without centering, with bricks about 24-27 inches square and 2 inches thick laid in deep mortar and covered with $\frac{1}{4}$ inch lead; the dome supported on 4 piers, the thrust being taken by 2 semi-domes and 4 massive buttresses; the interior lined throughout in coloured marbles and mosaics



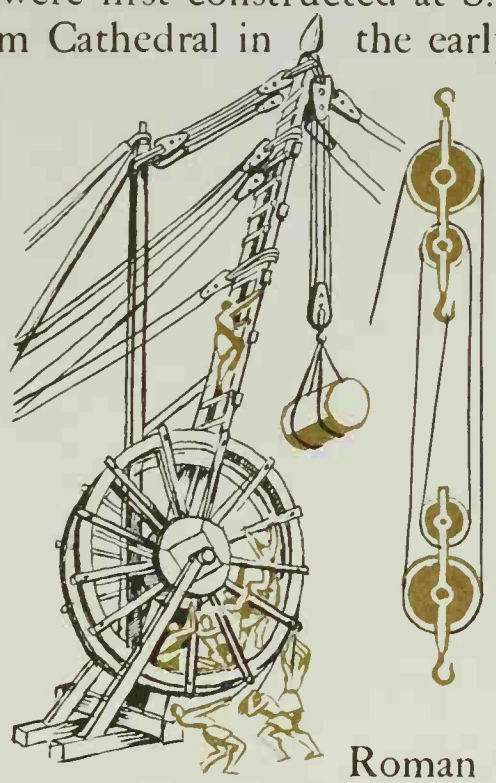
ROMANESQUE


Lindisfarne
Durham
Fountains
York
Chester
Lincoln
Peterborough
Worcester
Tewkesbury
Ely
Norwich
Gloucester
St Albans
Rochester
Winchester
Canterbury
Exeter
Romsey
Anglo-Saxon period 449-1066
Norman period 1066-1154
GERMANY
Hildesheim
Gernrode
Cologne
Fulda
Aix-la-Chapelle
Maria Laach
S. Riquier
Mainz
RHINE LAND
Worms
Bayeux
Jumièges
Prémontré
Caen
Rouen
Laon
Mont-S. Michel
Paris
S. Denis
Speyer
Chartres
Clairvaux
Strasbourg
Orleans
Vignory
Angers
II
Germigny-des-Près
Tours
Reichenau
Vézelay
S. Gall
III
Citeaux
Poitiers
Limoges
Cluny
Autun
Angoulême
VIII
V
LOMBARDY
Soulac
IV
Clermont-Ferrand
Verona
Torcello
Périgueux
Grenoble
Milan
Venice
Le Puy
Pavia
Bordeaux
Conques
Cahors
Moissac
VI
VII
Bologna
Ravenna
Zara
S. Sebastian
Toulouse
Pisa
Florence
Vitoria
Roncesvalles
Arles
Assisi
Burgos
ITALY
SPAIN
Rome
Monte Cassino
Traini
Troja
Bari
APULIA
Luco
Oviedo
Le Puy
S. Sebastian
Santiago de Compostela
Leon
Toulouse
Vitoria
Roncesvalles
Palermo
Cefalu
Burgos
Puente-la-Reina
Monreale
Ripoll
SICILY
SPAIN
Pilgrimage routes to Santiago de Compostela
principal routes
other routes
100 miles
French architectural regions:
I Normandy
II Anjou
III Poitou
IV Aquitaine
V Auvergne
VI Lanquedoc
VII Provence
VIII Burgundy

INTRODUCTION



Romanesque architecture (8th-12th centuries) was based on the Roman system of arched buildings, Early Christian basilicas & influences from Syria and Byzantium. In the 10th and 11th centuries both the omnipotence of the Roman Church as a spiritual & a secular power, and the foundation and expansion of the Monastic Orders, resulted in the building of innumerable abbeys, priories, cathedrals and pilgrimage churches. S. Benedict had founded the Benedictines (529), and monks of this Order founded at Cluny the reformed Cluniac Order (910) which pursued the ideal of an united Christendom. At its zenith the 'Congregation of Cluny' numbered 1450 monastic houses; followed by the more austere Order of Cistercians founded at Citeaux (1092), which, by 1200, had 694 monasteries. Other Monastic and Military Orders were instituted, followed by the Friars in the early 13th century. The Norman conquest of England (1066) brought a rapid building of abbeys, priories, cathedrals; smaller churches (p.102) & castles (p.104). Few civil buildings remain. Romanesque churches were massive in construction, with thick walls built of smallish stones & rubble, of brick and, in Italy, of marble; they had round arches & small windows, whilst simple columns were transformed into clustered piers. Stone vaulting was developed from the dark barrel-vault to the groined cross-vault, which gave light from clerestory windows. These vaults were built as a protection against fire and as an aid to acoustics. Ribbed cross-vaults were first constructed at S. Ambrogio, Milan, and in Durham Cathedral in the early 12th century.



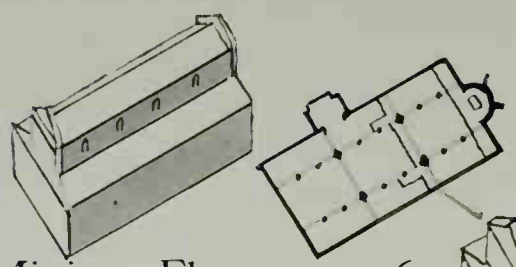
Roman

ROMANESQUE

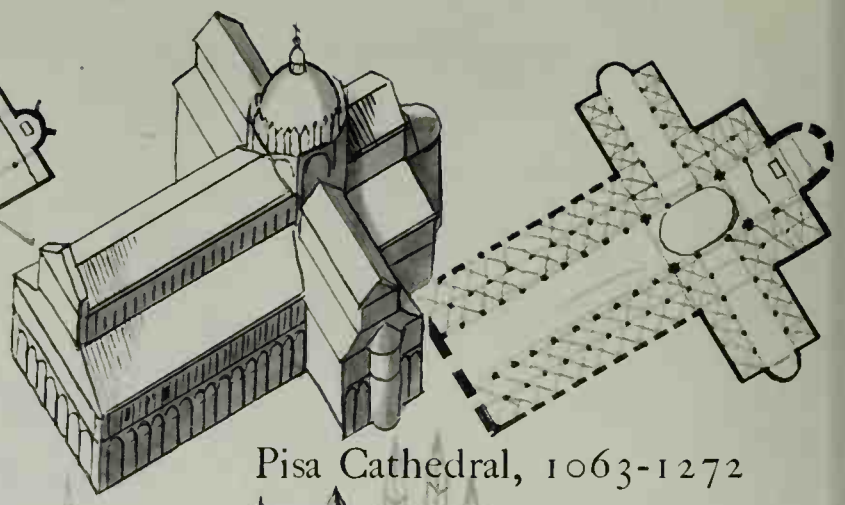
plans and elevations
to the same scale

200

ITALY

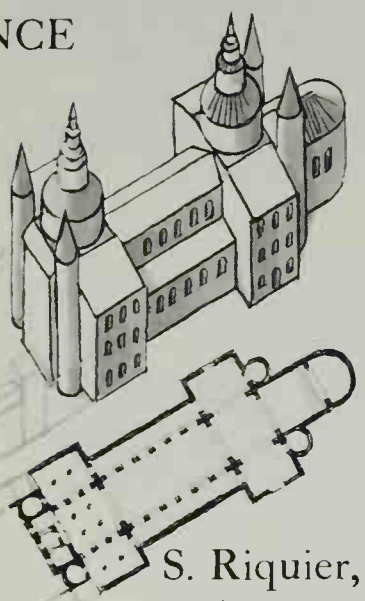


S. Miniato, Florence, 1062

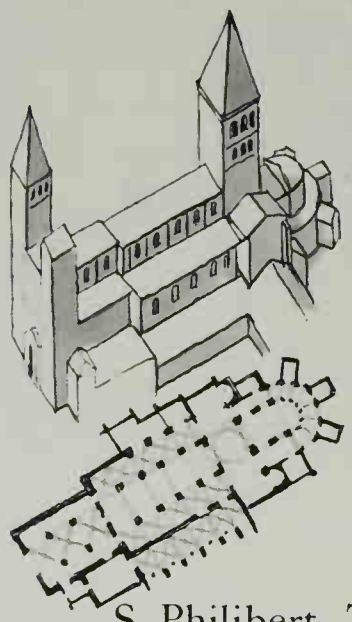


Pisa Cathedral, 1063-1272

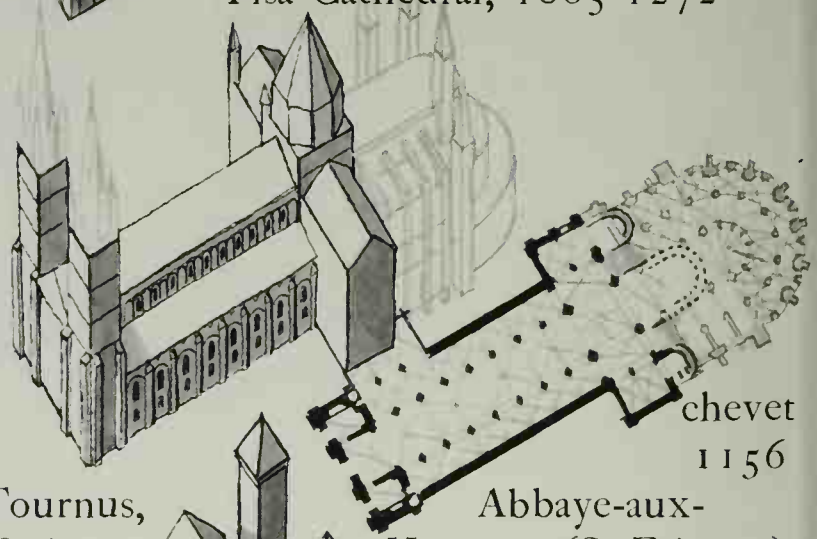
FRANCE



S. Riquier,
nr Abbeville
(restored), *c.* 799



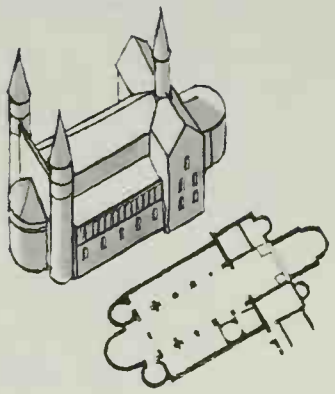
S. Philibert, Tournus,
c. 950-1120 & later



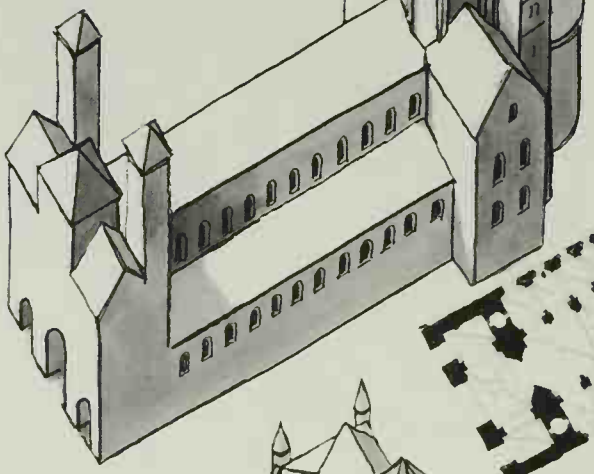
chevet
1156

Abbaye-aux-
Hommes (S. Etienne),
Caen, 1066-1077

GERMANY

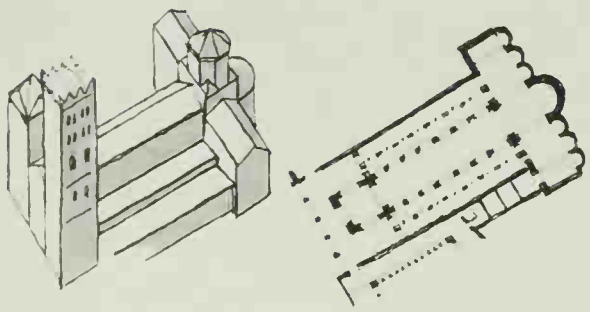


S. Cyriakus, Gernrode,
961 and later

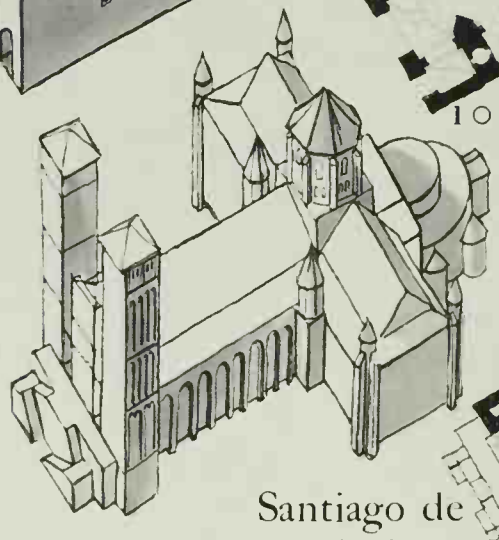


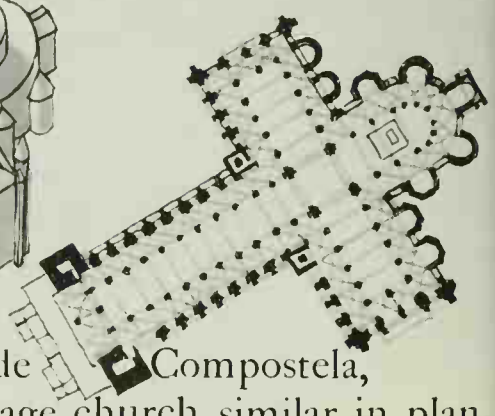
Speyer Cathedral
1031-61 & 12th century

SPAIN



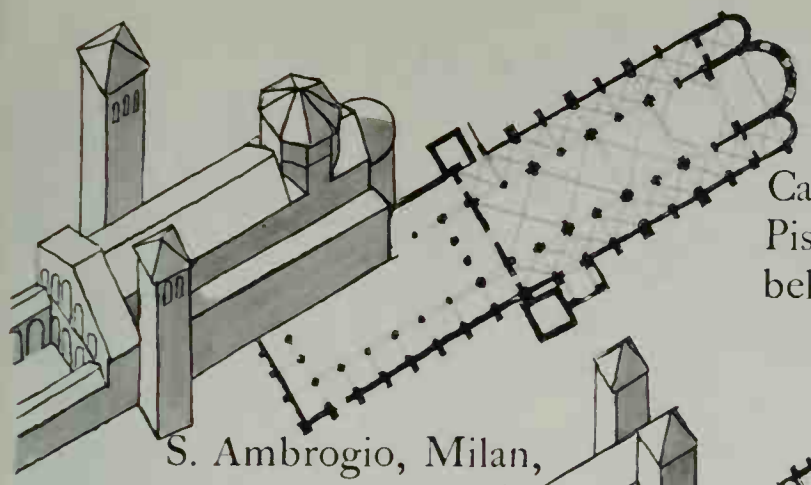
Ripoll Abbey,
Catalonia, 1020-1032



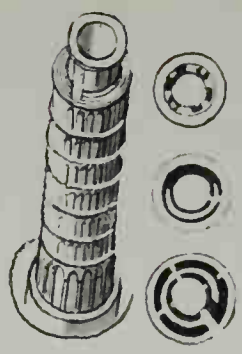


Santiago de Compostela,
c. 1075-1121: pilgrimage church similar in plan
to Tours, Limoges, Conques and Toulouse

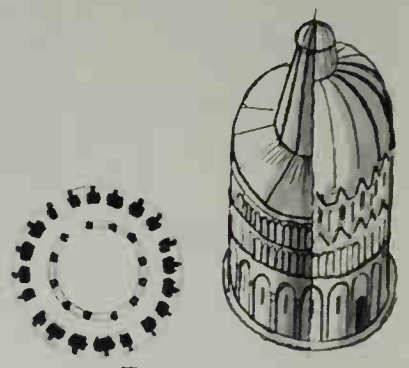
PLANS & ELEVATIONS



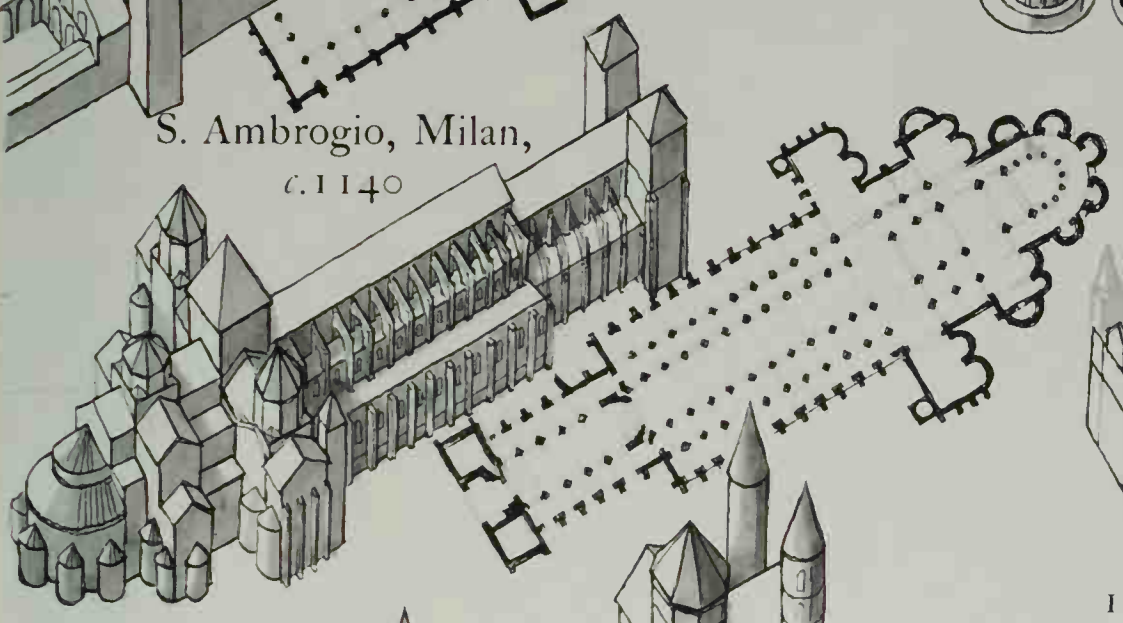
S. Ambrogio, Milan,
*c.*1140



Campanile.
Pisa, 1174;
belfry 1350



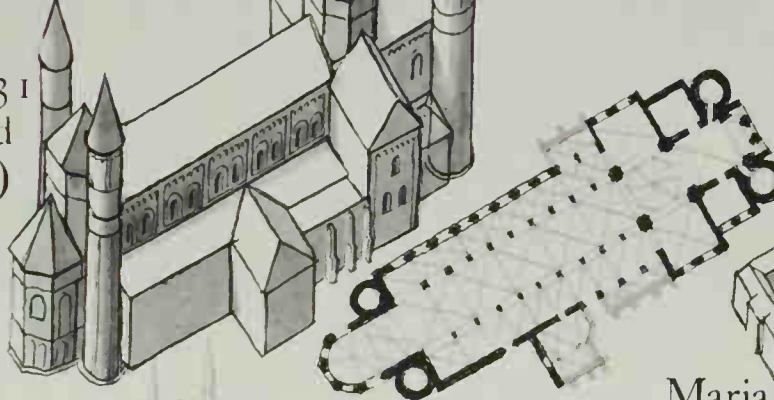
Baptistery,
Pisa, 1153-1278,
Gothic additions
14th century



Cluny Abbey III
(restored), 1088-1131
(elevation reversed
to show the apse)

Angoulême Cathedral,
1105-1128 and later

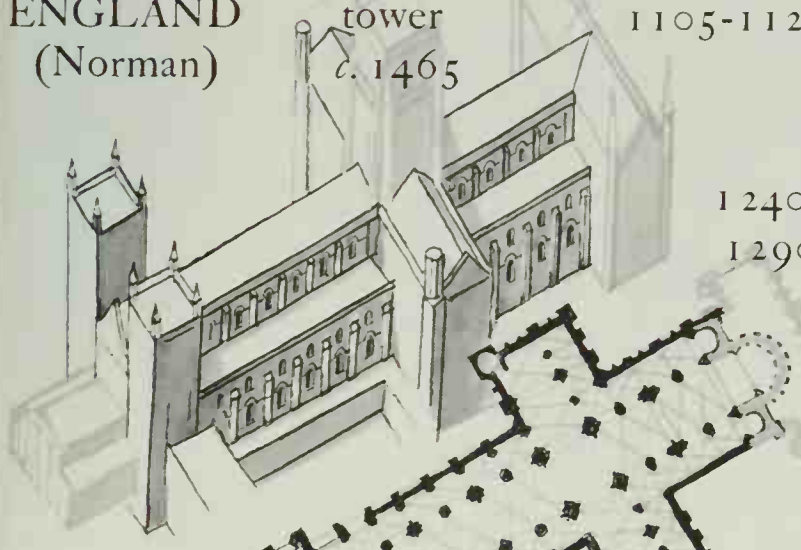
GERMANY



Worms Cathedral,
1105-1128 and later

Maria Laach Abbey, 1093-1156

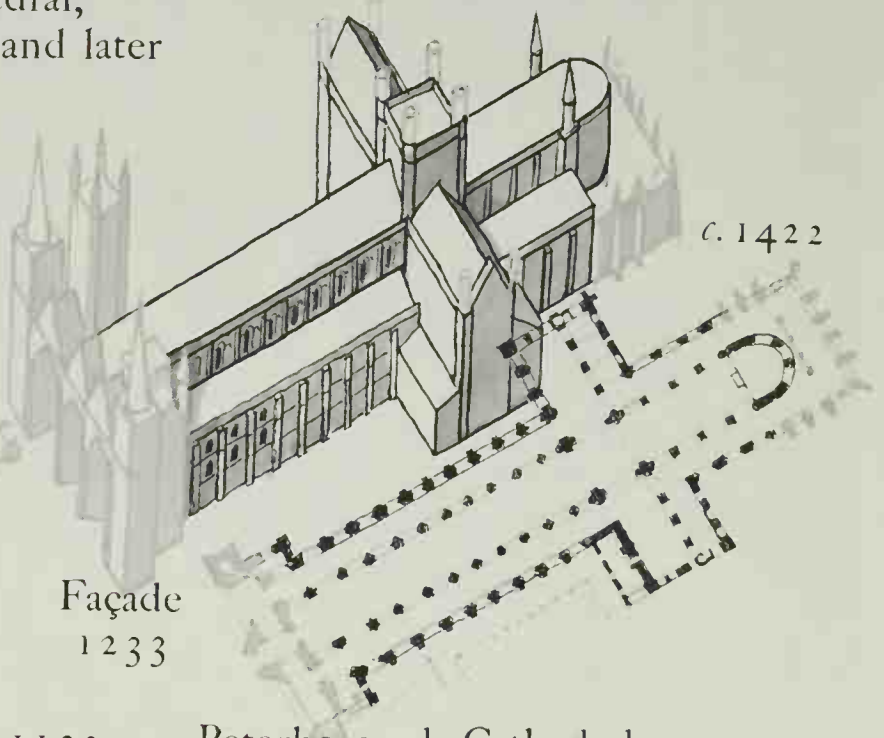
ENGLAND
(Norman)



tower
c. 1465

1240-
1290

1170-
1175



c. 1422

Façade
1233

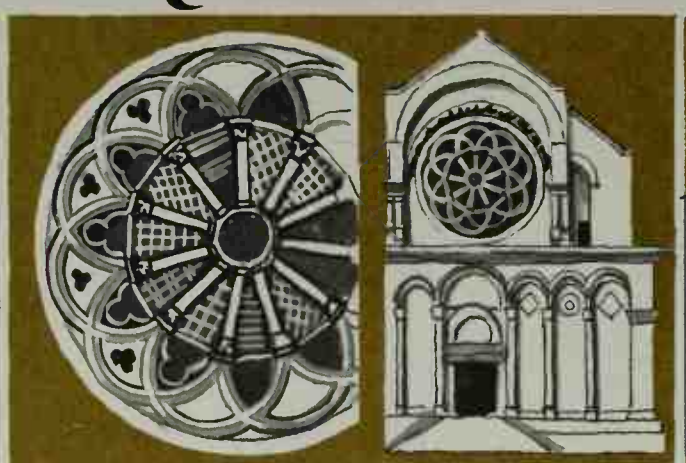
Durham Cathedral, 1093-1133

Peterborough Cathedral, 1177-1190

ROMANESQUE

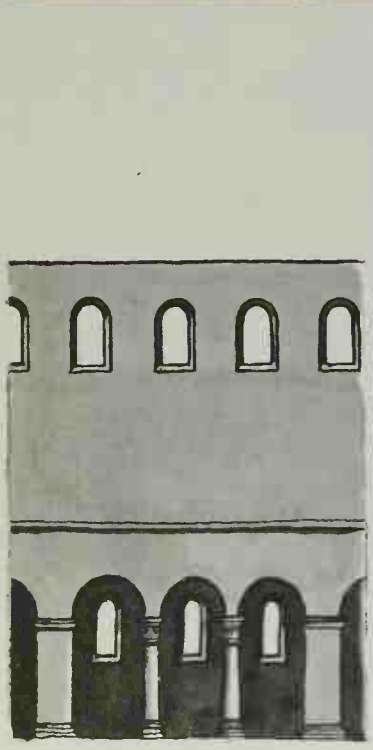
S. Miniato,
Florence, 1013

Pisa Cathedral,
1063-1092

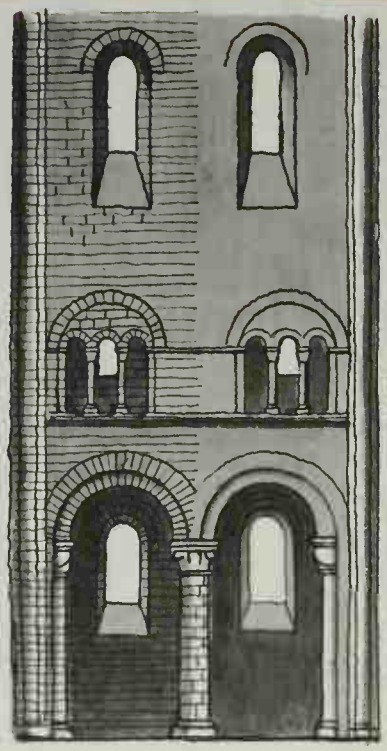


Troja Cathedral,
begun 1093

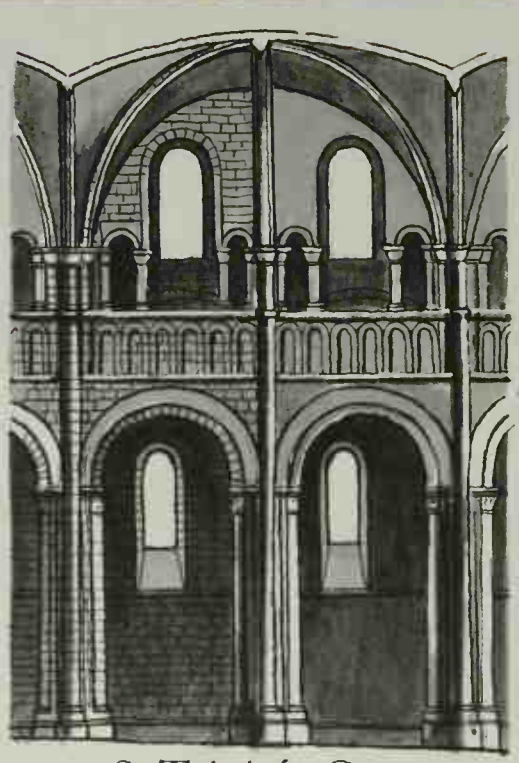
S. Zeno, Verona,
c. 1123-1135



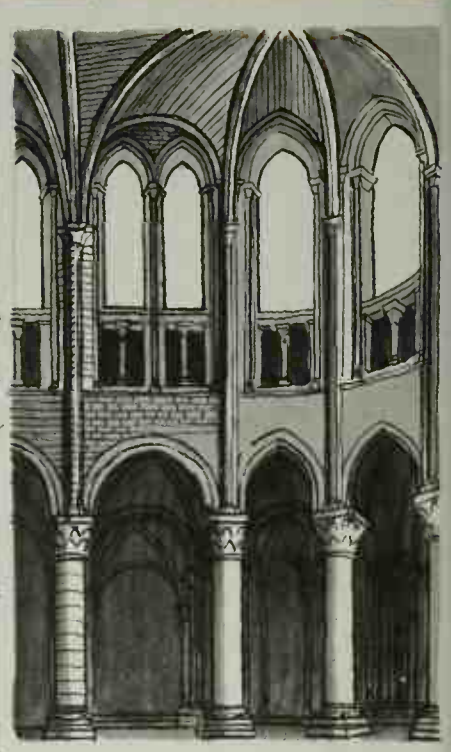
Hildesheim
1001-1033



Jumièges,
1037-1066



S. Trinité, Caen,
1062-1140



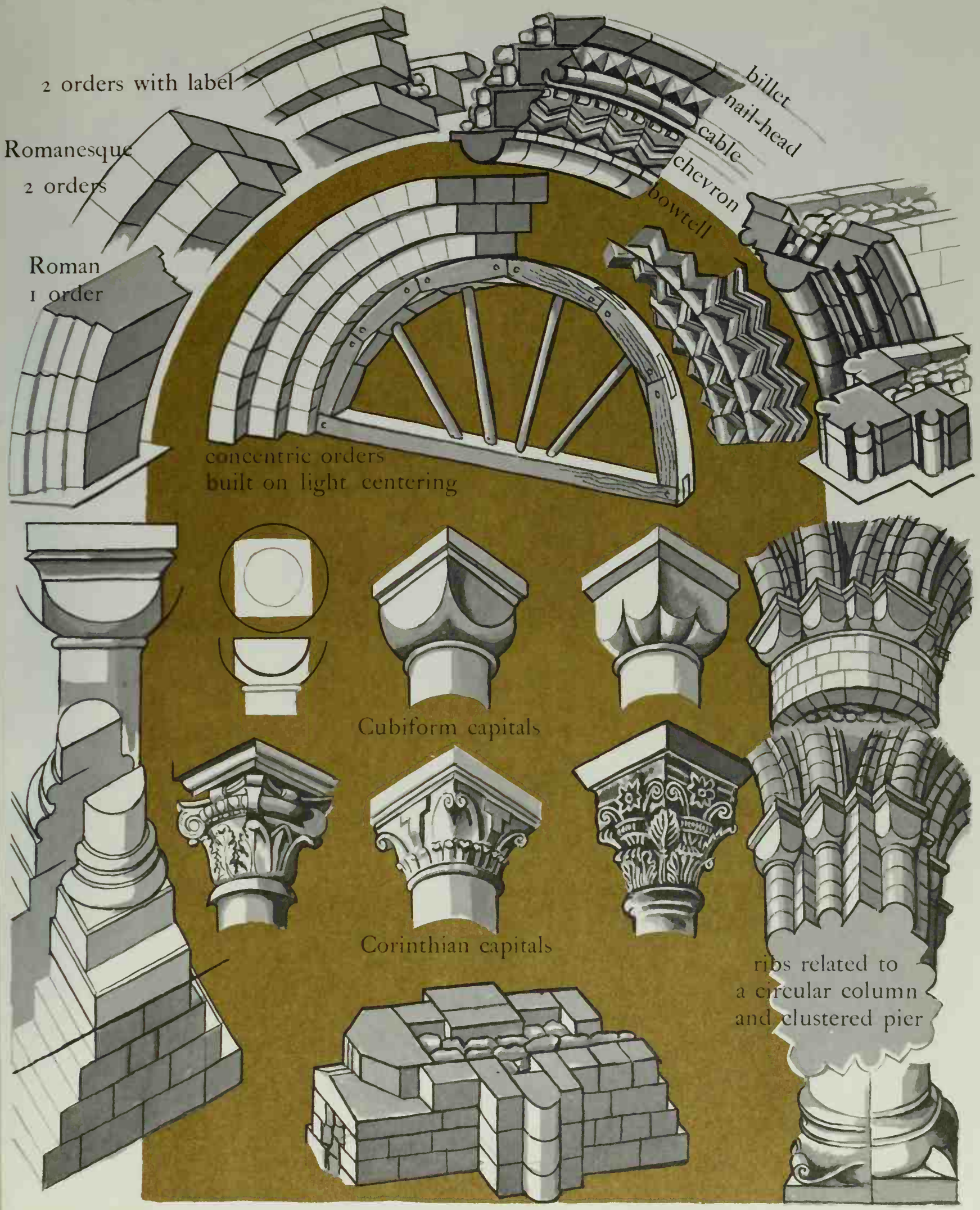
S. Germain-des-Prés,
Paris, *c.* 1160

Notre-Dame-la-Grande,
Poitiers, 1130-1145

Tewkesbury Abbey,
c. 1150

Celafù Cathedral,
1131-1200

ARCHES AND CAPITALS

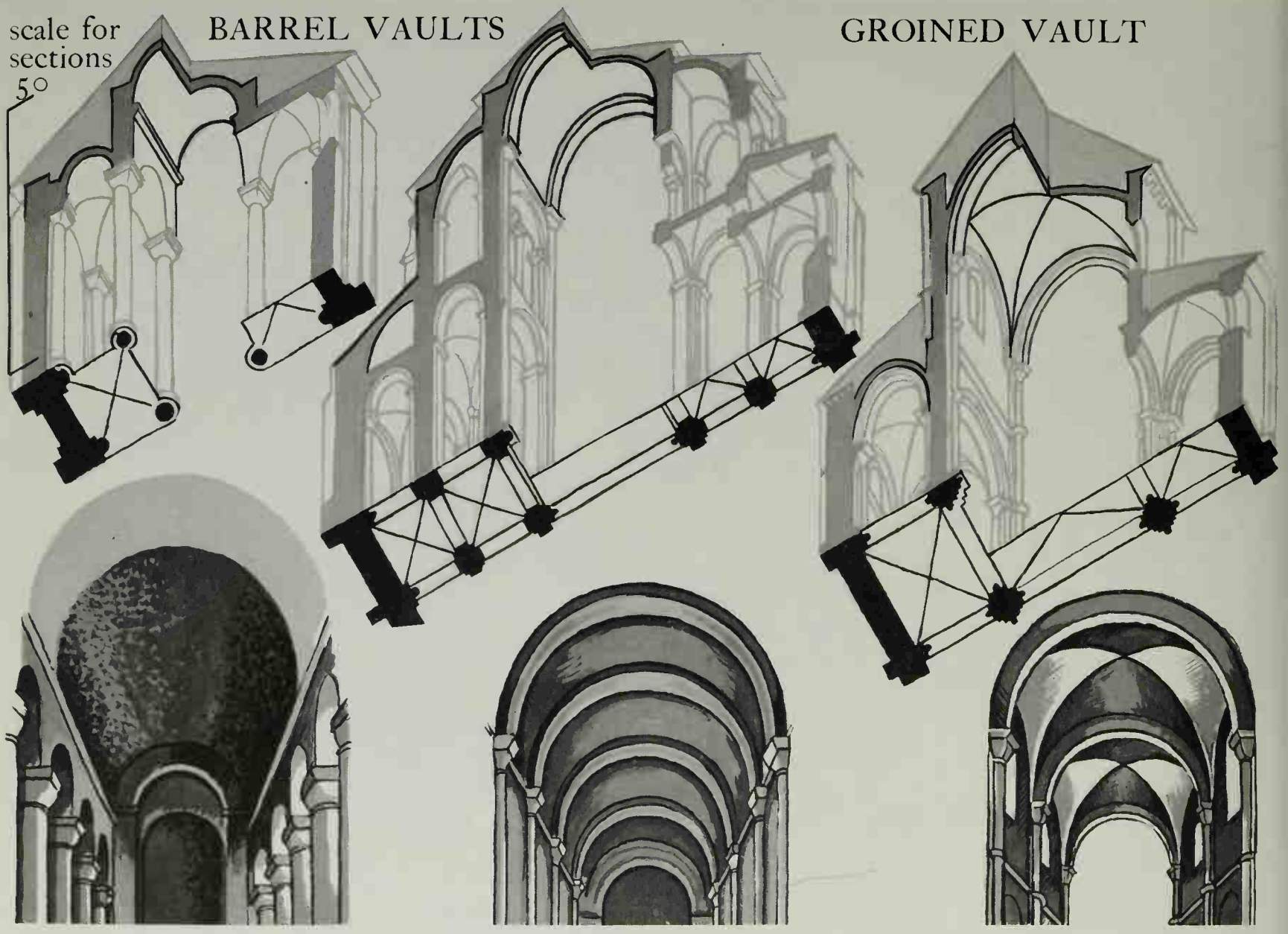


ROMANESQUE

scale for sections 5°

BARREL VAULTS

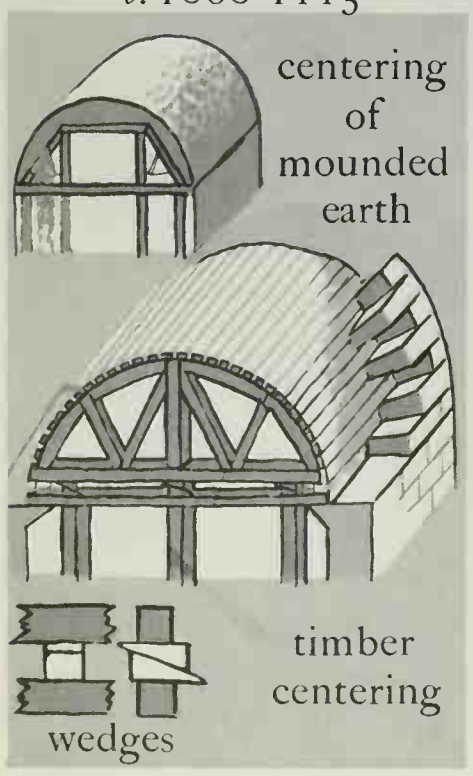
GROINED VAULT

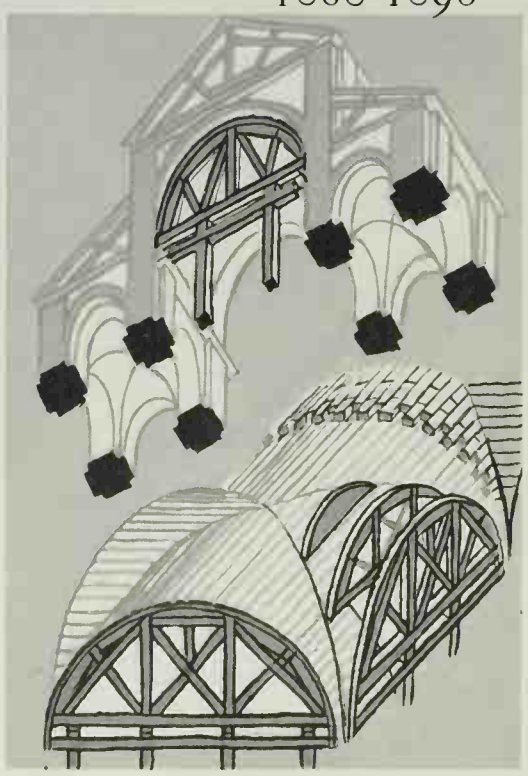


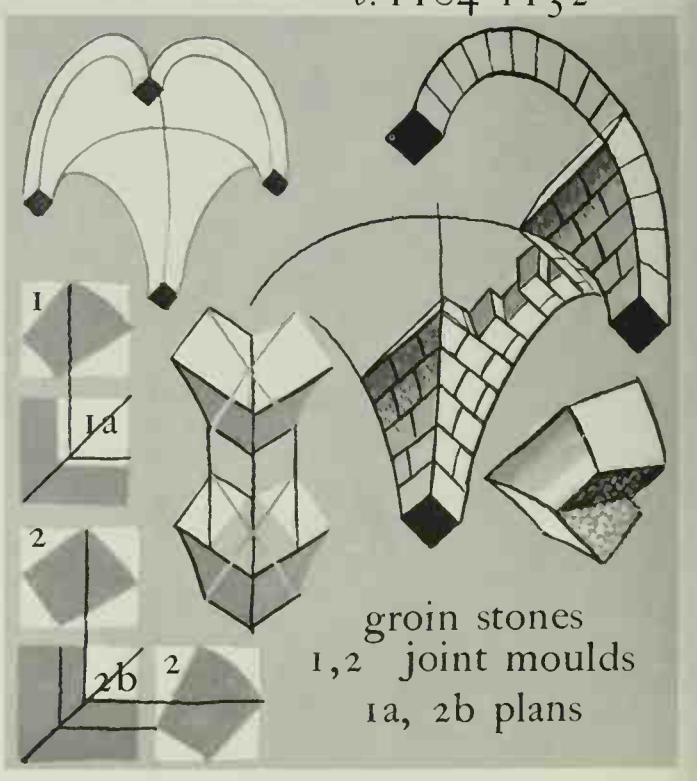
S. Savin-sur-Gartempe, *c.* 1060-1115

S. Sernin, Toulouse, 1080-1096

S. Madelaine, Vézelay, *c.* 1104-1132

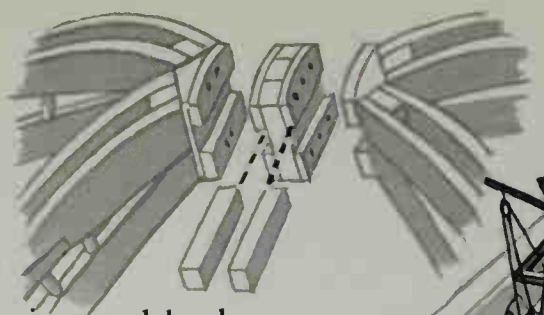






STONE VAULTING

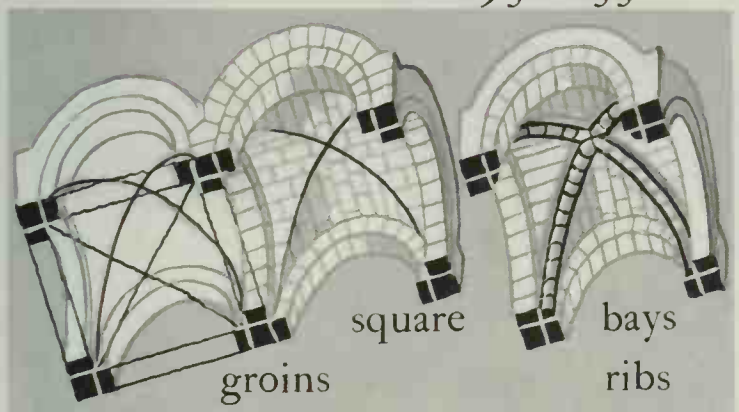
RIBBED VAULT



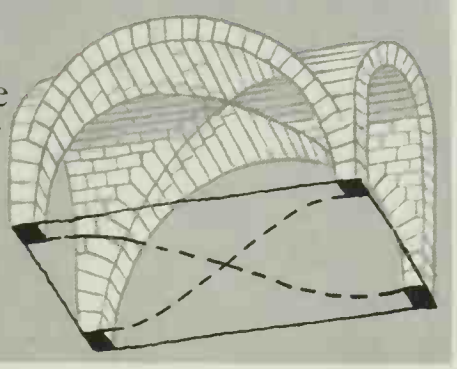
insert blocks to remove centering

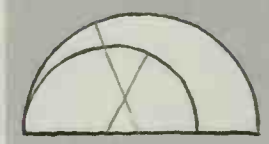
5°

Durham Cathedral:
nave 1093-1133

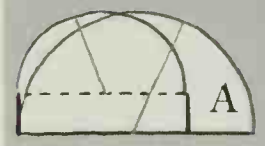


oblong bay: the lines of the groins 'wave' on plan, and need specially shaped groin stones

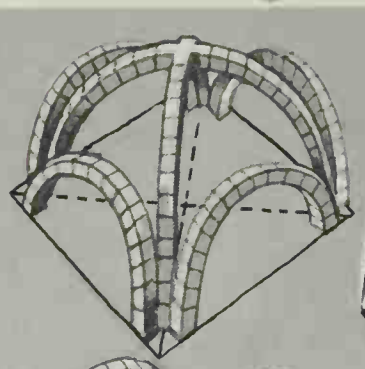


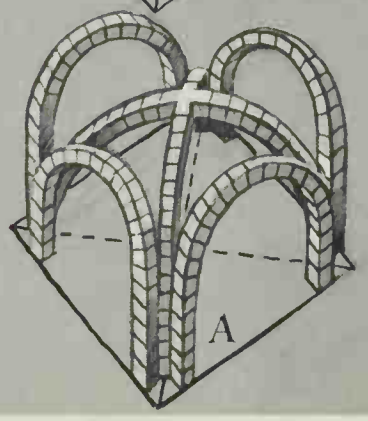


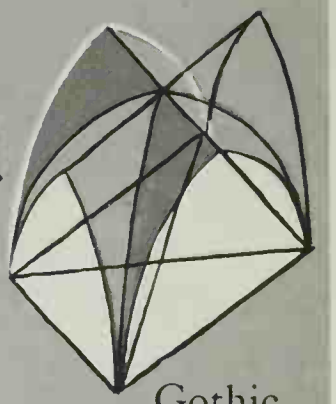
domical vault, semi-circular diagonal and transverse ribs



vault with level crowns transverse ribs stilted as at A

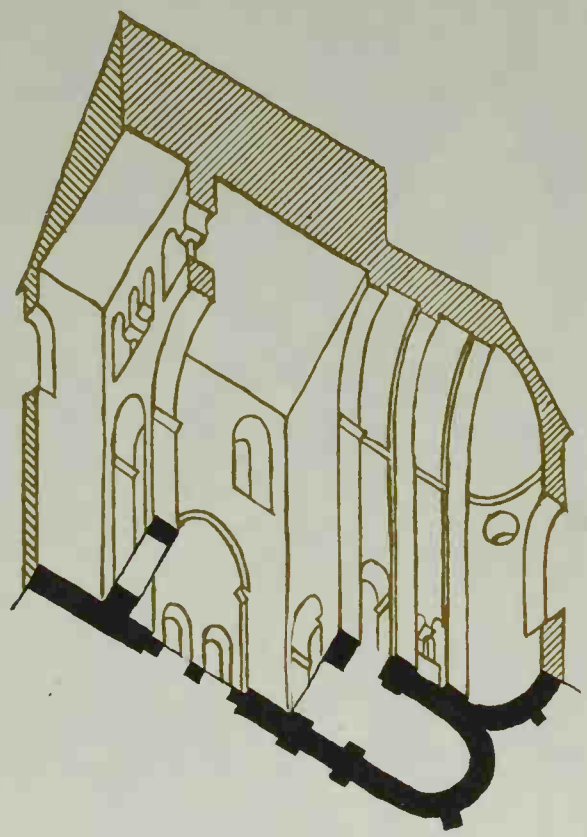




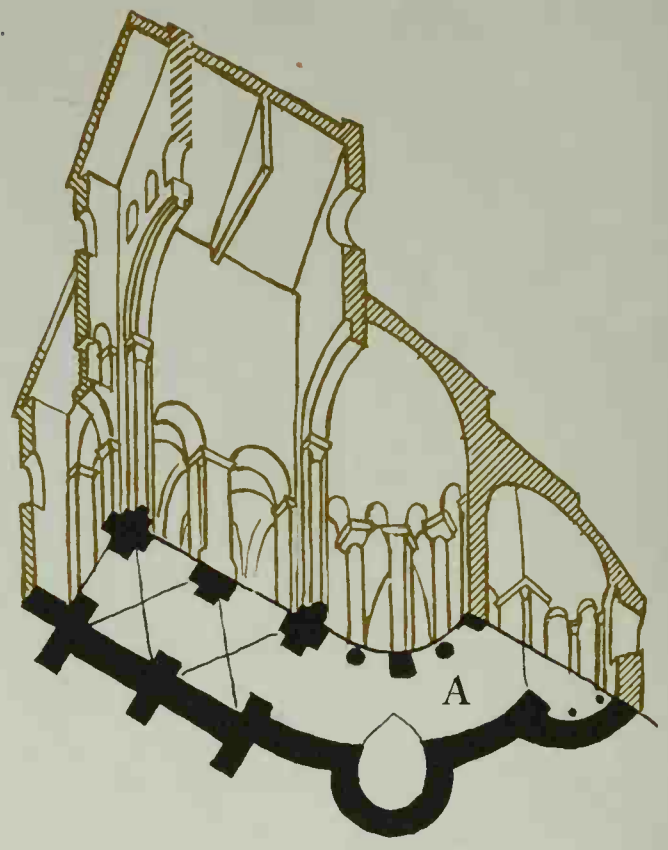


Gothic ribbed vault with pointed arches which can be made any height for any span

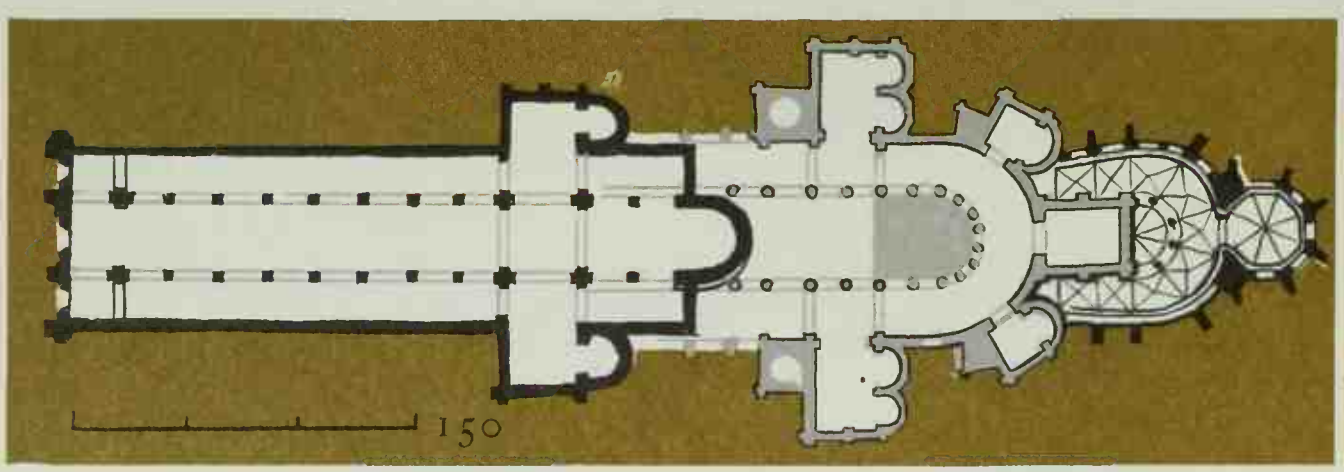
ROMANESQUE



parallel apses
S. Gencroux,
c. 950

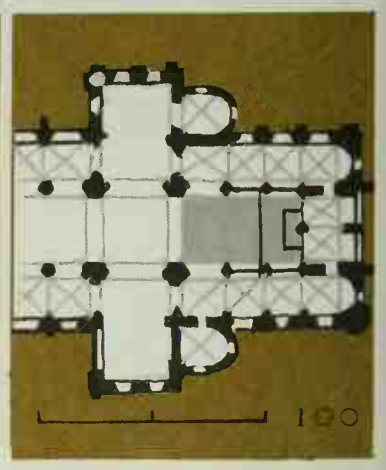


ambulatory A
Vignory,
c. 1030



parallel apses
1070-1077
Canterbury Cathedral

apse and ambulatory
1096-1130 1174-1184



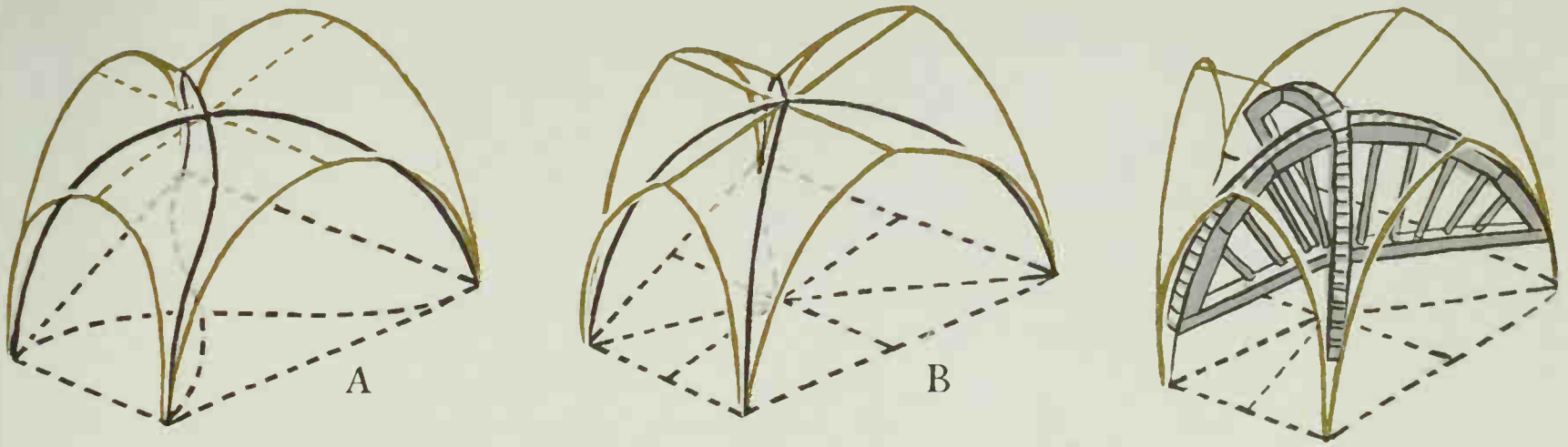
square apse
c. 1120
Romsey Abbey

The plan of the Romanesque church was based on that of the Early Christian basilica, but prominence was given to the transepts, choir and apse. In addition to parallel apses there was an ambulatory with radiating chapels called a Chevet (Fr. chef = head). An increase in the veneration of saints & sacred relics and in the numbers of pilgrims resulted in the need for the ambulatory or processional way. The Chevet became the typical form of east end for churches in Northern France. In England, e.g. at Canterbury and Norwich, it gave way to a square ending.

THE APSE

Notre-Dame-du-Port,
Clermont-Ferrand,
first half of 12th century

Abbey of S. Denis, nr Paris (restored), *c.*1140.
Built by Abbot Suger (1122-1151),
who 'enlarged and amplified the noble church'
because of the 'narrowness of the place'.



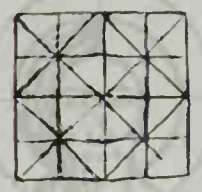
In ambulatory bays curved groins, made by the intersection of barrel-vaults A,
were simplified and strengthened by the introduction of the Gothic pointed arch B

GOTHIC


Edinburgh
Armagh
Carlisle
Durham
Ripon
York
Conway
Chester
Harlech
Lincoln
Lichfield
Peterborough
Ely
Gloucester
Cambridge
Oxford
London
Winchester
Bruges
Exeter
Canterbury
Antwerp
Cologne
Ghent
Amiens
Rouen
Beauvais
Laon
S. Denis
Rheims
Paris
Chartres
Troyes
Orléans
Sens
Angers
Bourges
Poitiers
Citeaux
Cluny
Clermont
Bordeaux
Albi
Toulouse
Avignon
Arles
Carcassonne
Burgos
Gerona
Barcelona
Utrecht
Münster
Bremen
Lübeck
Chorin
Marburg
Limburg
Annaberg
Prague
Oppenheim
Nuremberg
Dinkelsbühl
Strasbourg
Augsburg
Ulm
Munich
Vienna
Salzburg
Freiburg
Milan
Verona
Padua
Venice
Genoa
Bologna
Pisa
Florence
Siena
Perugia
Orvieto
Assisi
Rome
Naples
Palermo
Monreale
Messina
Santiago
León
Burgos
Barcelona
Avila
Segovia
Toledo
Valencia
c.1212
c.1230
c.1475
The retreat of the Moors
100 miles
100 miles
English Architectural Periods
Norman: late 11th & 12th centuries
Early English: 13th century
Decorated: 14th century
Perpendicular: 15th century
Brick Gothic
'Hall' Churches
French Architectural Periods
Gothique à Lancettes: 12th century
Rayonnant: 13th century
Flamboyant: 14th, 15th & early 16th centuries
Single-nave Churches

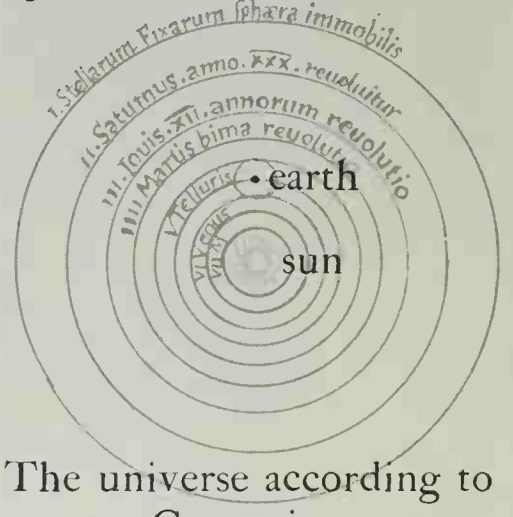
INTRODUCTION

1100	1200	1300	1400	1500	1550
Increase of trade, growth of towns, & rise of guilds	Ascension of Gothic in Ile de France	Black Death 1348-49		1453 End of Eastern Byzantine Empire	
		1346-The 100 Years' War-1453			
Universities Aristotle (via Arabs)	Scholasticism *c.*1225–S. Aquinas–*c.*1275	1304-Petrarch-1374	Humanism	Italian RENAISSANCE	
		1265–Dante-1321		1452–Leonardo da Vinci -1519	
Discoveries: 1214-Roger Bacon-1294 optical lens, mariner's compass, gunpowder, cannon				*c.*1450 printing	



Map of the world, 1527

The medieval universe



The universe according to 1473—Copernicus—1543

The enlargement of S. Denis, 1144 (p.89) inaugurated a lyrical form of construction in which pointed arches, high stone vaults and flying buttresses were fused into an organic whole, and which reached a crescendo in the cathedrals built in the Ile de France (pp.100-101). Gothic, or the 'style Ogivale' (Fr.: pointed) was known as 'Opus Modernum' or 'Opus Francigenum' (French work); the term 'Gothic', i.e. barbarian, was first used by the Humanists of the Renaissance. Few plans survive by the lay master-masons, who designed their buildings with 'a good wit of geometry' and who directed the quarry-men, stone-cutters, smiths, carpenters & workmen. In England (pp.102-105), France (pp.106-107), Italy (pp.108-109) and Germany (pp.110-111) castles, parish churches, guild-halls and houses followed the same pattern of pointed arches, pinnacles, spires & high-pitched roofs. South of the Alps in Italy Gothic was neutralised by the Roman tradition and ceased with the advent of the Renaissance in the 15th century.

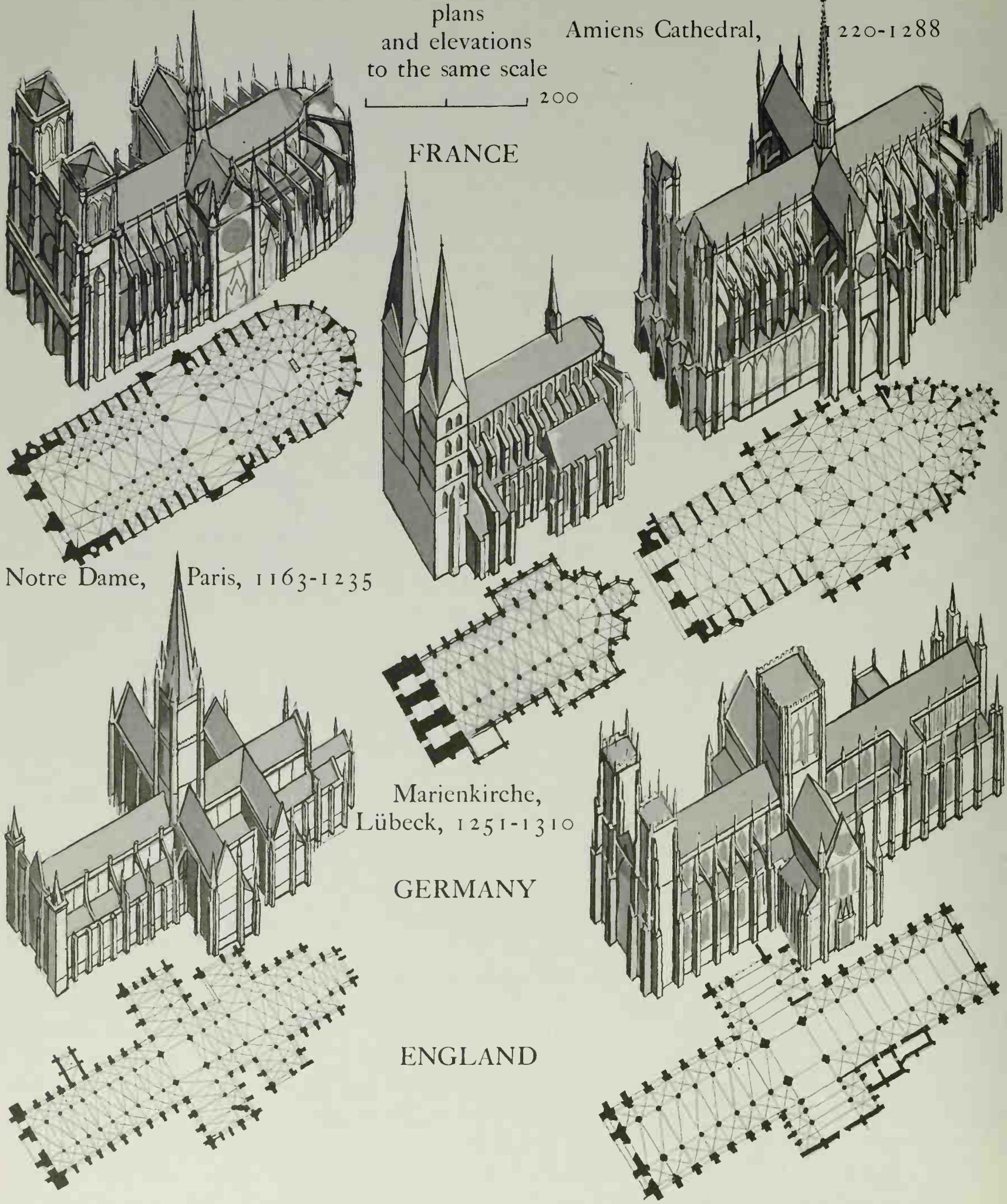
GOTHIC

plans
and elevations
to the same scale

200

FRANCE

Amiens Cathedral, 1220-1288



Notre Dame, Paris, 1163-1235

Marienkirche,
Lübeck, 1251-1310

GERMANY

ENGLAND

Salisbury Cathedral, 1220-1258

York Cathedral, 1261-1324

PLANS & ELEVATIONS

ITALY

Florence Cathedral, 1296-1462

dome added by Brunelleschi 1420-37

three apses completed 1421

Siena Cathedral, 1245-1380

SPAIN

Burgos Cathedral, 1220-1500

St Peter's, Rome, begun 1506

GOTHIC

150

timber roof

stone vault

clerestorey

triforium

flying buttress

nave arcade

buttress

aisle nave aisle

Rheims Cathedral, 1212-1300

central tower, 1307-11

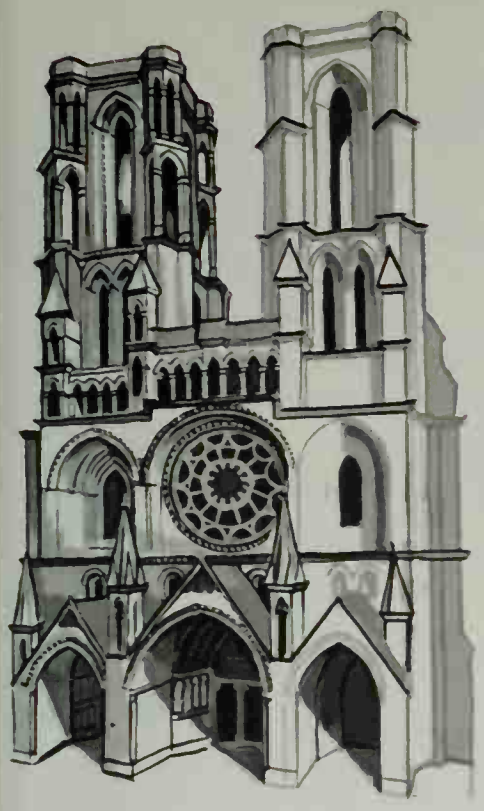
100

west towers, 1400

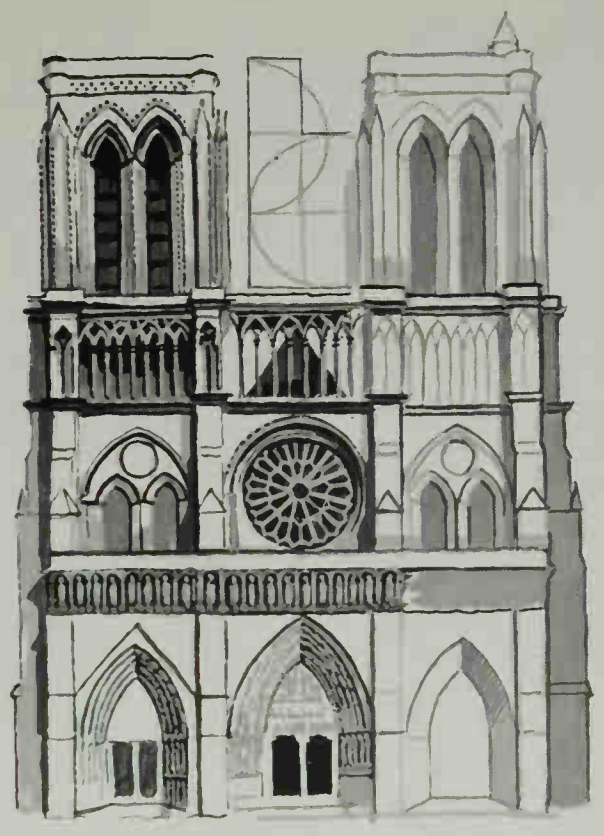
A Nave for laity
B Crossing
C Transept
D Choir aisle
E Sacristry
F Chancel G Choir for dean & chapter H Presbytery
I Cathedra or bishop's throne
K High altar L Reredos M Retro-choir
N Principal shrine O Ambulatory P Lady chapel

Lincoln Cathedral, 1220-1280

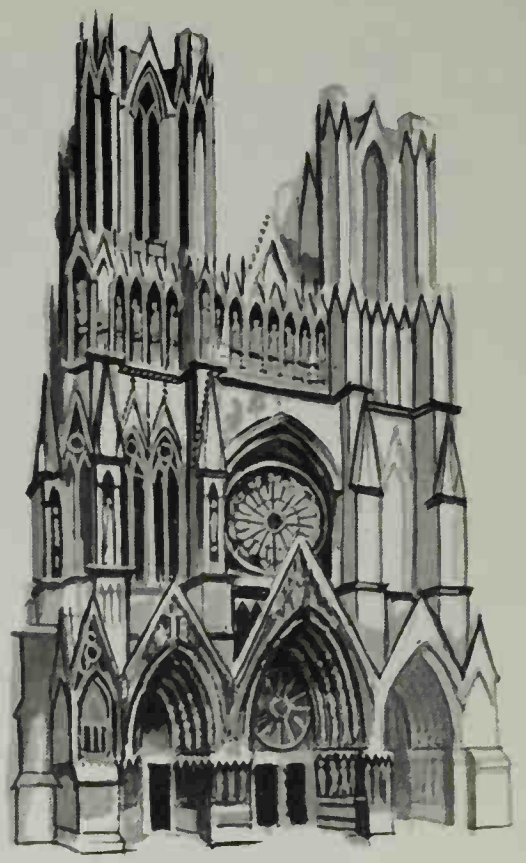
THE PARTS OF A CATHEDRAL



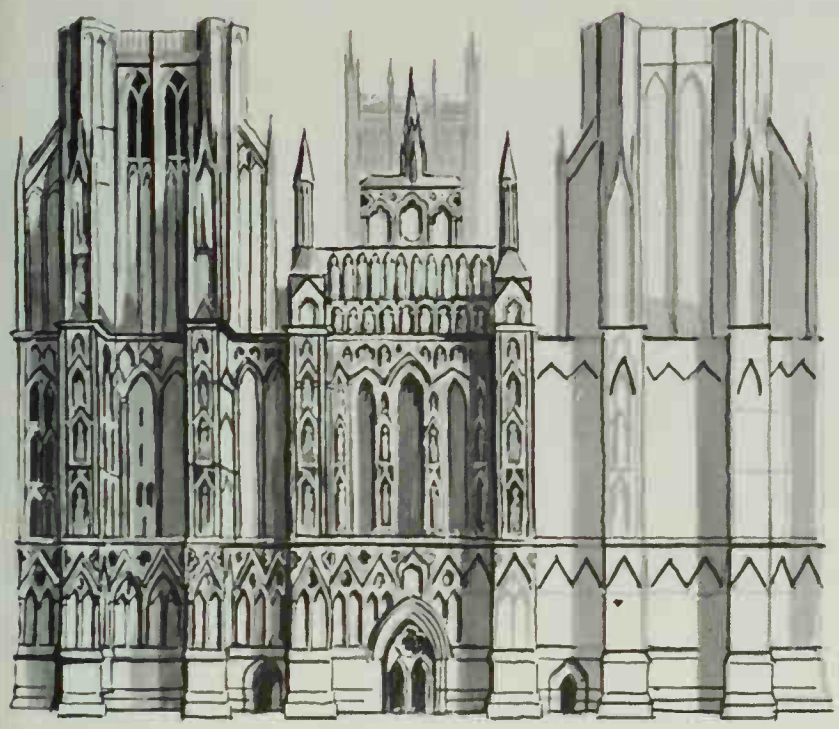
Laon Cathedral,
*c.*1235

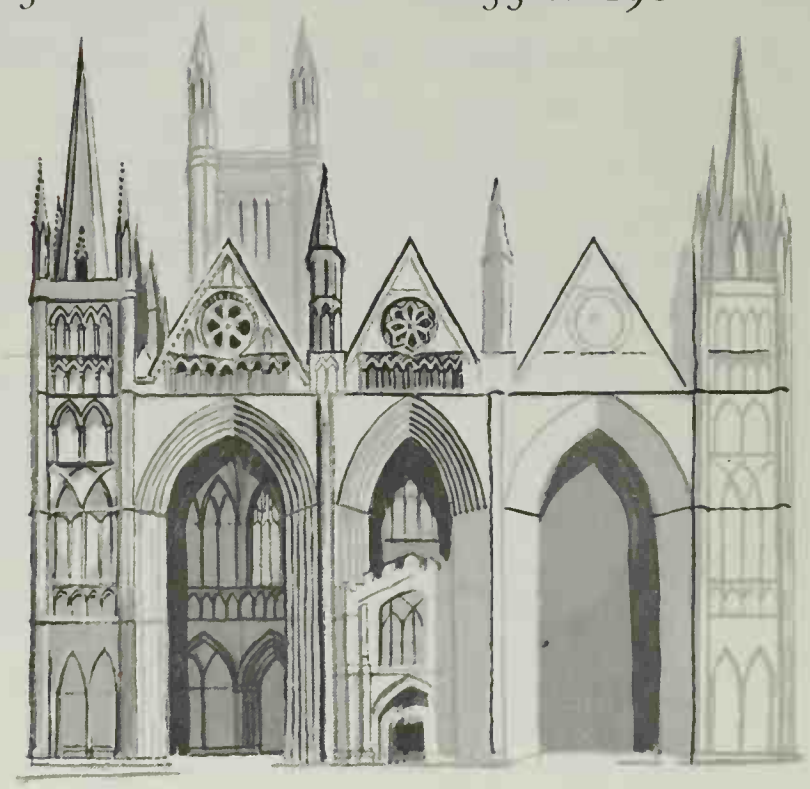


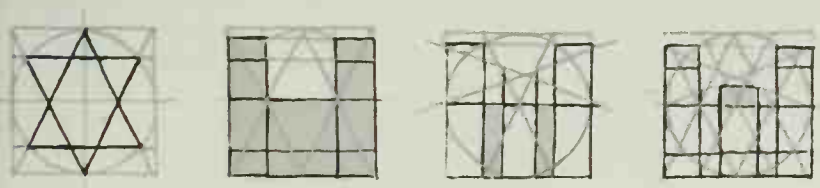
Notre Dame, Paris,
*c.*1200-1250



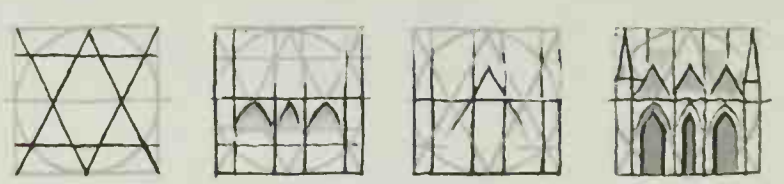
Rheims Cathedral,
*c.*1255-*c.*1290







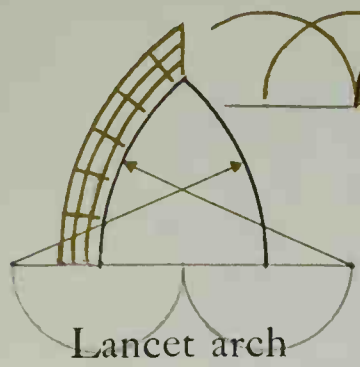
Wells Cathedral, *c.*1220-1242



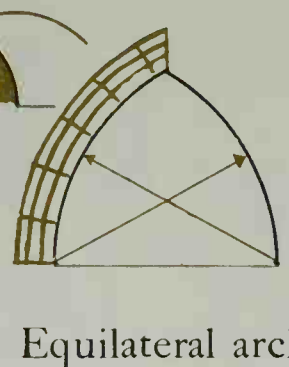
Peterborough Cathedral, *c.*1235

THE WEST FRONT

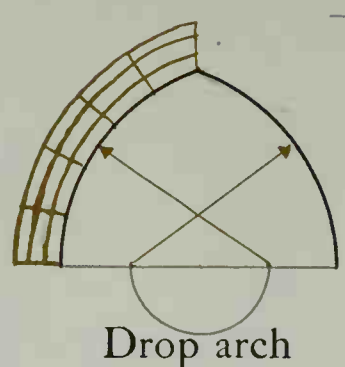
GOTHIC



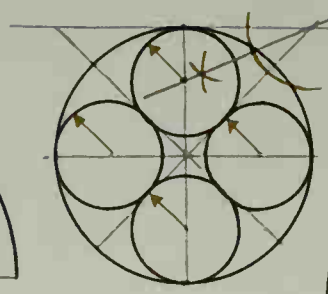
Lancet arch

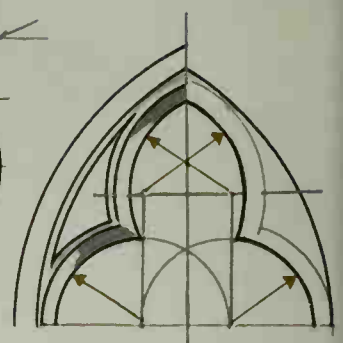


Equilateral arch



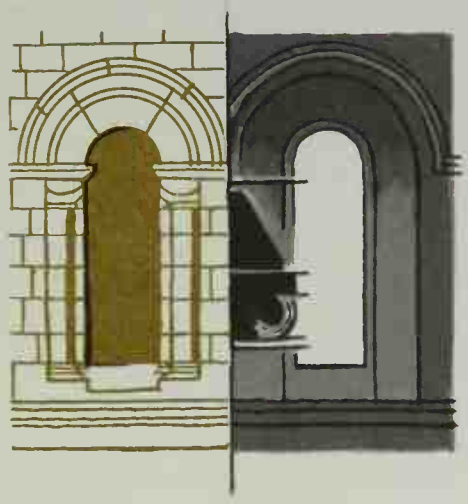
Drop arch

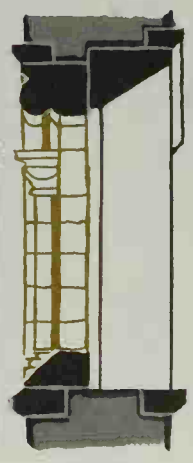




Cusped arch

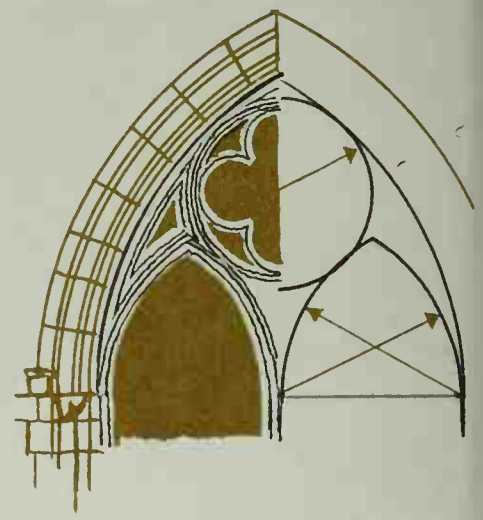
(Romanesque) Norman

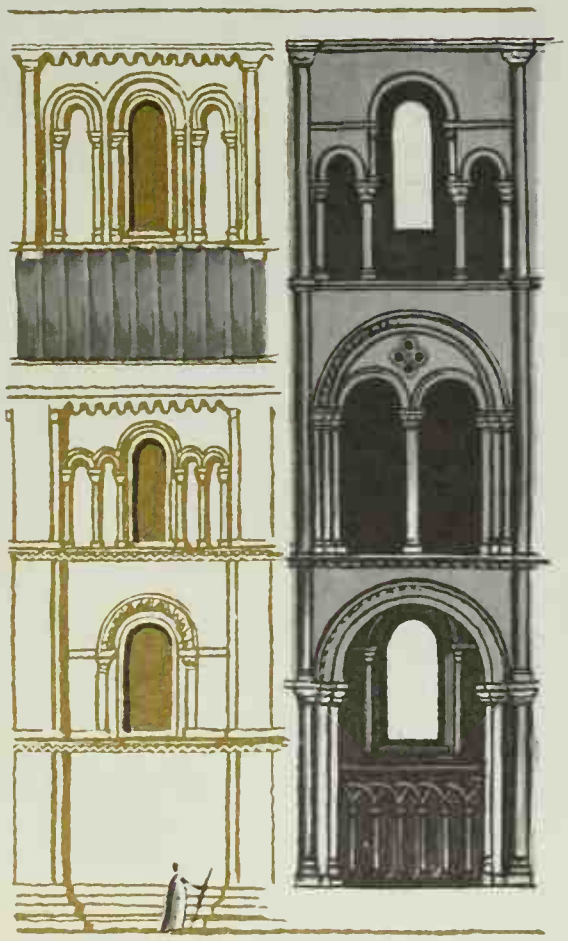




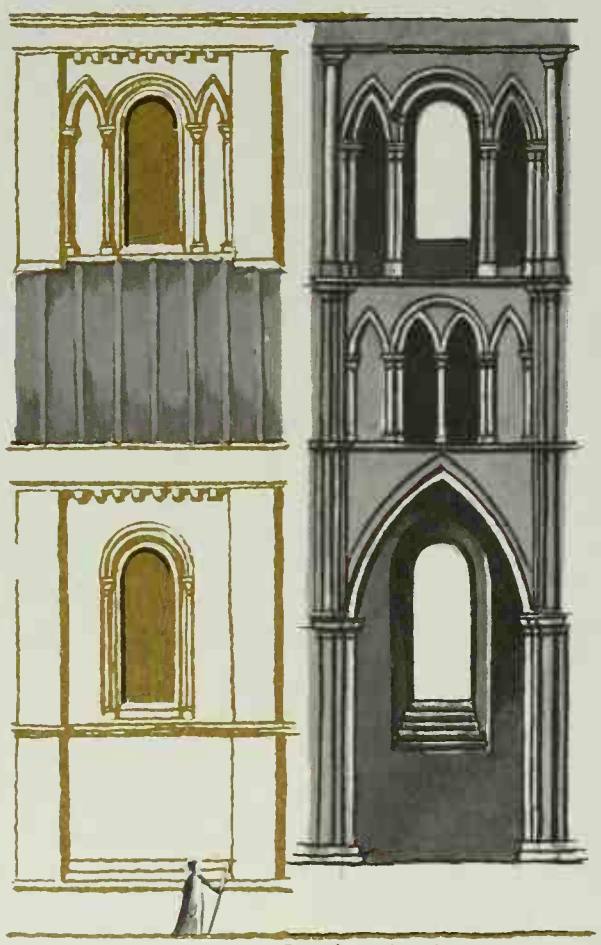
Transitional

Early English (lancet)





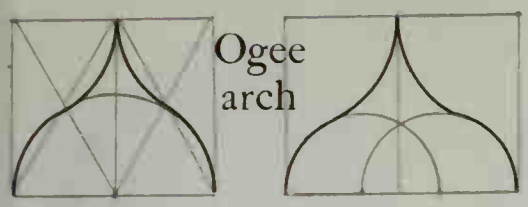
Peterborough Cathedral:
choir, *c.* 1140

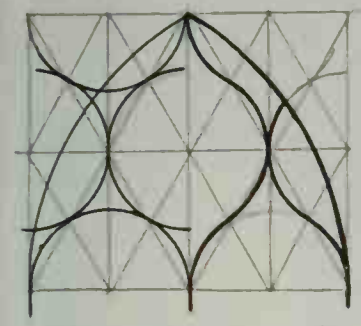


Ripon Cathedral:
choir, 1154-1181

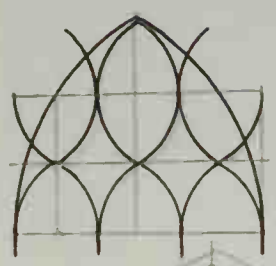
Ely Cathedral:
presbytery, 1235-1252

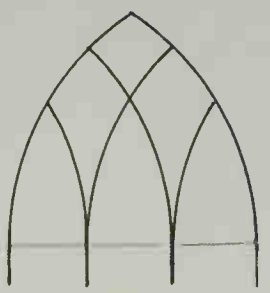
ENGLAND, WINDOW TRACERY

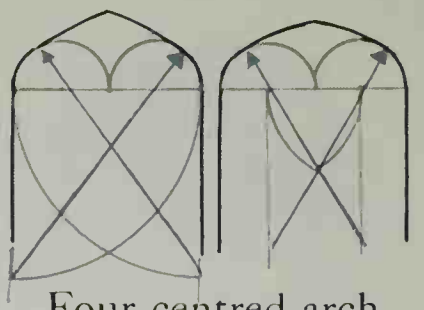




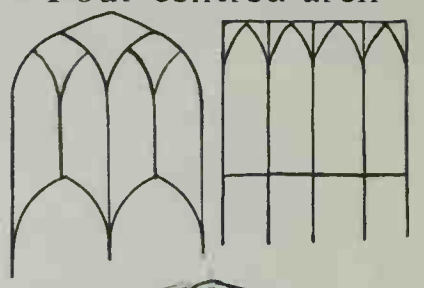
Reticulated arch

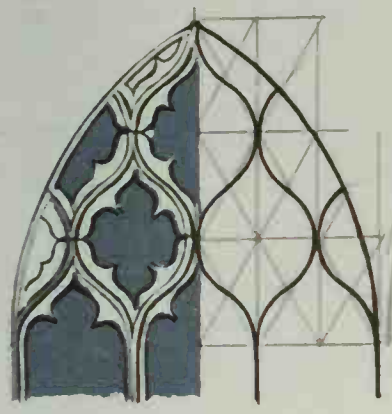




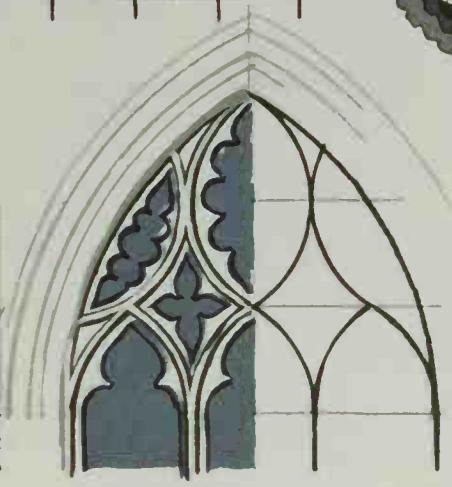


Four-centred arch

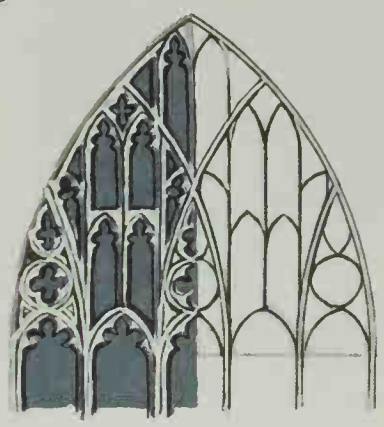




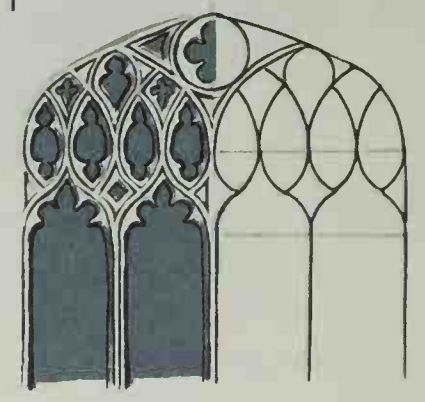
(geometrical)



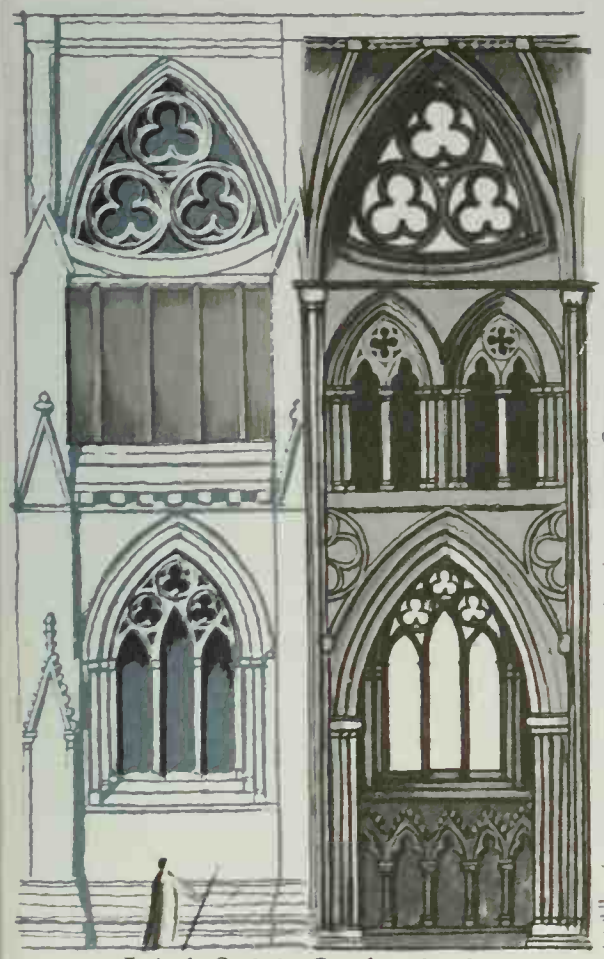
Decorated



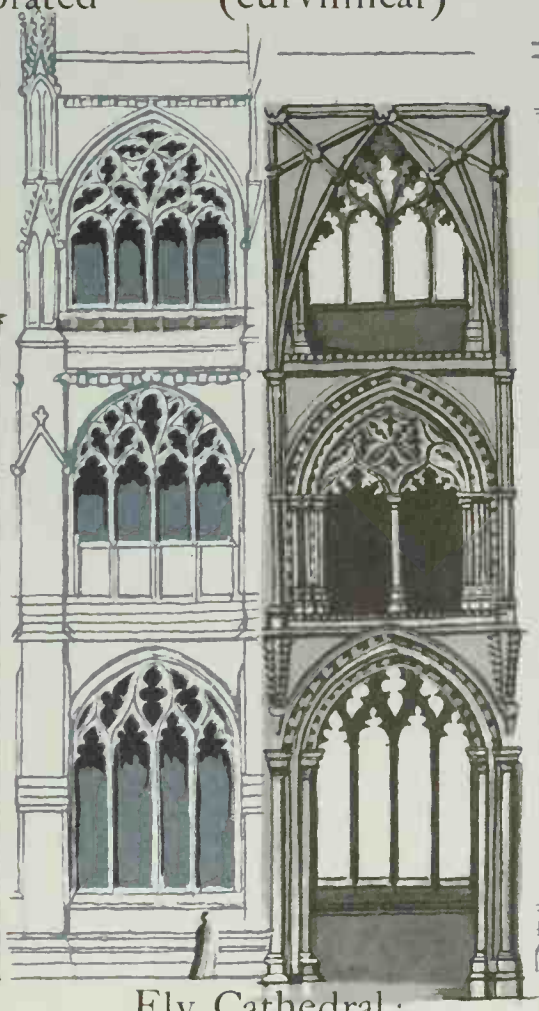
(curvilinear)



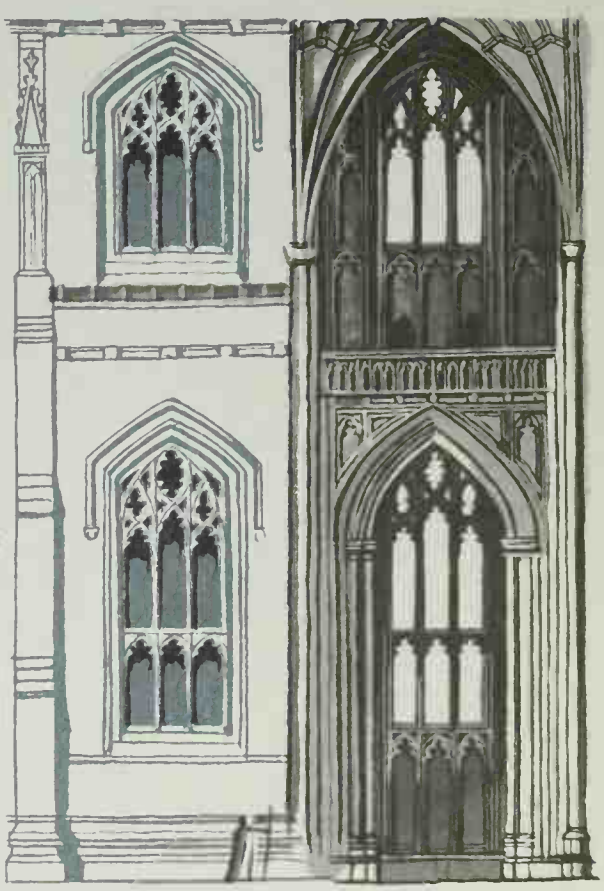
Perpendicular (rectilinear)



Lichfield Cathedral:
nave, *c.* 1250



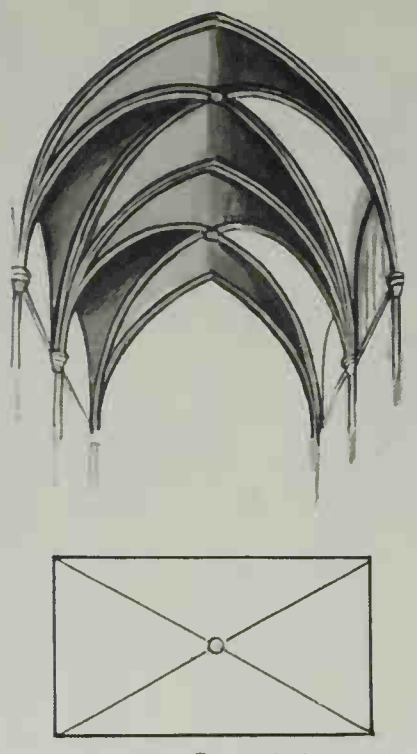
Ely Cathedral:
choir, 1338-1350



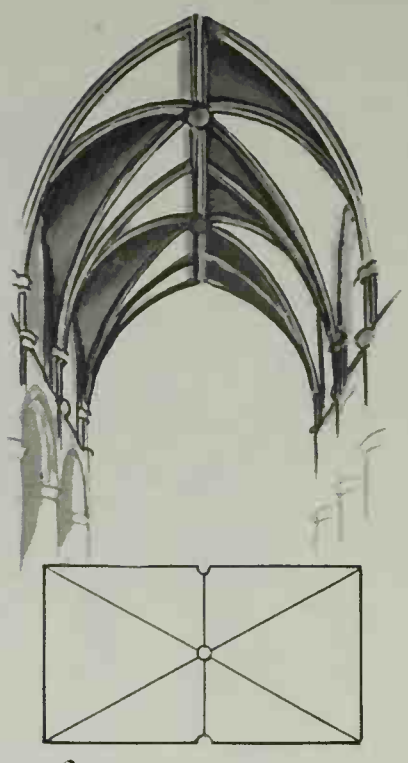
Winchester Cathedral:
nave, *c.* 1394-1460

GOTHIC

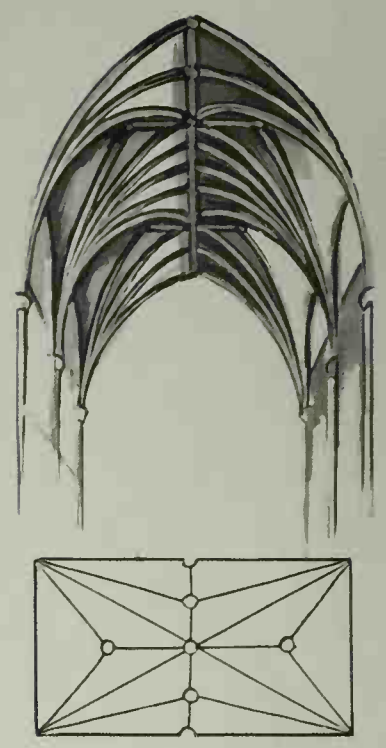
Sexpartite or six-part ribbed vault
Canterbury Cathedral choir, 1275-1278



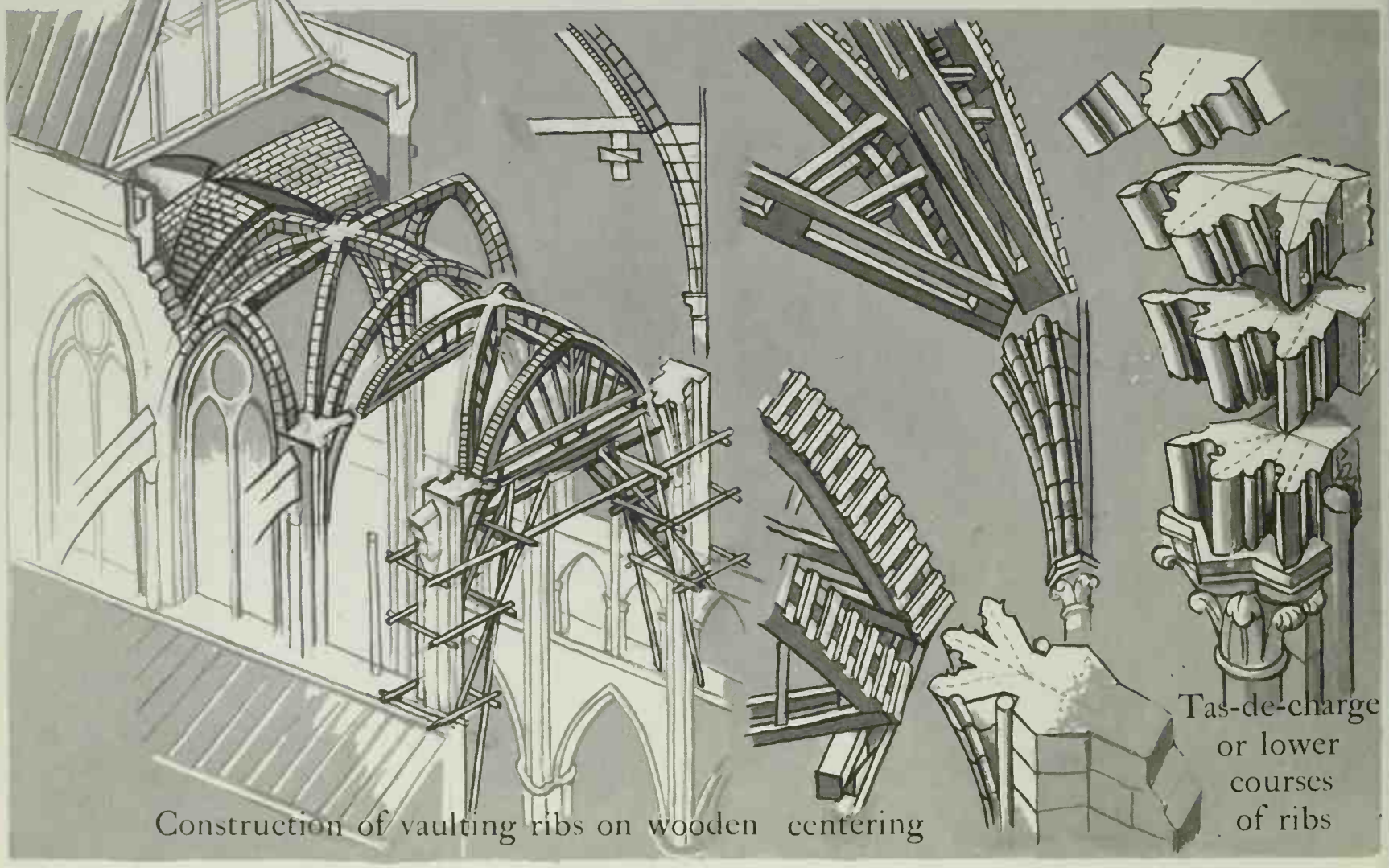
Quadripartite or four-part ribbed vaults
Salisbury Cathedral nave, 1220-1258



Gloucester Cathedral nave, 1242



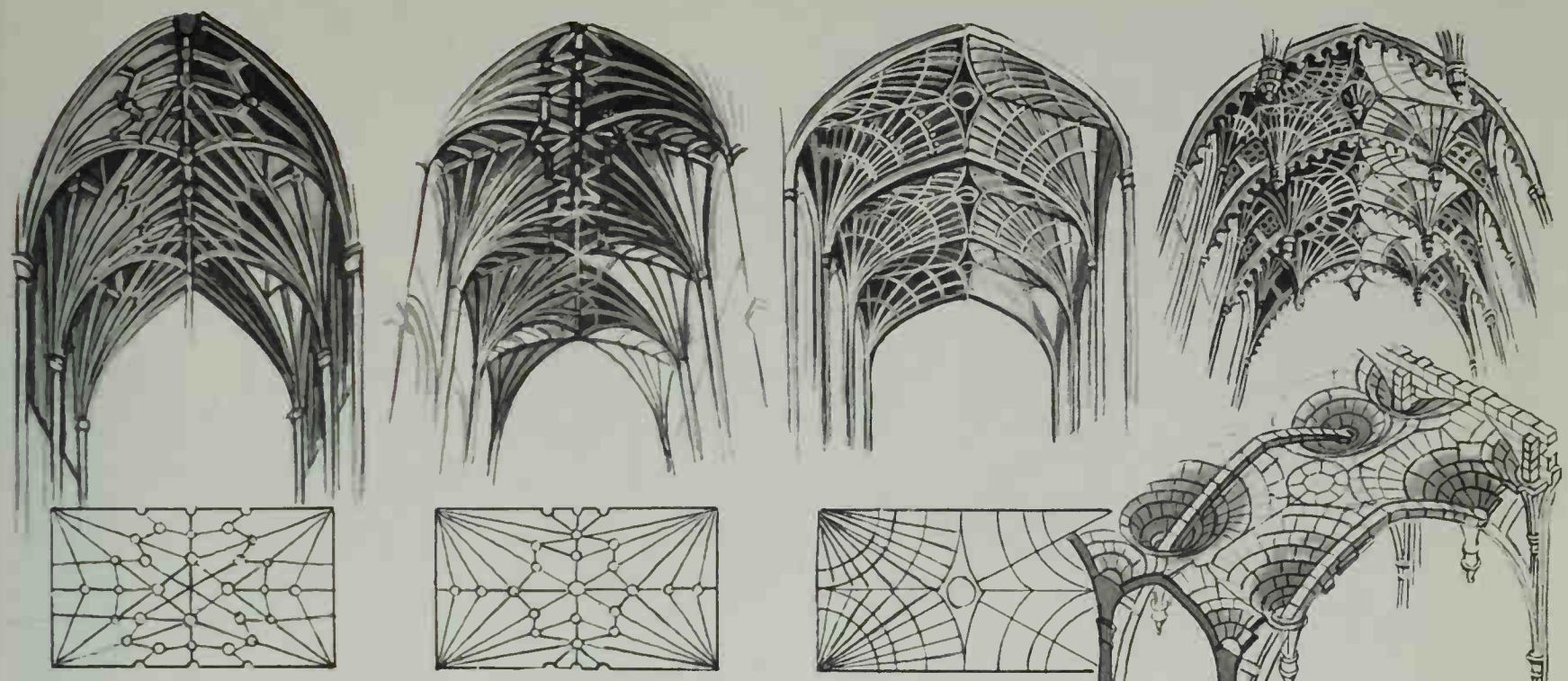
Addition of tiercerons or intermediate ribs
Lincoln Cathedral nave, *c.*1253



Construction of vaulting ribs on wooden centering

Tas-de-charge or lower courses of ribs

ENGLAND, STONE VAULTING



Introduction of liernes or small ribs with shorter web courses

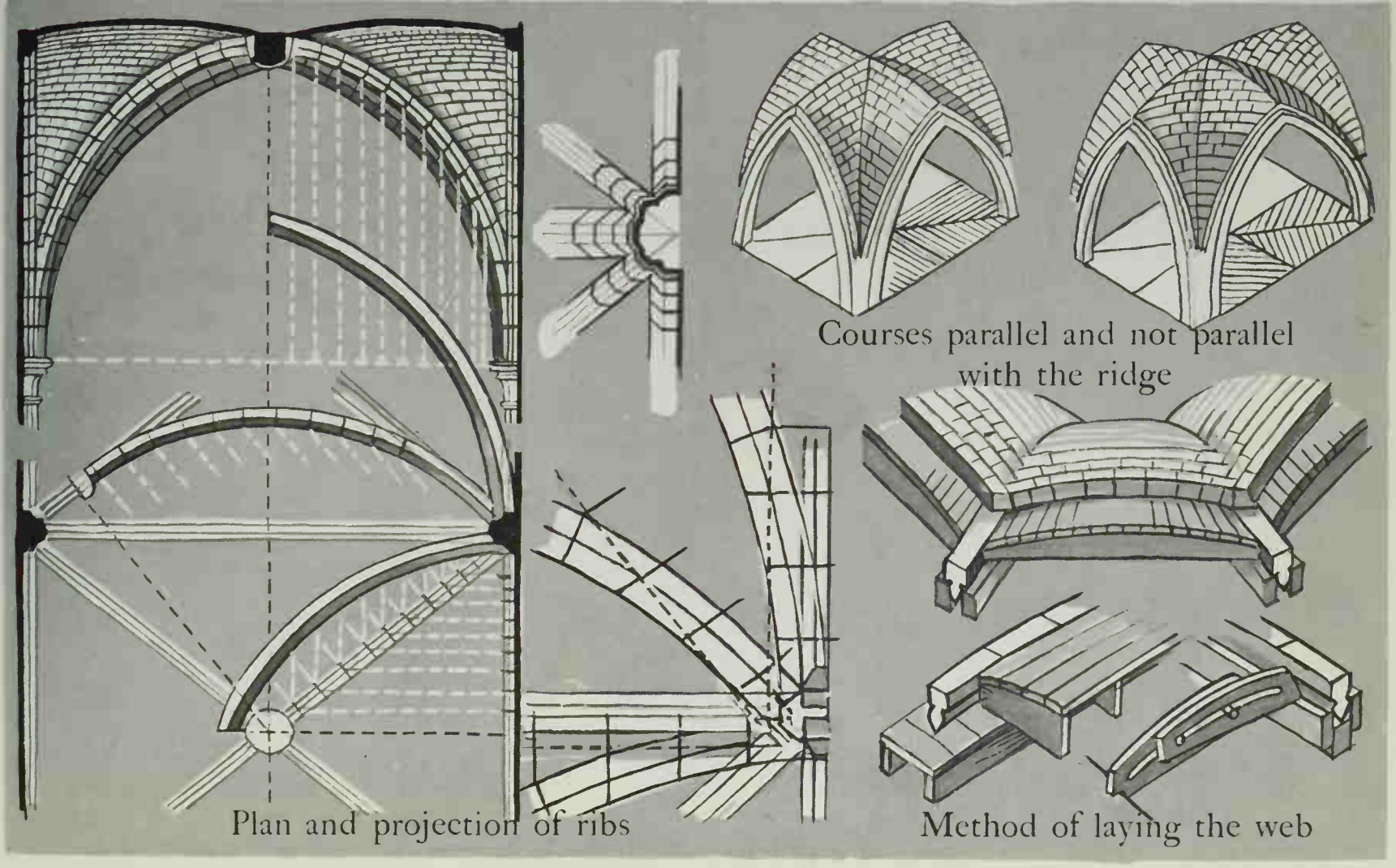
Winchester Cathedral nave, 1371-1460

Norwich Cathedral nave, 1463-1472

Fan vaults: all ribs of equal span and the web carved from the same stone

King's College Chapel, Cambridge, 1446-1515

Henry VII's Chapel, Westminster Abbey, 1502-1512

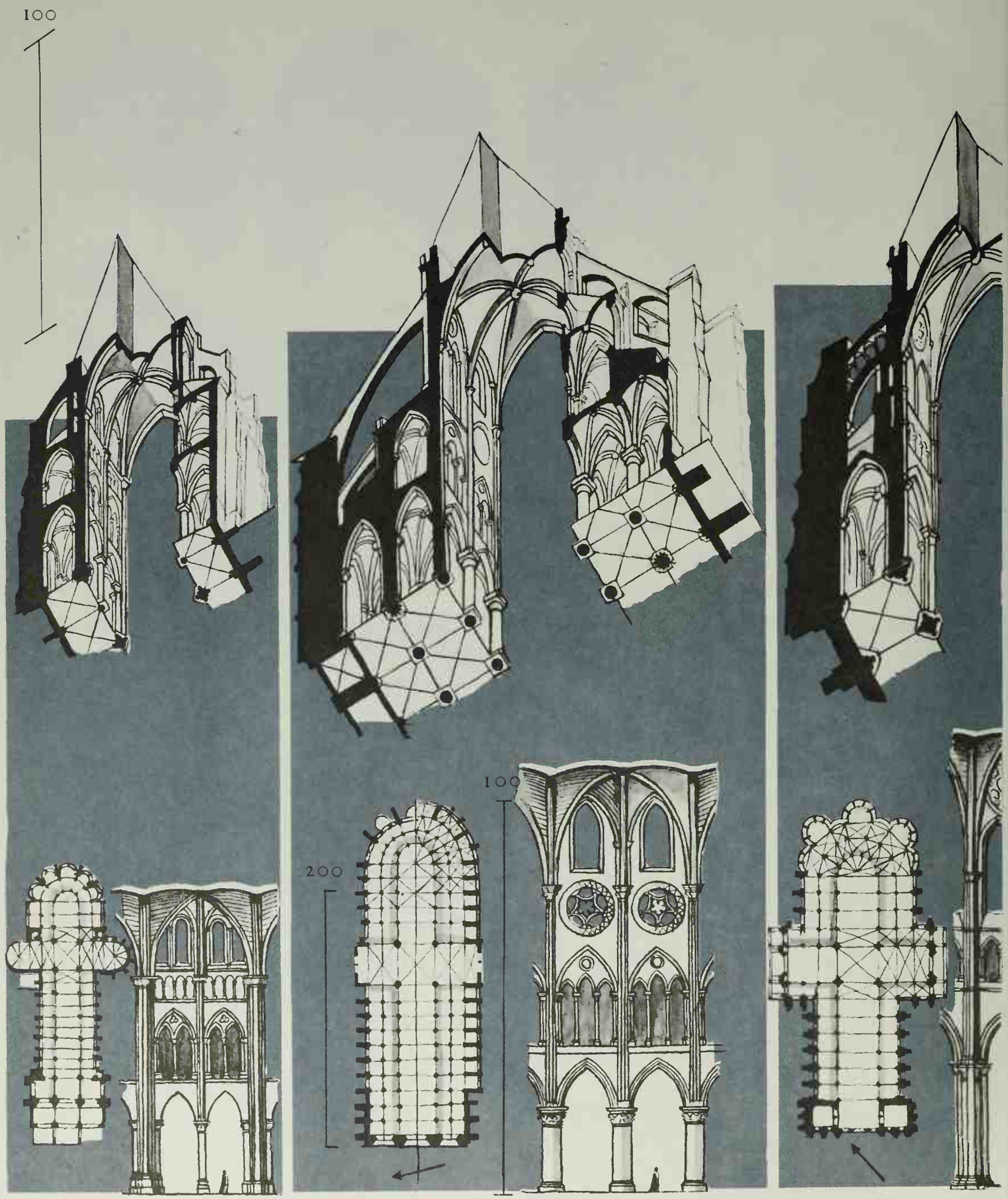


Plan and projection of ribs

Courses parallel and not parallel with the ridge

Method of laying the web

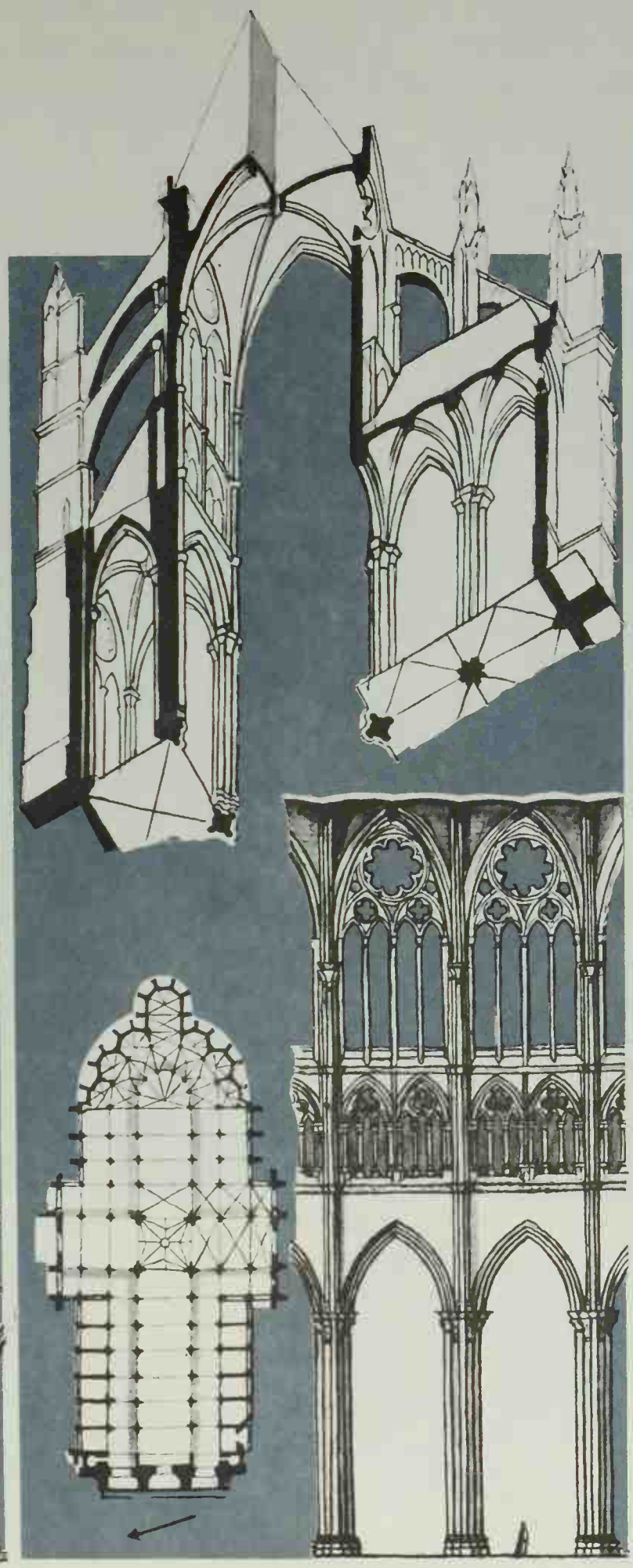
GOTHIC CATHEDRALS,



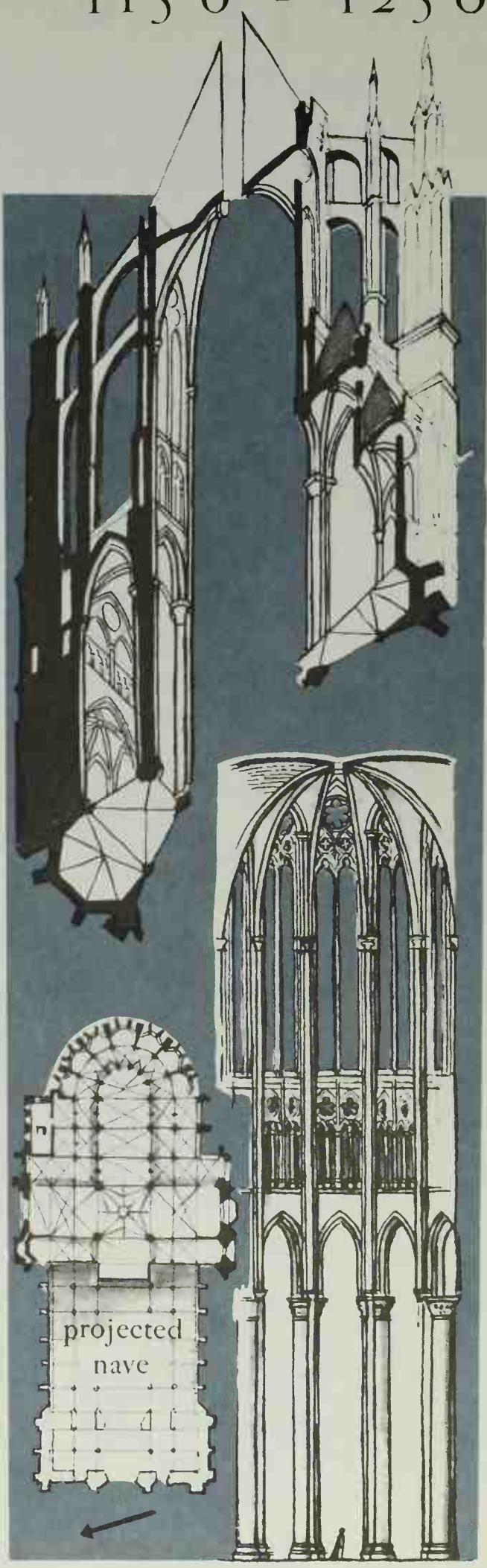
Noyon, *c.*1150-55 Notre Dame, Paris, 1163-1235 Chartres,

ILE - DE - FRANCE 1150 - 1250

1194-1260



Amiens, 1220-88



Beauvais, 1225-72

GOTHIC

ANGLO-SAXON
5th-11th centuries

NORMAN
(Romanesque)
late 11th and 12th centuries

EARLY ENGLISH
13th century

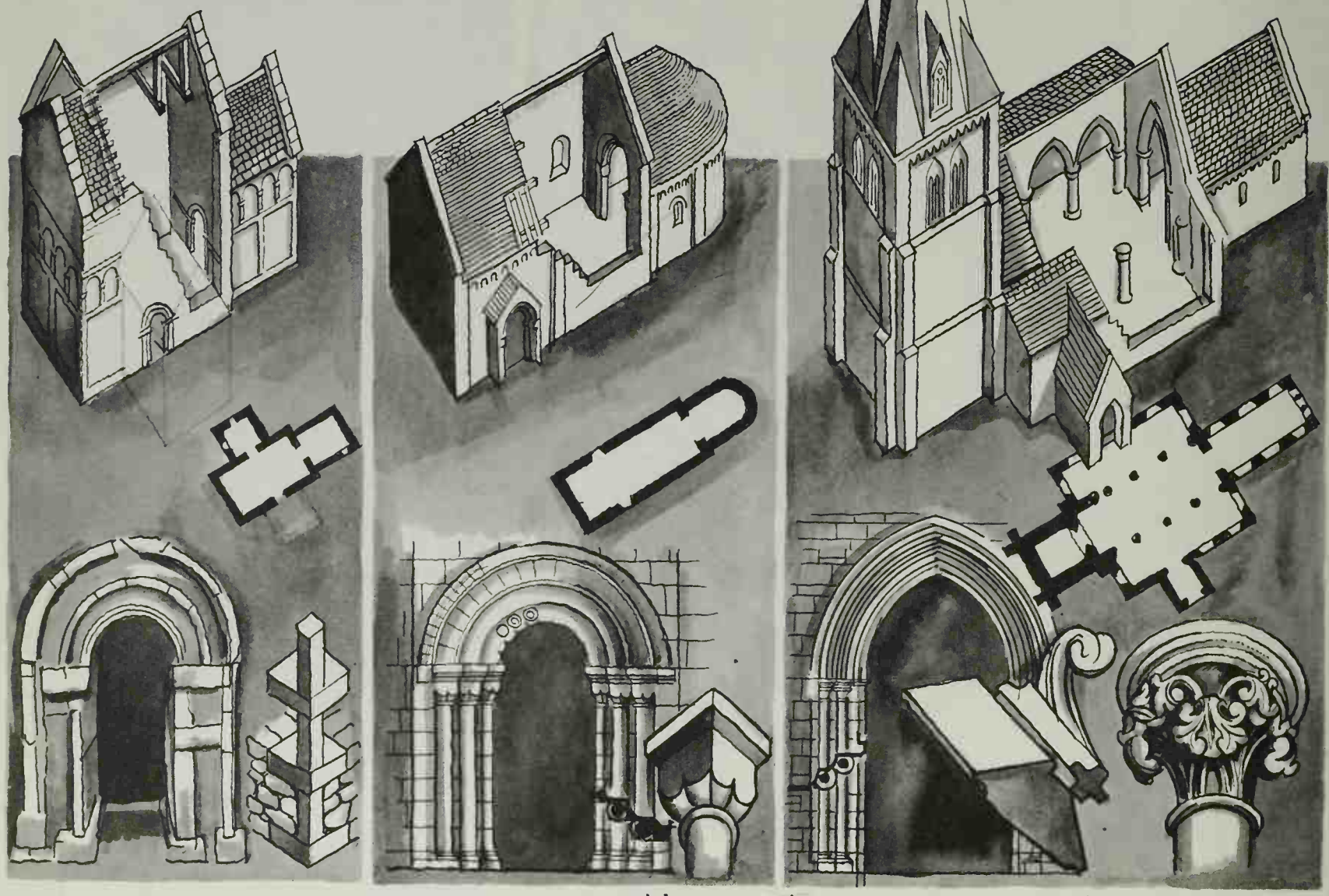
plans

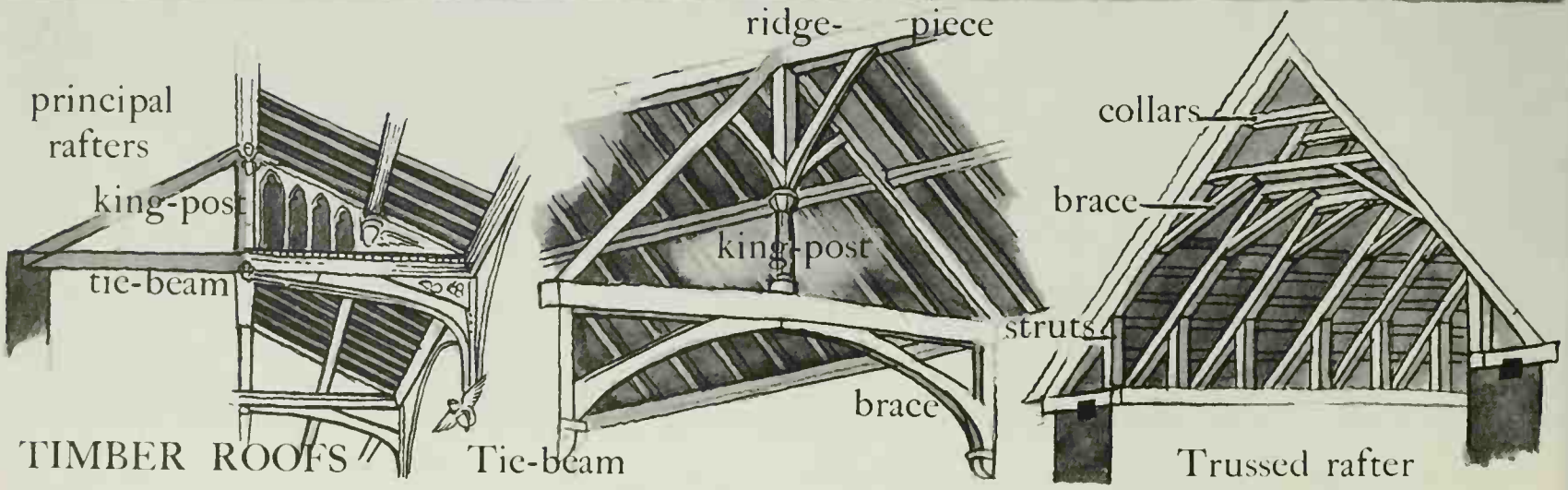
100

projections

100

broach spire





TIMBER ROOFS

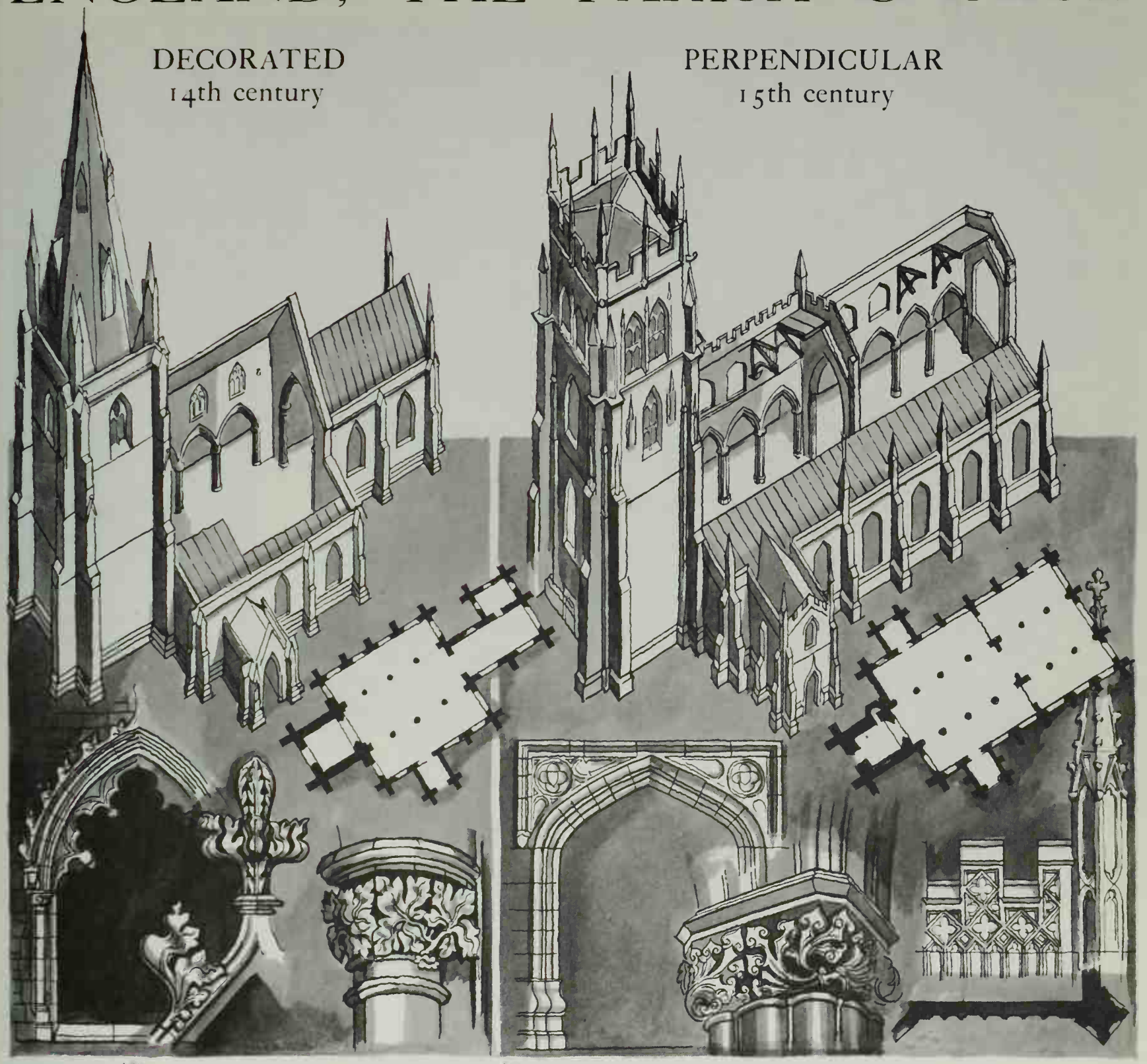
Tie-beam

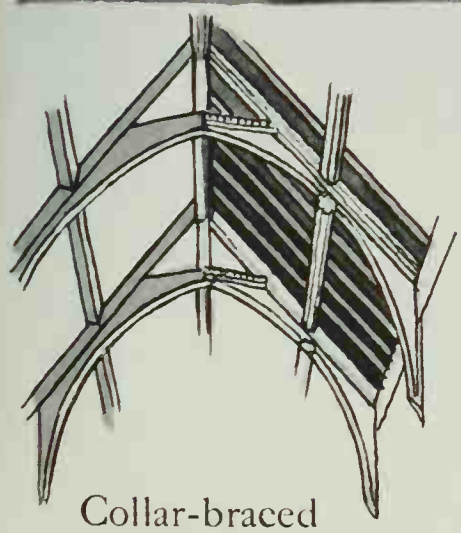
Trussed rafter

ENGLAND, THE PARISH CHURCH

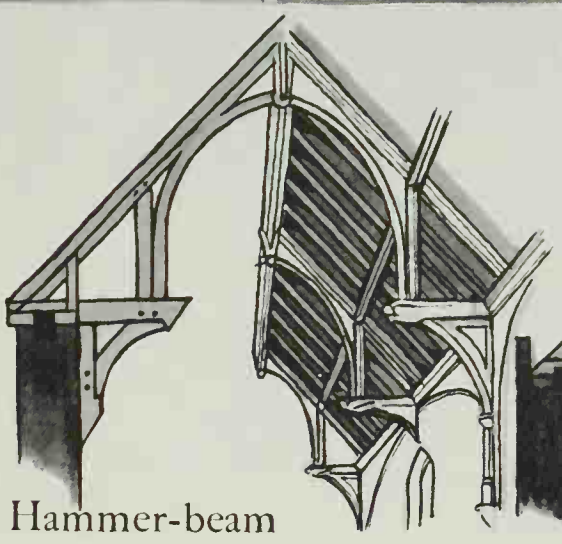
DECORATED
14th century

PERPENDICULAR
15th century

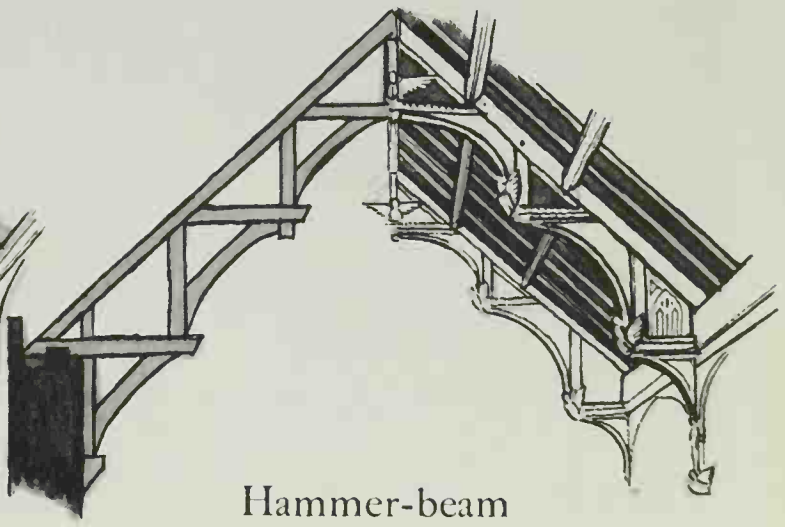




Collar-braced



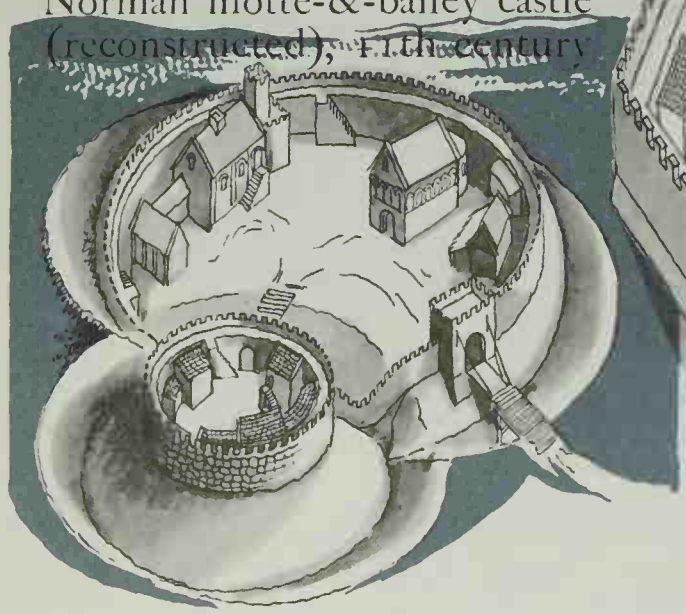
Hammer-beam



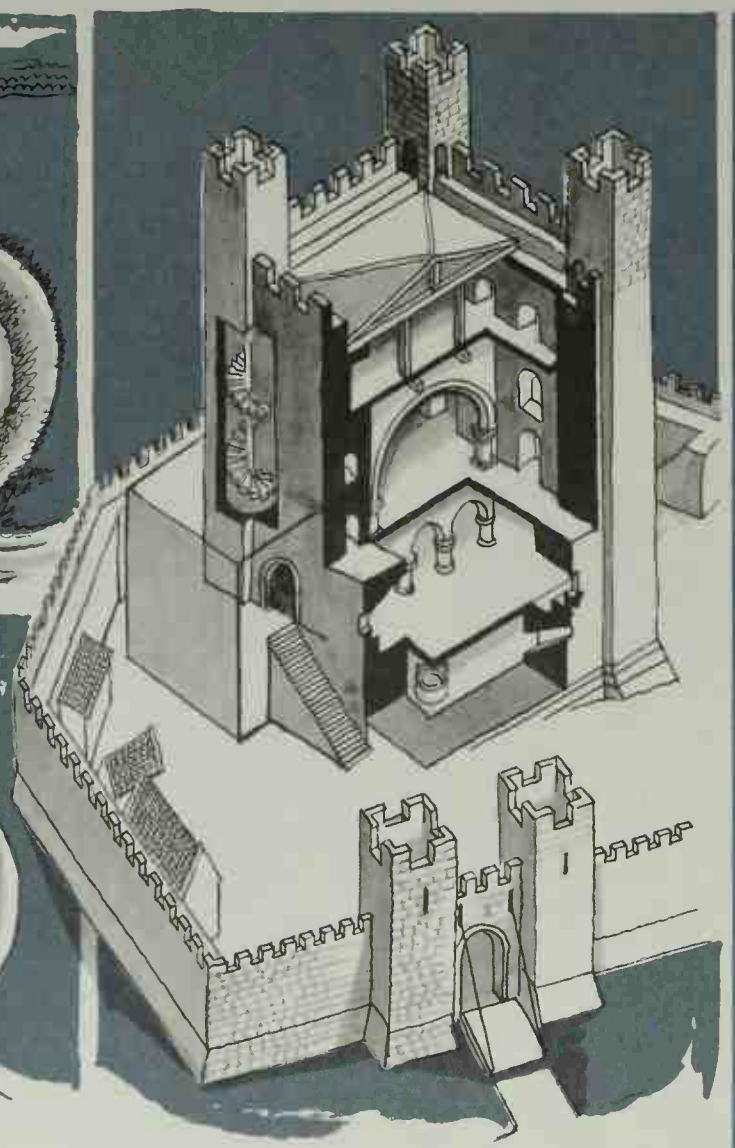
Hammer-beam

GOTHIC

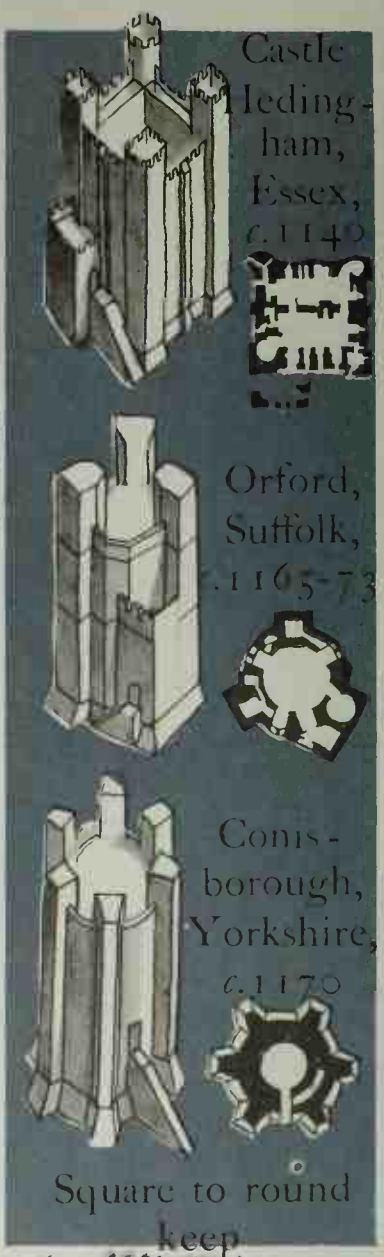
Norman motte-&-bailey castle (reconstructed), 11th century



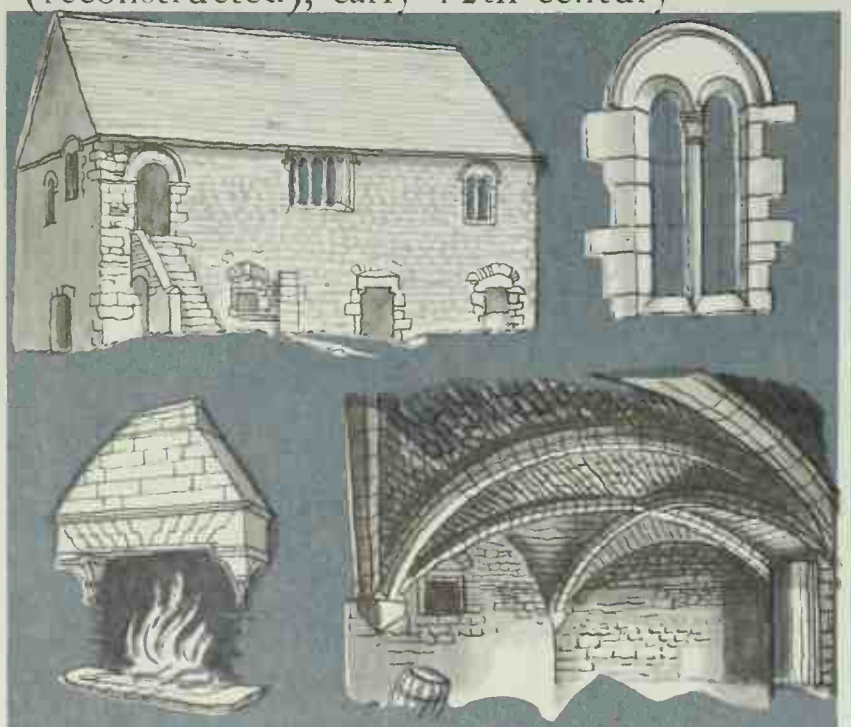
Shell keep and bailey (reconstructed), early 12th century



Section of a square keep, early 12th century



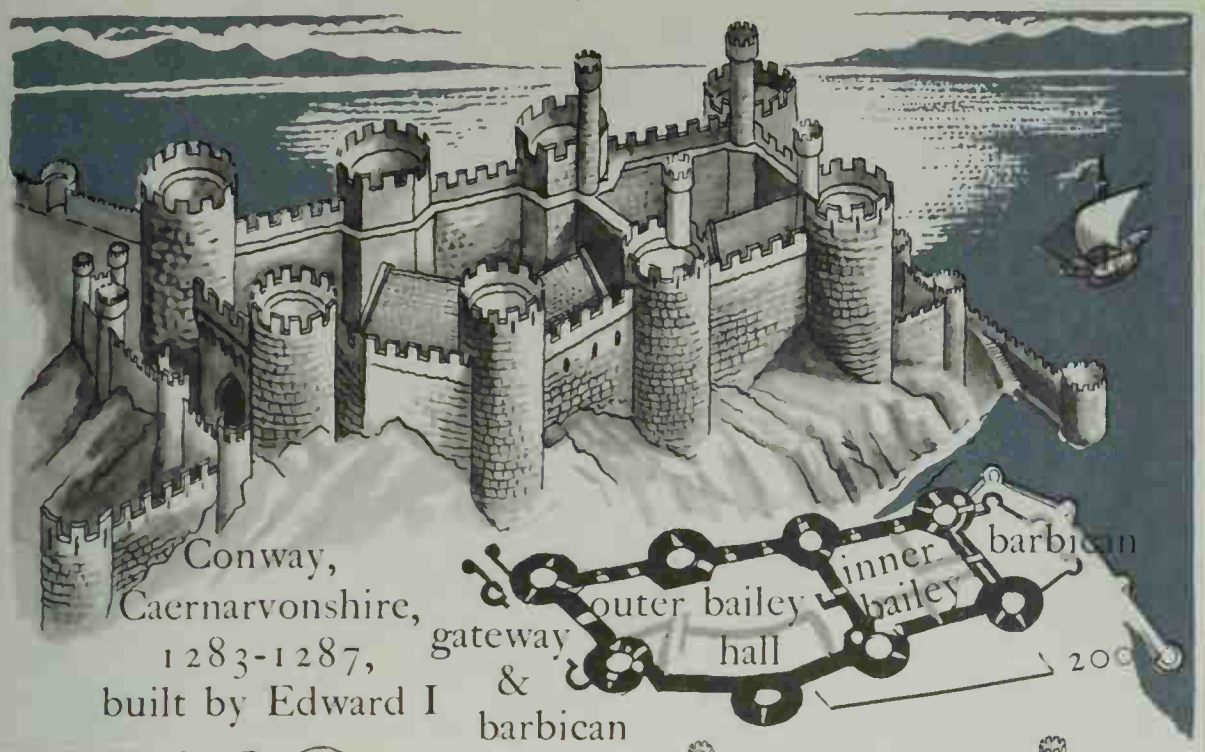
Square to round keep



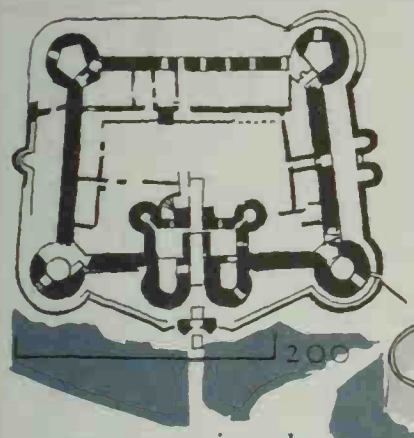
The Manor House, Boothby Pagnall, Lincolnshire, *c.*1180

Little Wenham Hall, Suffolk, *c.*1260-1286

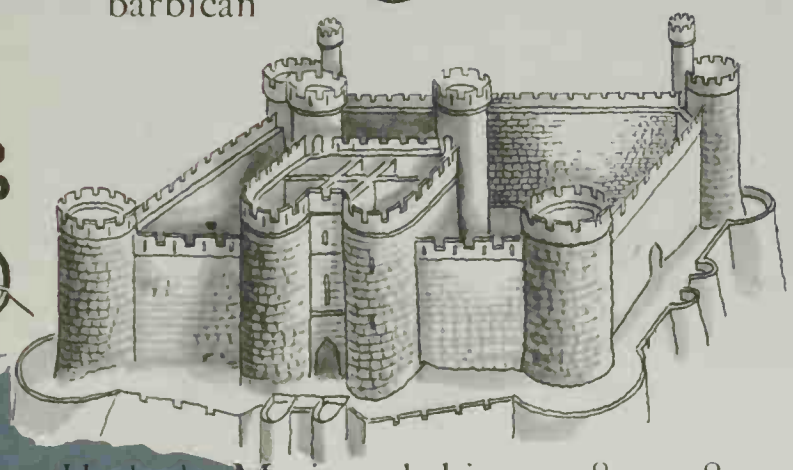
ENGLAND, CASTLES & HOUSES



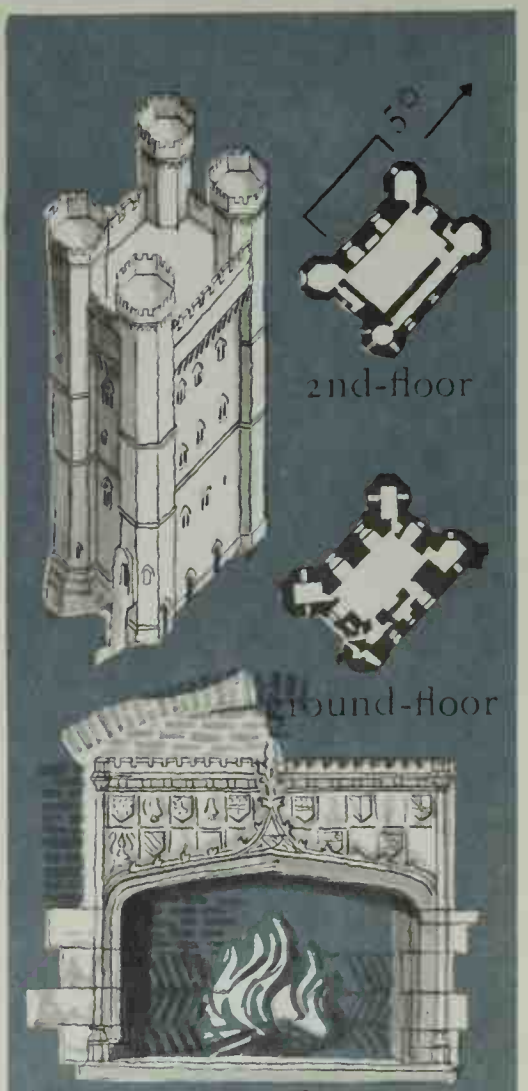
Conway, Caernarvonshire, 1283-1287, built by Edward I



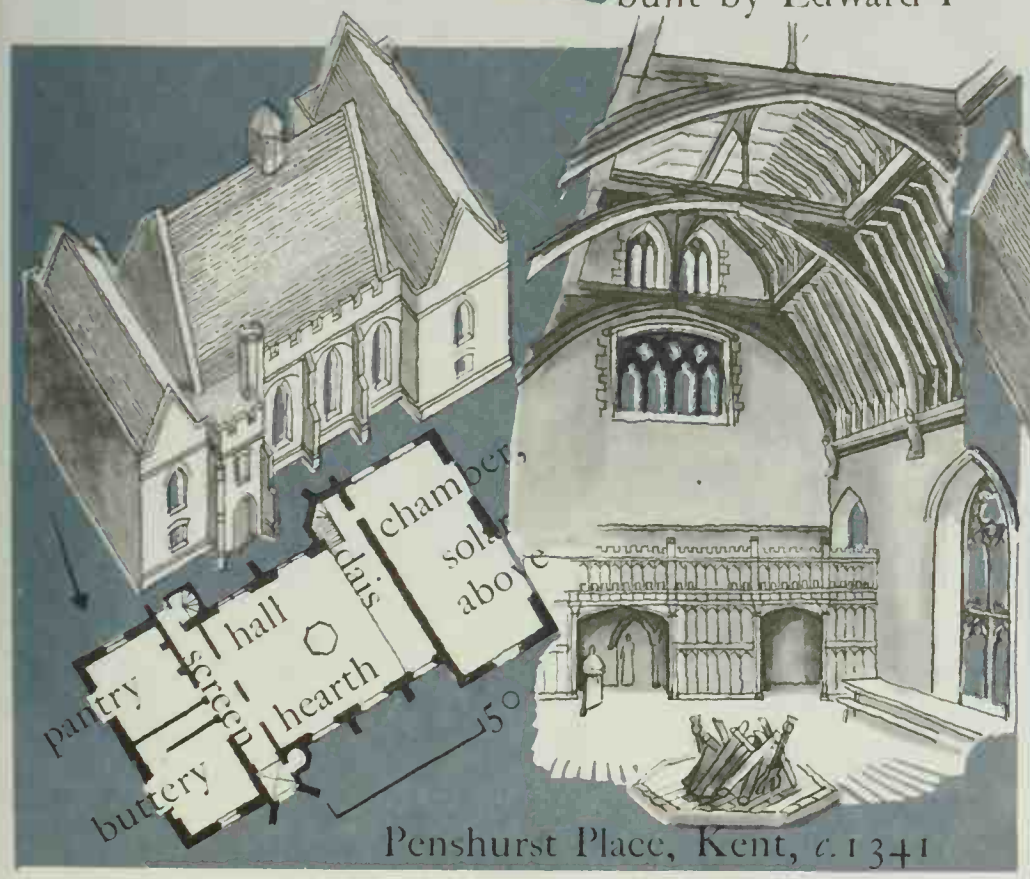
concentric plan



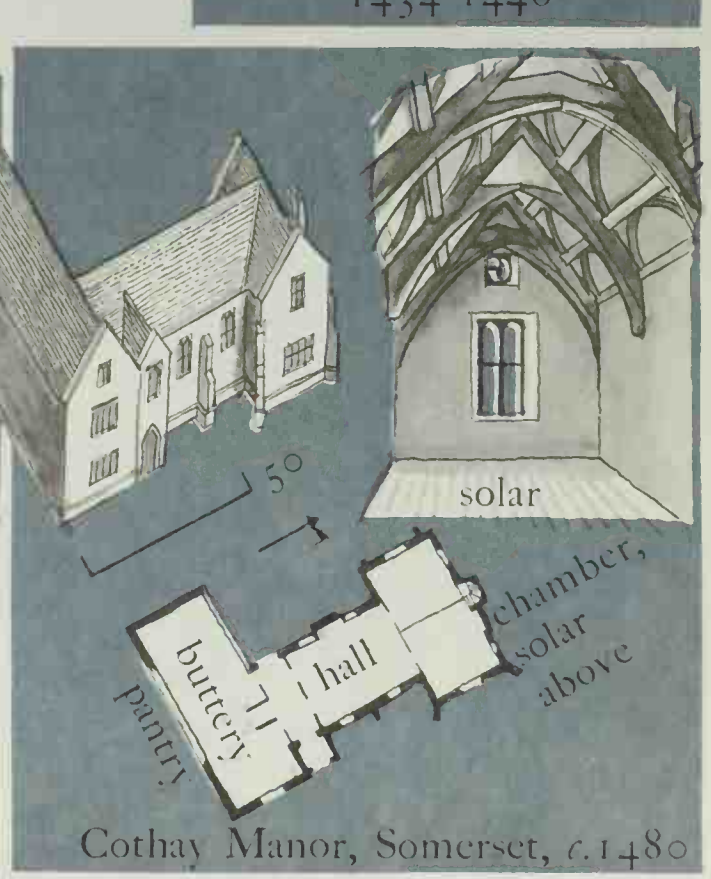
Harlech, Merionethshire, 1283-1289, built by Edward I



The decline of the castle
Tattershall, Lincolnshire:
tower-house of brick,
1434-1446

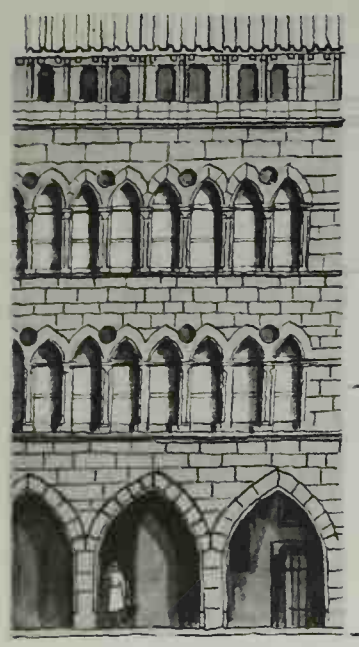


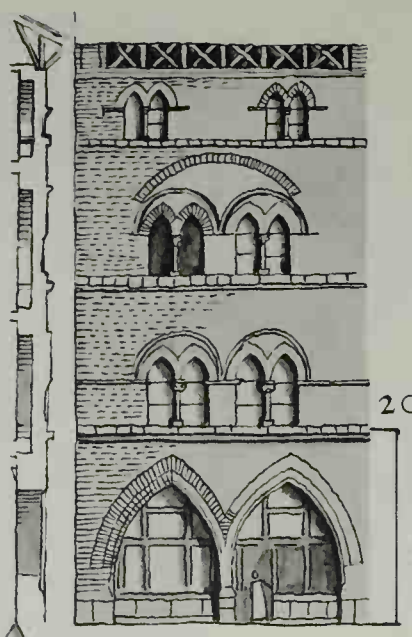
Penshurst Place, Kent, *c.* 1341



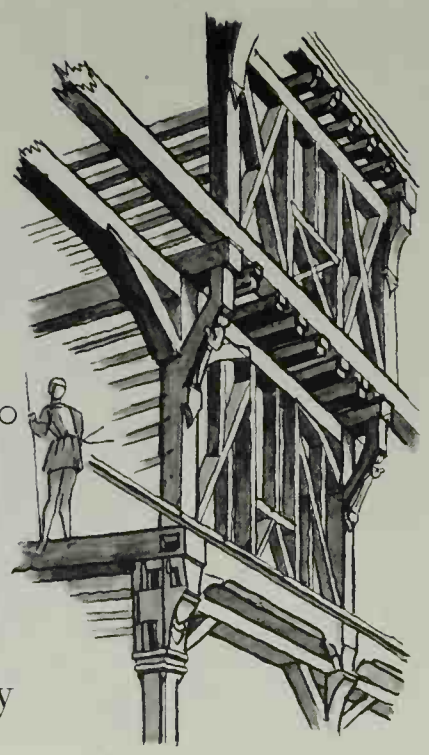
Cothay Manor, Somerset, *c.* 1480

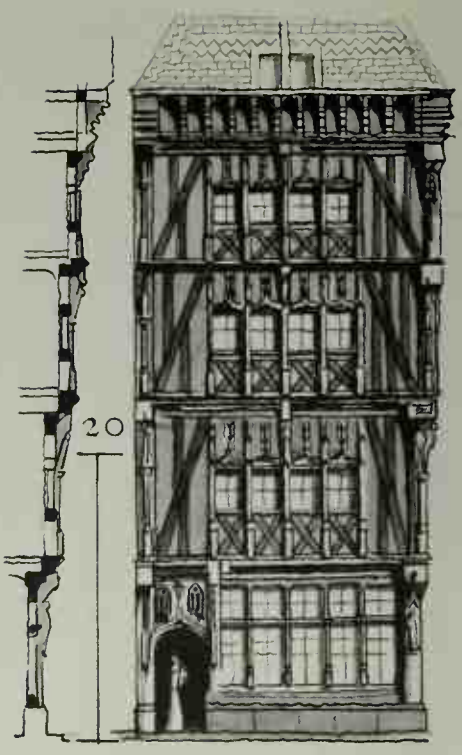
GOTHIC



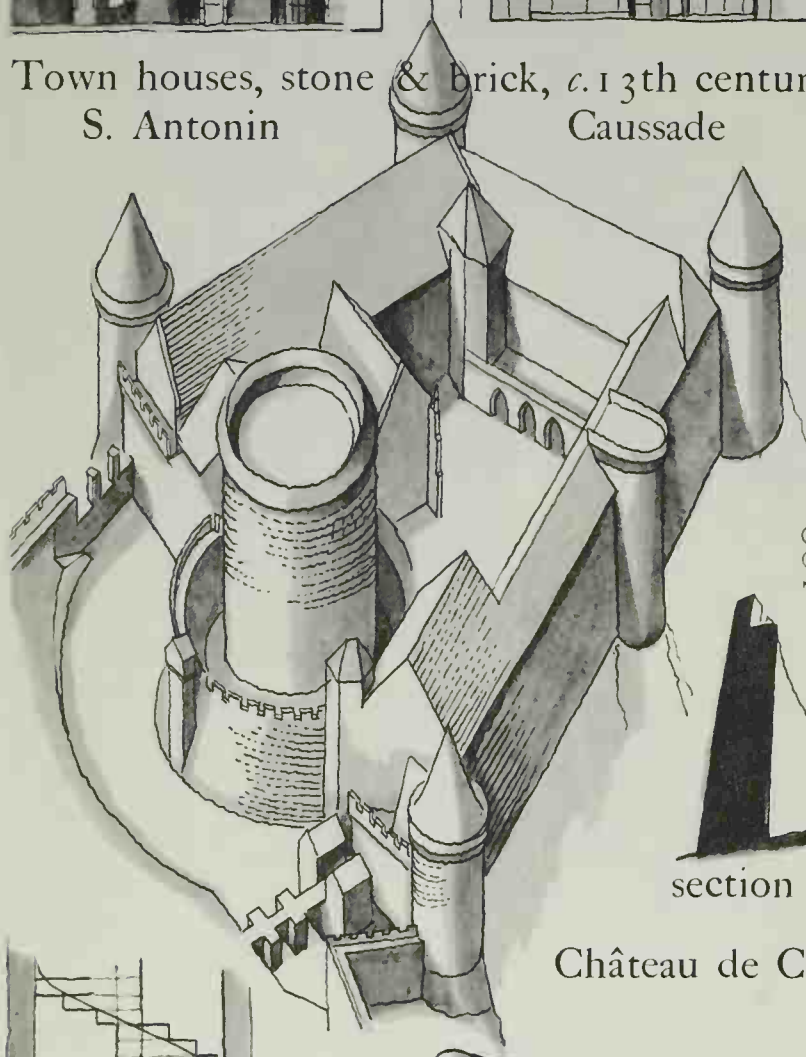


Town houses, stone & brick, *c.* 13th century
S. Antonin — Caussade

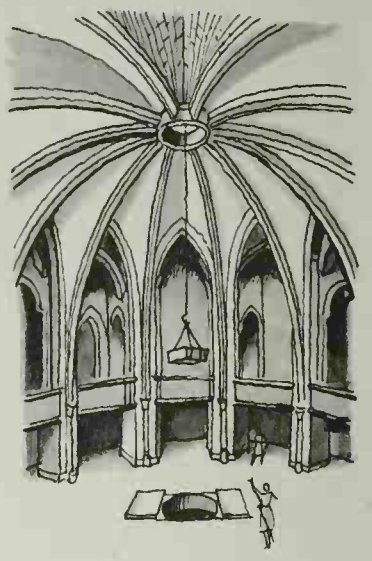




Town houses, half-timbered, *c.* 13th century
Châteaudun — Rouen

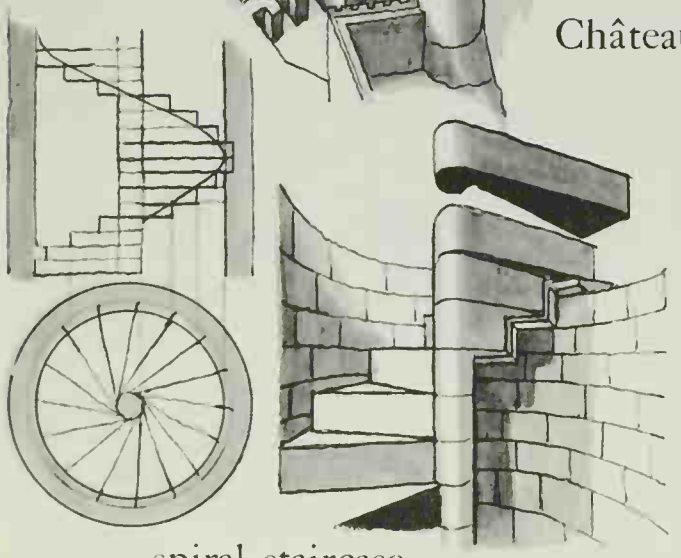


main hall

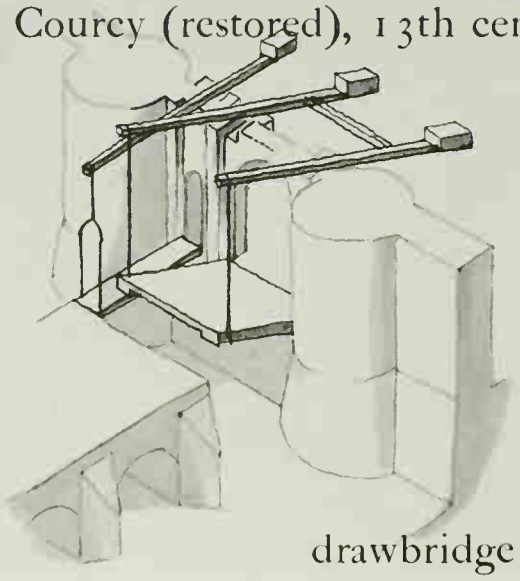


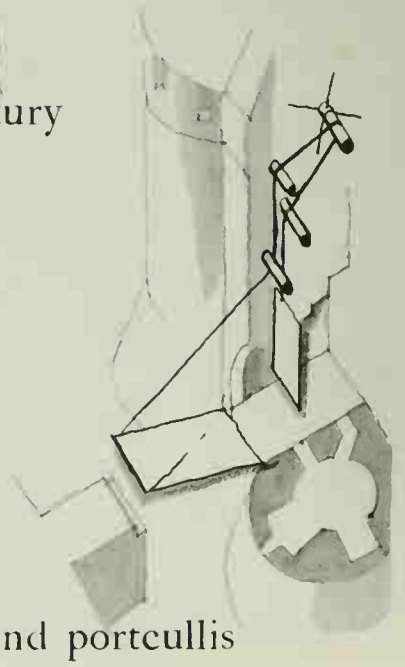
section of donjon or keep

Château de Courcy (restored), 13th century



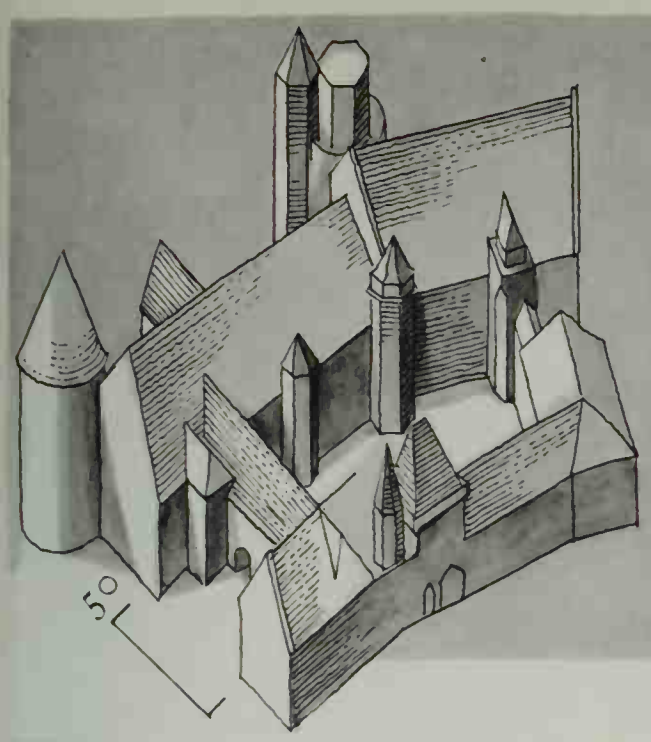
spiral staircase

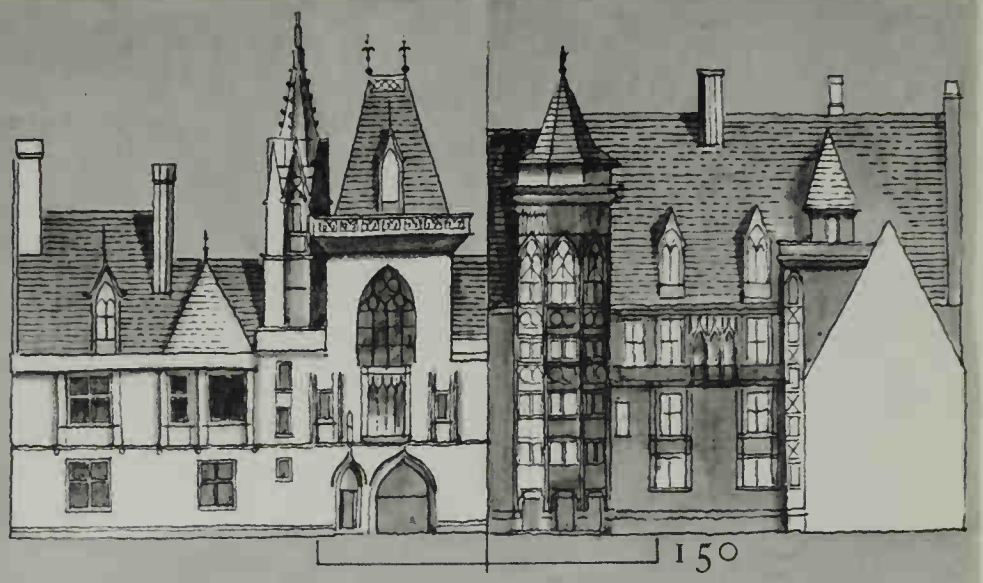




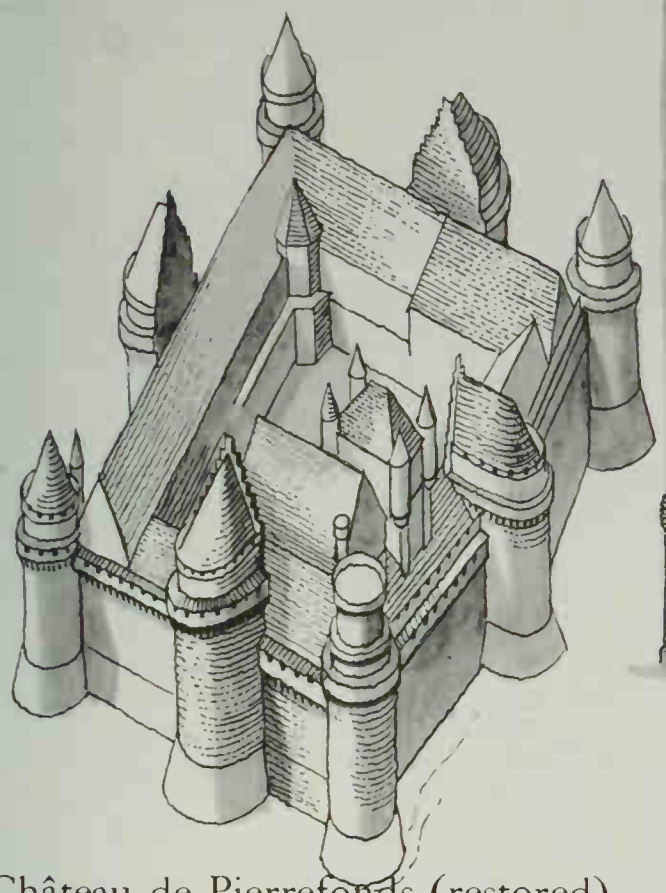
drawbridge and portcullis

FRANCE, CASTLES & HOUSES

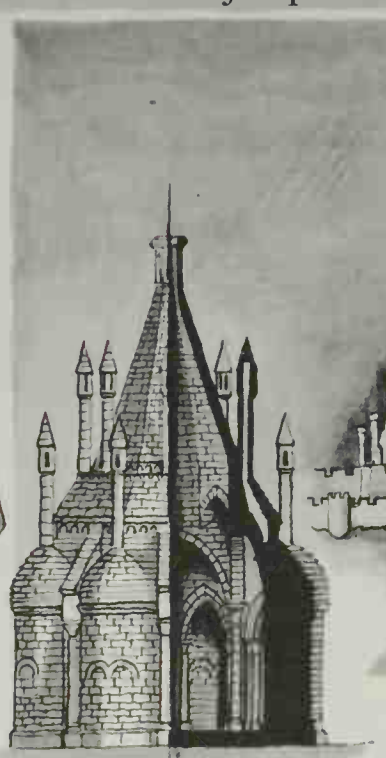




The house of Jacques Cœur, Bourges, 1443

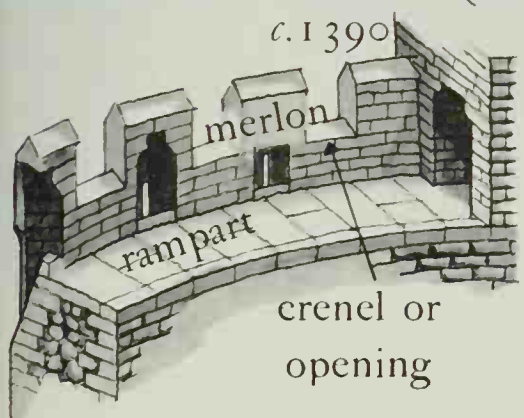


Château de Pierrefonds (restored), *c.*1390

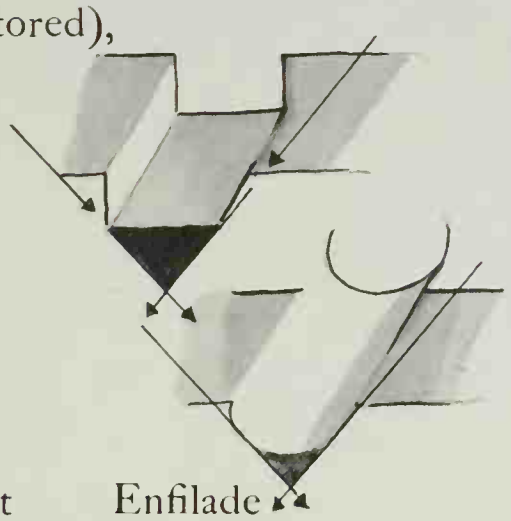


kitchen

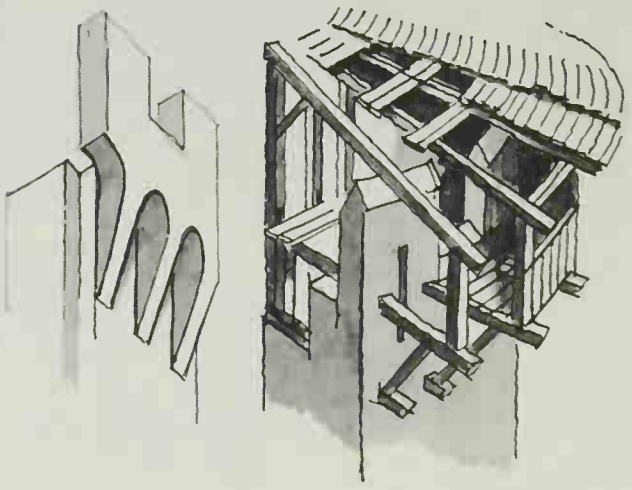
Château de Saumur, from *Les très riches heures du Duc de Berry*, by Pol de Limbourg, *c.*1409-1416



crenellation or embattlement



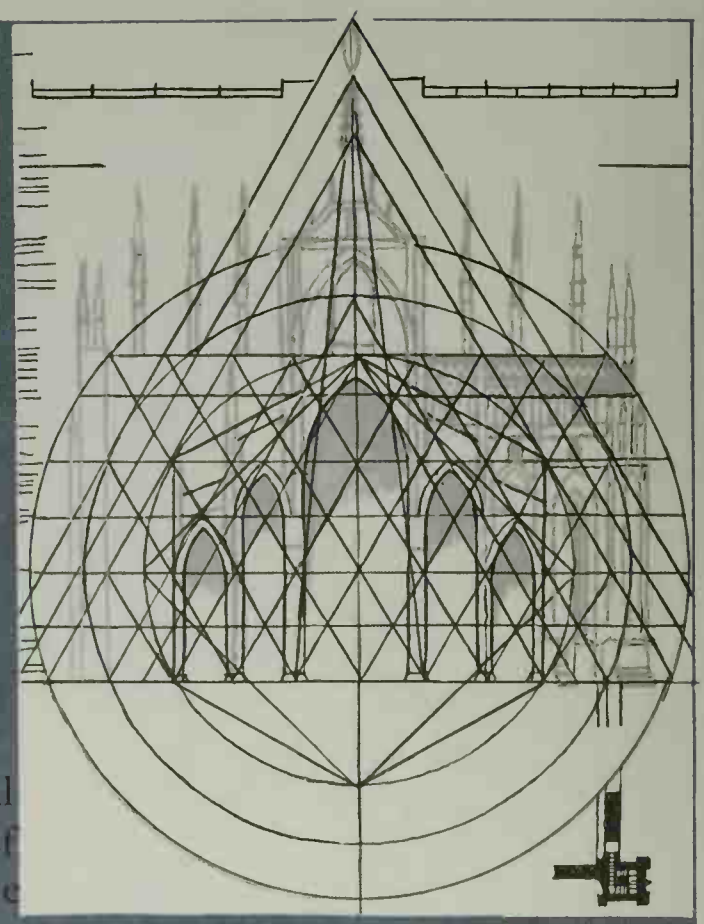
Enfilade



Machicolation, wooden hoarding

GOTHIC

NORTH ITALY



Milan Cathedral,
1385-1485,
built by German, French & Italian master-masons. The sectional diagram from Caesare Cesariano's edition of 'Vitruvius' (Como, 1521) is based on a design made in 1391 to establish the heights of the nave and aisles

Palazzo Loredan,
12th century

Palazzo Pisani,
14th century

Details of Venetian palaces on the Grand Canal

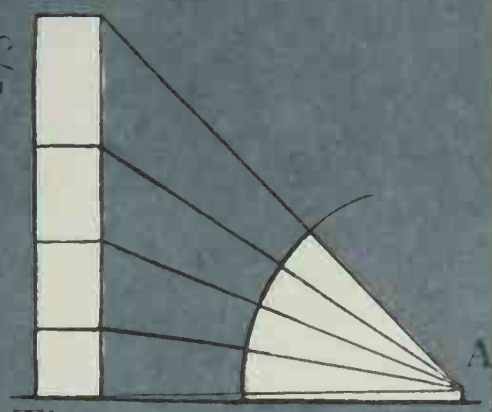
*c.*1309 onwards — *c.*1423-38

The Palace of the Doges, Venice

ITALY

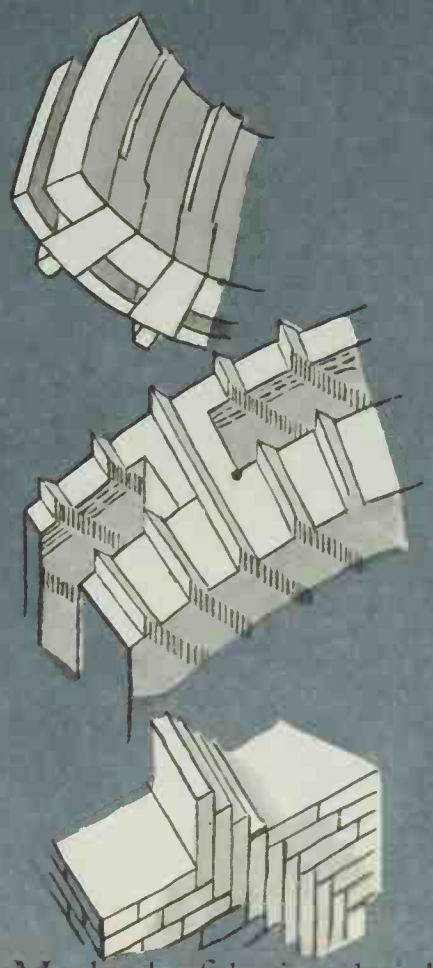
CENTRAL ITALY

Florence Cathedral,
1296-1462 (plan p.91),
begun by Arnolfo di Gambio,
and continued by Giotto,
master of works 1334-37,
Andrea Pisano and Talenti,
who enlarged the first plan.
Choir and 3 apses built
1350-1421.
The dome constructed by
Brunelleschi 1420-1437,
in brick without centering.



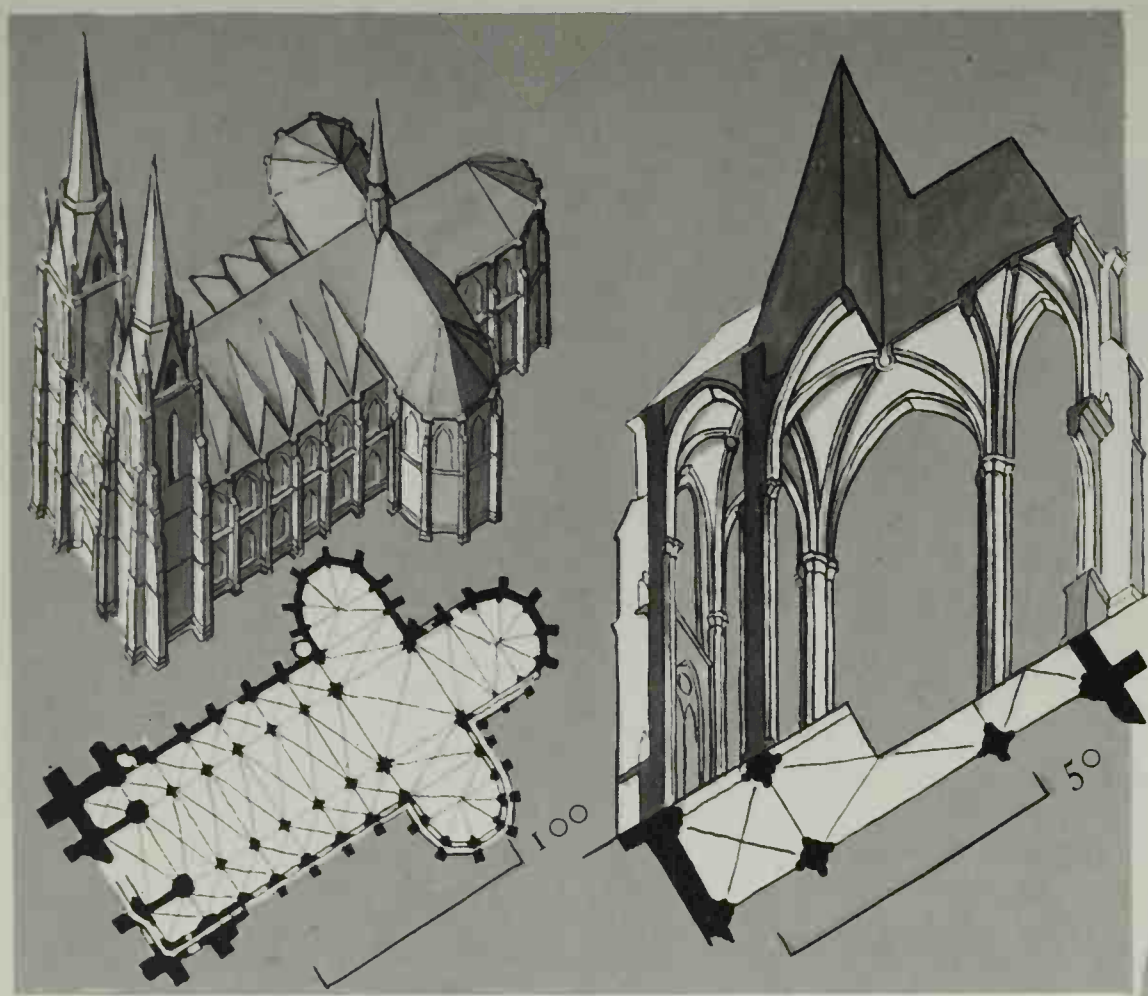
The storeys appear equal
to a spectator at A

Campanile, Florence, 1334-1387,
designed by Giotto

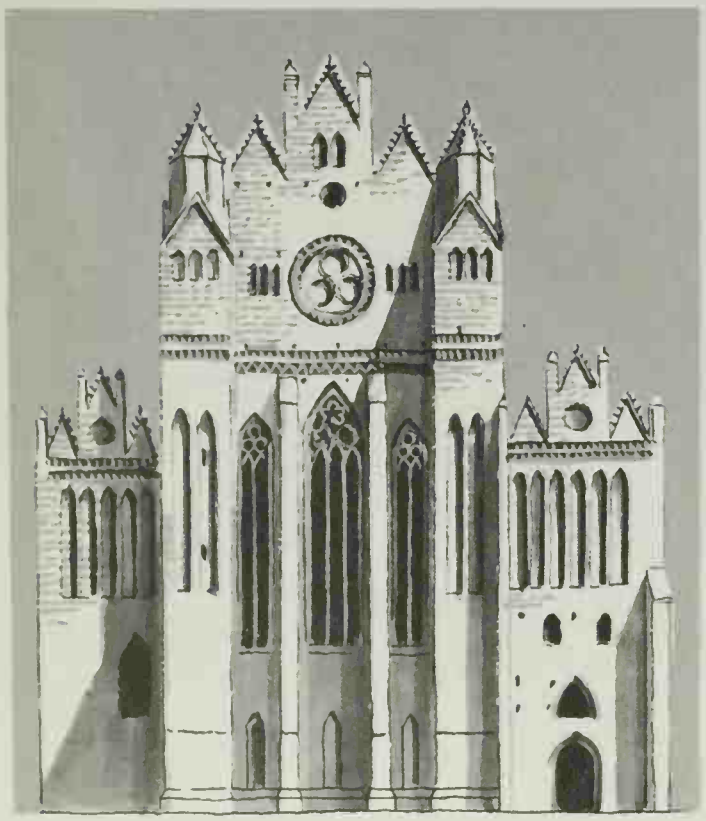


Method of laying bricks

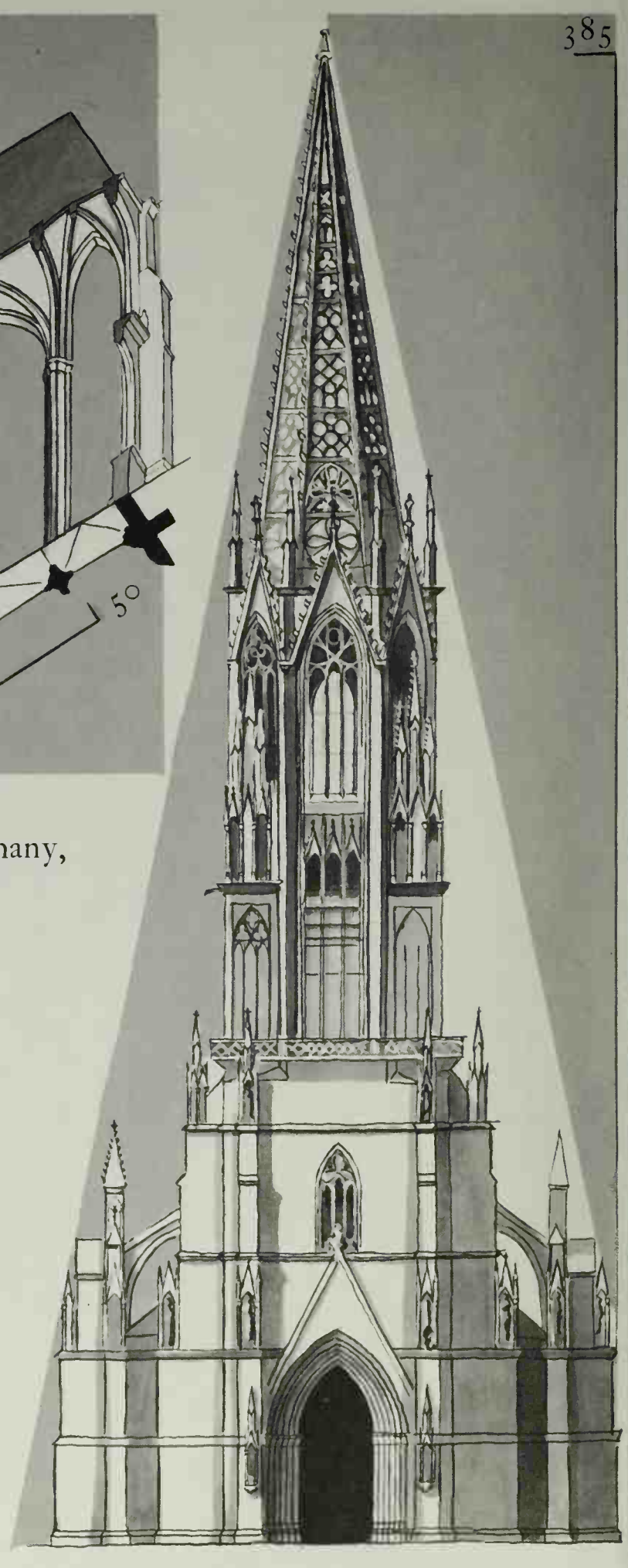
GOTHIC



S. Elizabeth, Marburg, *c.*1233-1283:
one of the many 'Hall' churches in North Germany,
having the nave and aisles of equal height

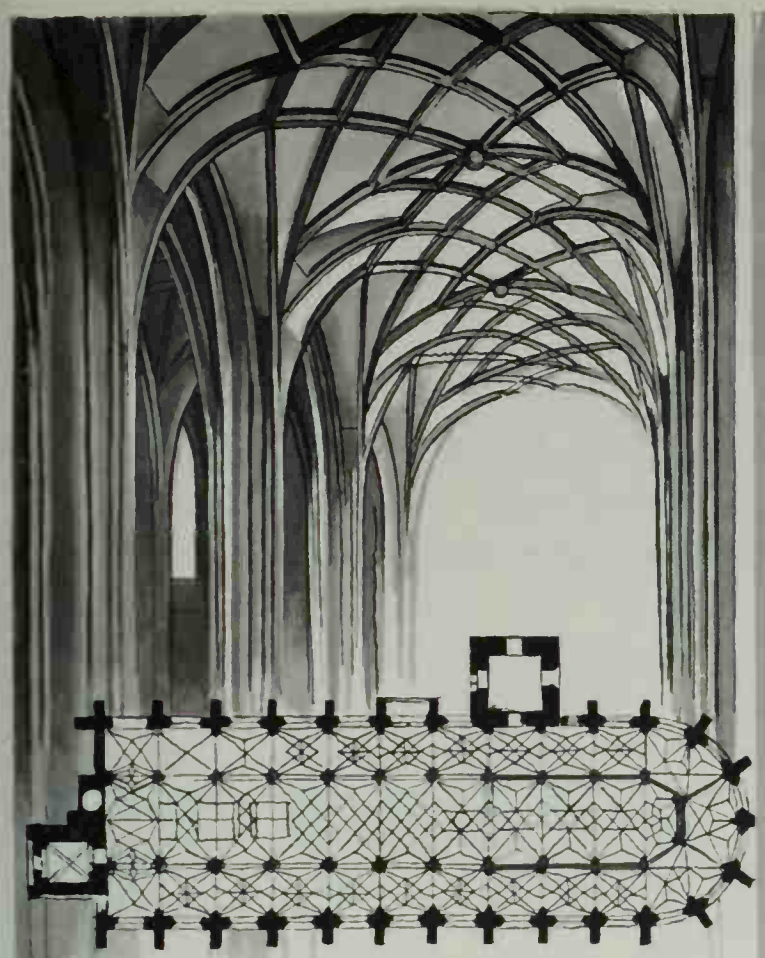


Chorin Abbey, *c.*1273-1334:
west front

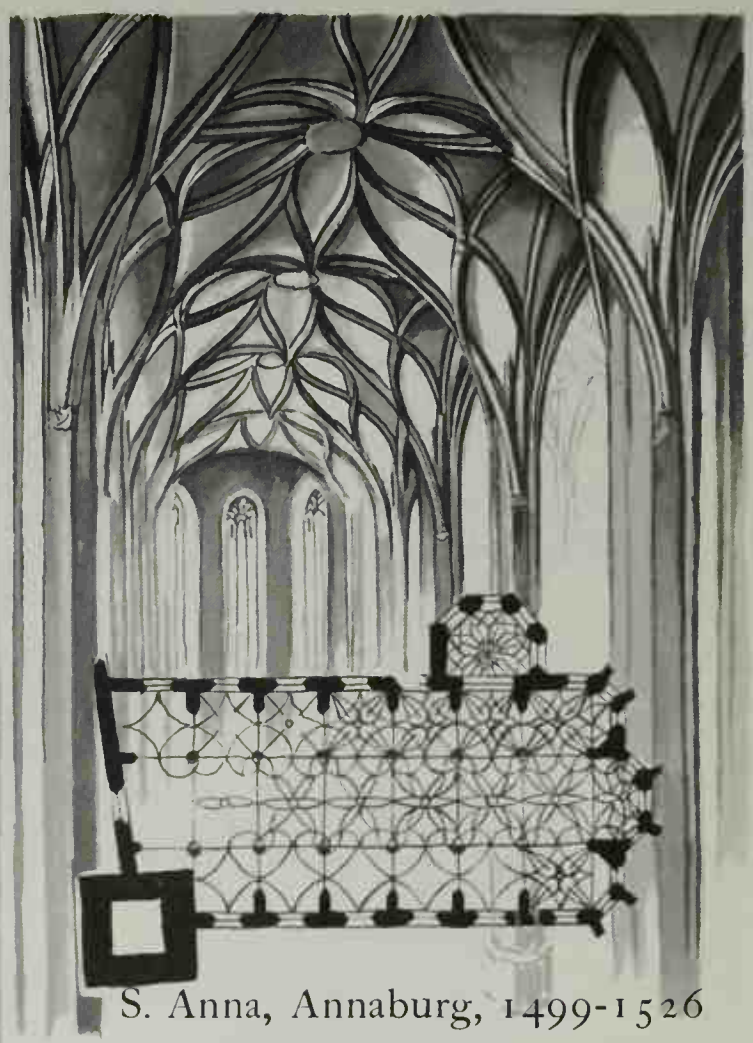


Freiburg Cathedral, *c.*1268-1288:
west front

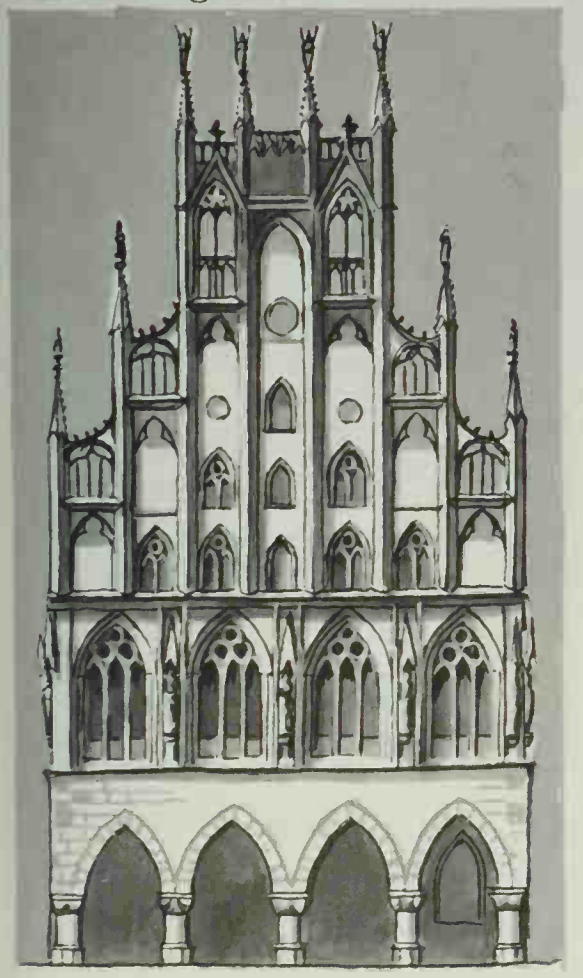
GERMANY



S. George, Dinkelsbühl, 1448-1492

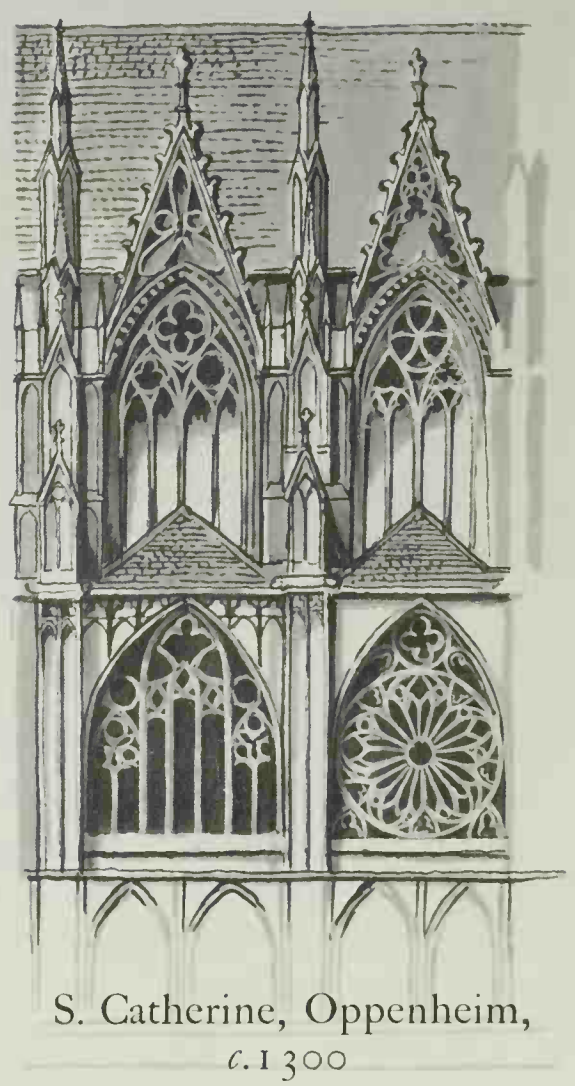


S. Anna, Annaburg, 1499-1526



Town hall, Münster,
late 14th century

plan & elevation
of a pinnacle after
Roriczer German
master-mason, *c.* 1492



S. Catherine, Oppenheim,
c. 1300

RENAISSANCE BAROQUE

1400 — 1500 — 1600

The Turks take Constantinople 1453 & block trade with the Orient: this leads to maritime discoveries

Spain — Spain united 1497 — 1519—Charles V—1556—Philip II of Spain—1598 — The Empire of and his son

Italy — Florence: the Renaissance — Rome: temporal power of the Popes — Venice: trade lost

France — Franco-Spanish rivalry in Italy 1515—Francis I—1547 — Italian influence

Holland — 1568 Revolt of the

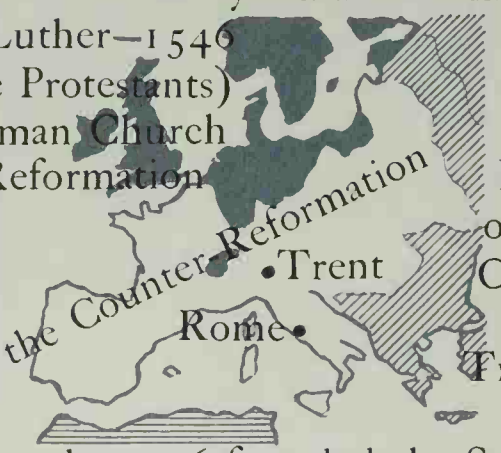
England — 1485—Henry VII—1509—Henry VIII—1547 — 1558—Elizabeth I—1603

War of the Roses — Italian influence — Mary I marries Philip II of Spain

Germany — head of some 300 states — 1483–Martin Luther–1546

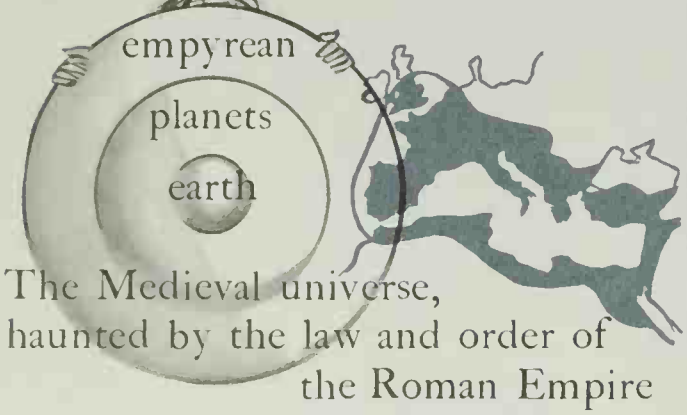
Protests (hence Protestants) against the Roman Church leads to the Reformation

Invention of printing brought the revival and spread of Latin and Greek texts

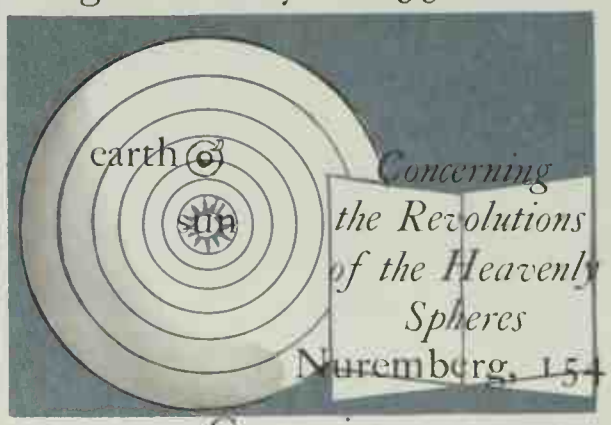


Internal Reformation of the Roman Church at the Council of Trent 1545-63, aided by

1499–S. Ignatius Loyola–1556 founded the Society of Jesus



The Medieval universe, haunted by the law and order of the Roman Empire



1473——Copernicus——1547

1564–Bruno–1600

THE RENAISSANCE

The Renaissance (Florence) — High Renaissance (Rome) — Mannerism

1400 — 1500 — 1600

Renaissance churches were centralized and designed on the drawing-board.

They were inspired by classical architecture, as interpreted by Vitruvius (above all, by Roman temples, arches, domes & the Five Orders (pp.116-117)), & obeyed the canon of the Divine Proportions (pp.118-119).

The increasingly dramatic movements of High Renaissance and Mannerist buildings became, especially in the 'theatrical' churches of the Counter-Reformation, an interplay of forces. (This required the drawing of

INTRODUCTION

1614—30 Years' War—1648 Conflict for colonies and overseas trade

to new Atlantic seaports. Domination of Spain in Italy ends 1710

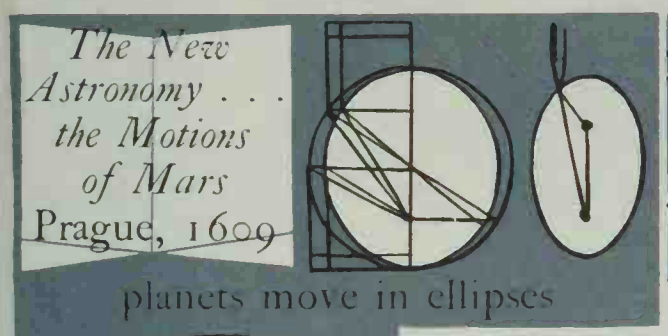
1610-Age of the Cardinals-1643-Ascension of France: Louis XIV—1715—Louis XV—1774

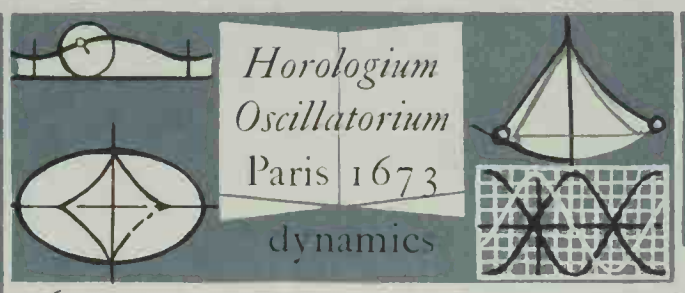
Netherlands from Spain 1648 Republic of the United Provinces

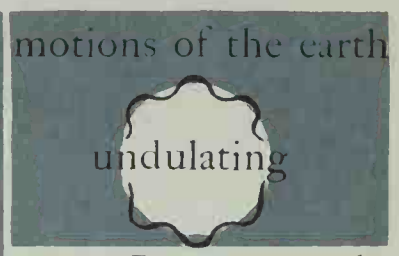
James I—1625-Charles I—1649-1660-Charles II—1685-89 1702-Anne-14-George I-1727

Divine Right of Kings Commonwealth James II Colonial Expansion

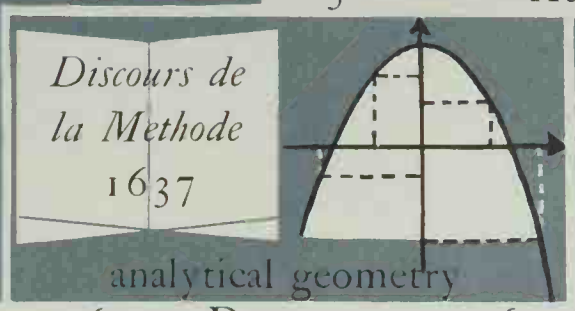
Impoverished by the 30 Years' War Kingdom of Prussia 1701 Frederick the Great 1740-85

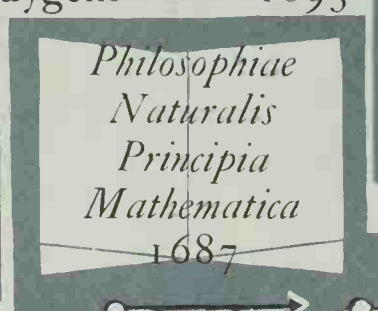


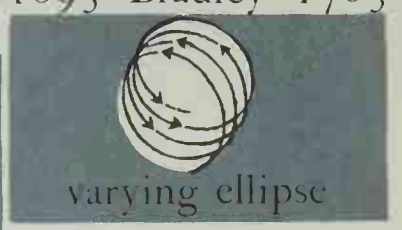




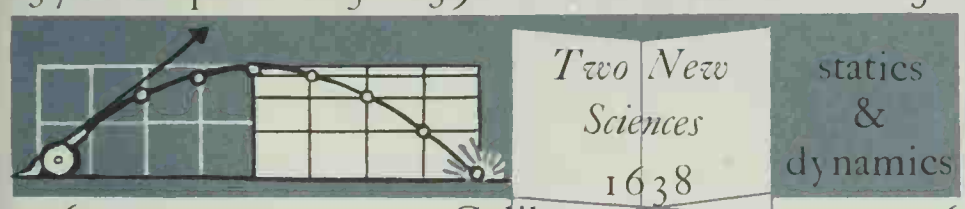
1571—Kepler—1630 1630—Huygens—1695 1693-Bradley-1763

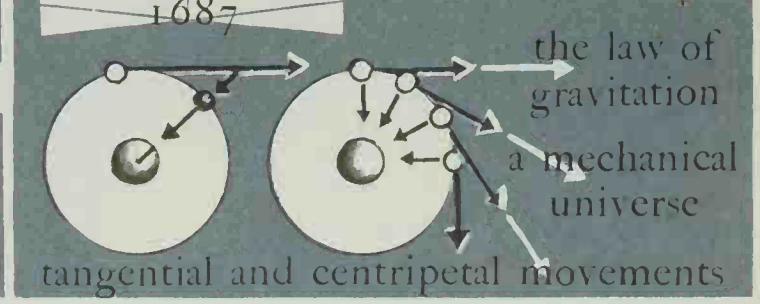






1596—Descartes—1650 1707—Euler—1783





1564—Galileo—1642 1642—Newton—1727

THE BAROQUE

Baroque 1600

three-dimensional elevations and curved details by means of projective geometry, which had been developed by the new science of dynamics.)

This Baroque style was finally resolved into the lighter curves of the Rococo.

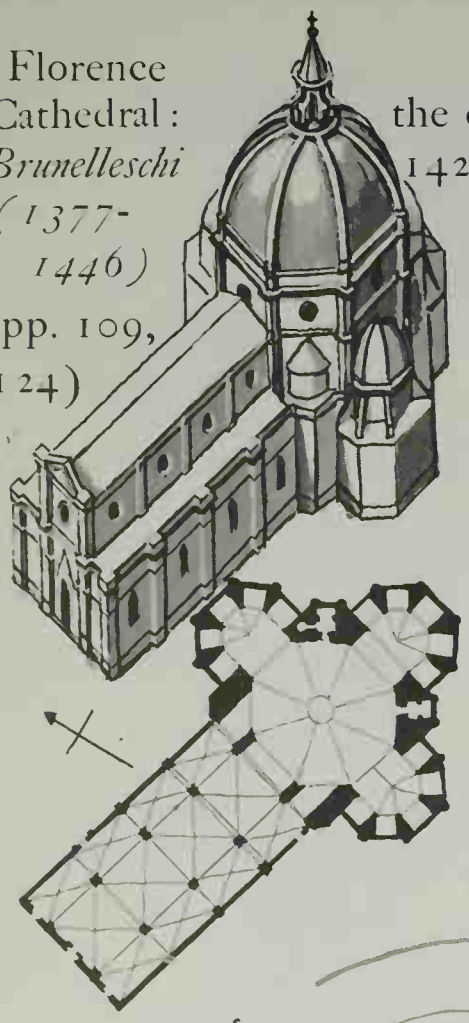
Rococo 1700 1750

The architecture of each European country was a reaction to that of Italy, modified by its own native characteristics.

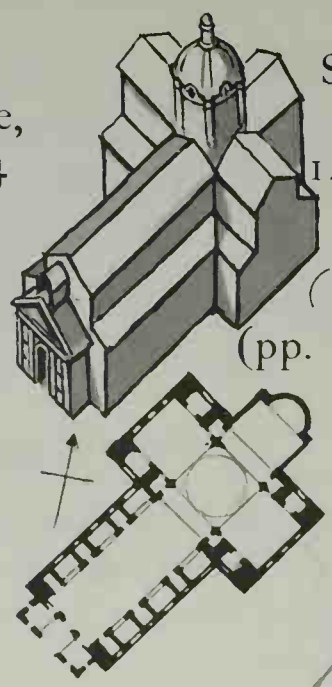
France (pp.130-133), Germany & Austria (pp.134-135), Spain (pp.136-137), England (pp.138-159).

RENAISSANCE - BAROQUE

Florence Cathedral: the dome, 1420-34 *Brunelleschi (1377-1446)* (pp. 109, 124)



S. Andrea, Mantua, 1472-1512 *Alberti (1404-72)* (pp. 120, 122)



Pope Julius II (1503-13) had the old basilican church pulled down (p.70), and successive plans were made for the new church:

1 *Bramante (1444-1514)* 1506

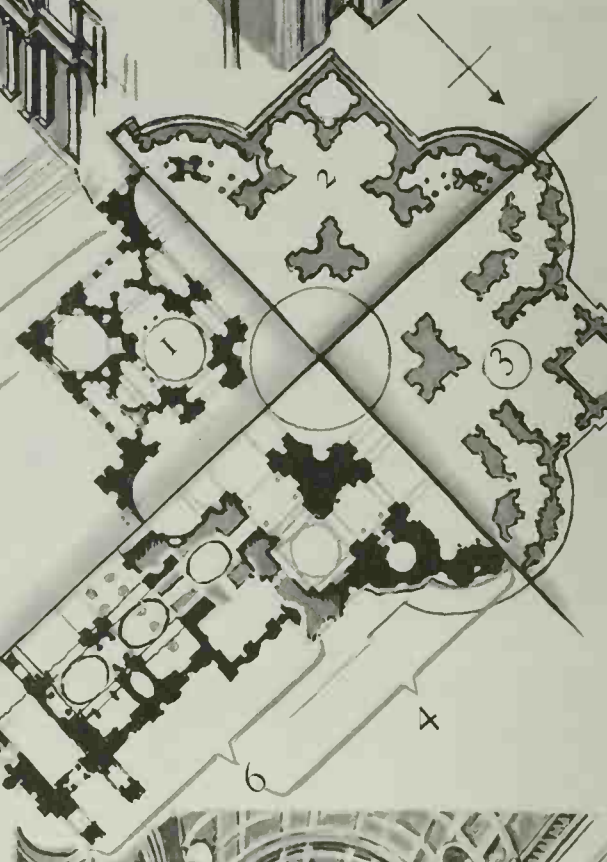
2 *Raphael (1483-1520)* 1515-20

3 *Sangallo the Younger (1485-1546)* 1539

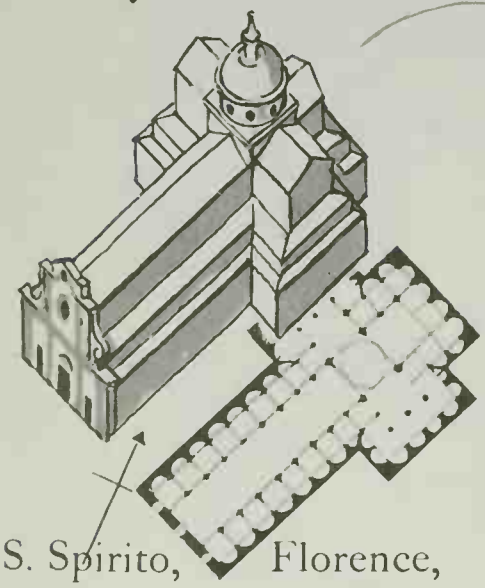
4 *Michelangelo (1474-1564)* 1546-64 also designed the dome, completed 1585-90 by *Giacomo della Porta (1541-1604)* and *Domenico Fontana (1543-1607)*;

5 side cupolas added 1564, by *Vignola (1507-73)*

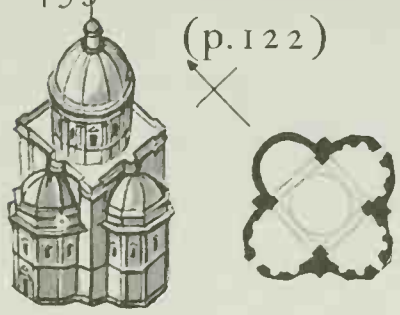
6 *Carlo Maderna (1556-1629)* lengthened nave to form a Latin cross & added the façade 1606-12



St Peter's, Rome, 1506-1612 (pp. 93, 124)



S. Spirito, Florence, 1435 *Brunelleschi* (p.122)



S. Maria della Consolazione, 1508, *Bramante* & *Cola di Caprarola*

PLANS & ELEVATIONS

500

plans and elevations
to the same scale

The Gesù,
Rome,
1568-75
Vignola
(1507-73)
(pp. 120,
122)

S. Maria della Salute,
Venice, 1632
Longhena (1604-75)

Piazza, St Peter's, Rome, 1655-67
Bernini (1589-1680)

Vierzehnheiligen,
S. Germany,
1744-72 *Neumann*
(1687-1753)
(p. 137)

The
Escurial,
near
Madrid,
1559-84

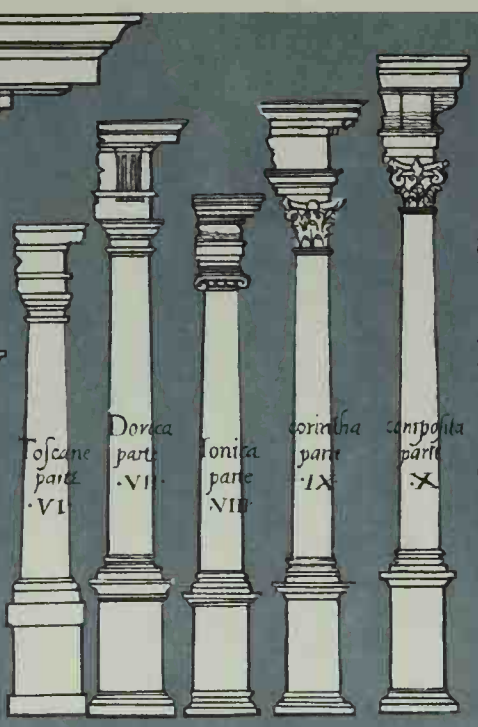
Juan
de Herrara
(c.1530-97)
(p. 138)

The Dome of the Invalides, Paris,
1693-1706 *J. H. Mansart*
(1646-1708) (pp. 125, 131)

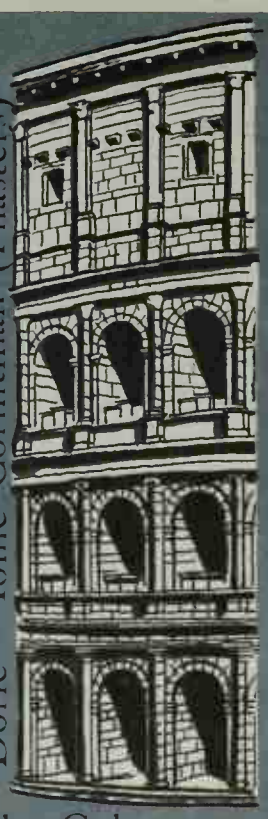
St Paul's Cathedral, London,
1675-1710
Sir Christopher Wren (1631-1723)
(pp. 144-145)

Karlskirch,
Vienna,
1716-29
J. B. Fischer
von Erlach
(1656-1725)

RENAISSANCE - BAROQUE

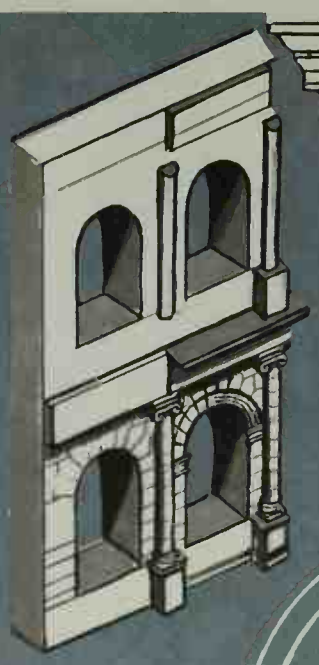


The Five Orders, after *Serlio*, 1540



Doric Ionic Corinthian (Pilasters)

The Colosseum, Rome, A.D. 70-82

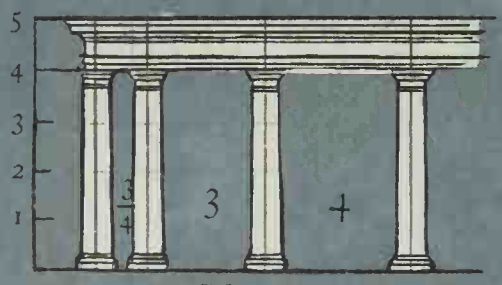


Superimposition of Orders:

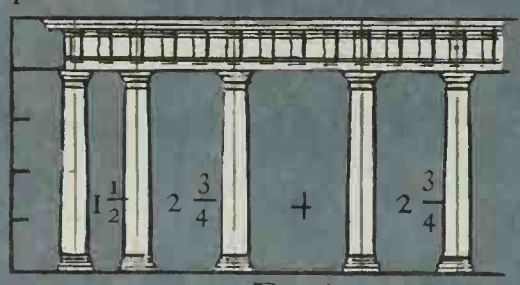
Ionic

Composite

Corinthian

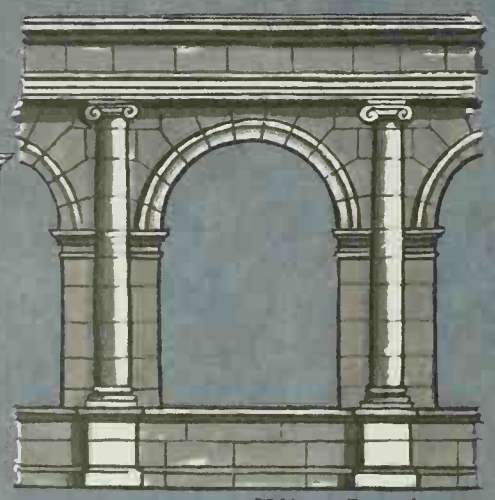


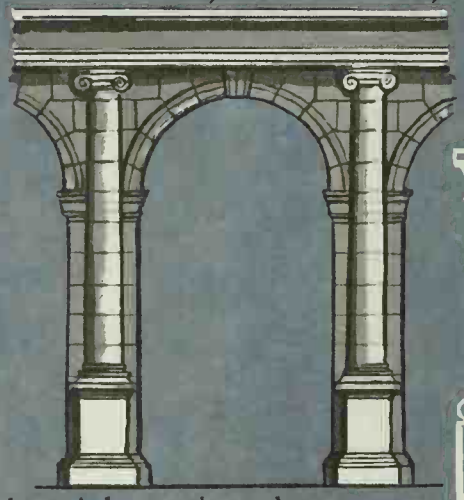
Tuscan



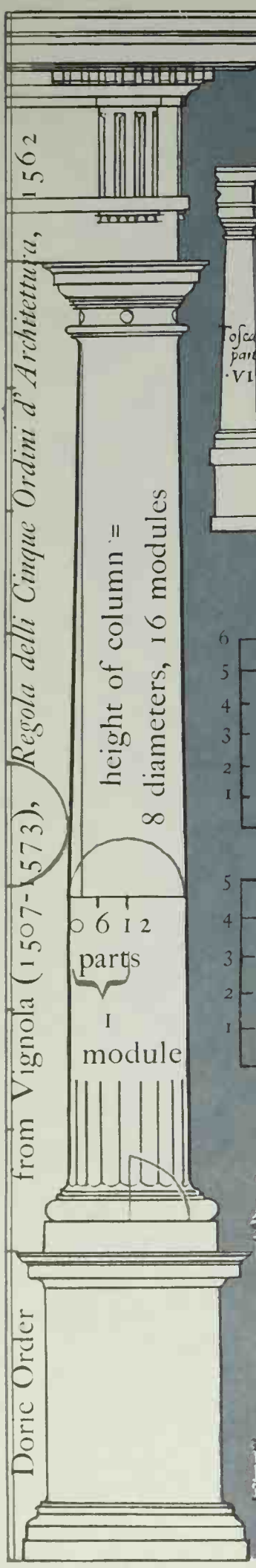
Doric

The intercolumnations of each Order, after *Gibbs*, 1732





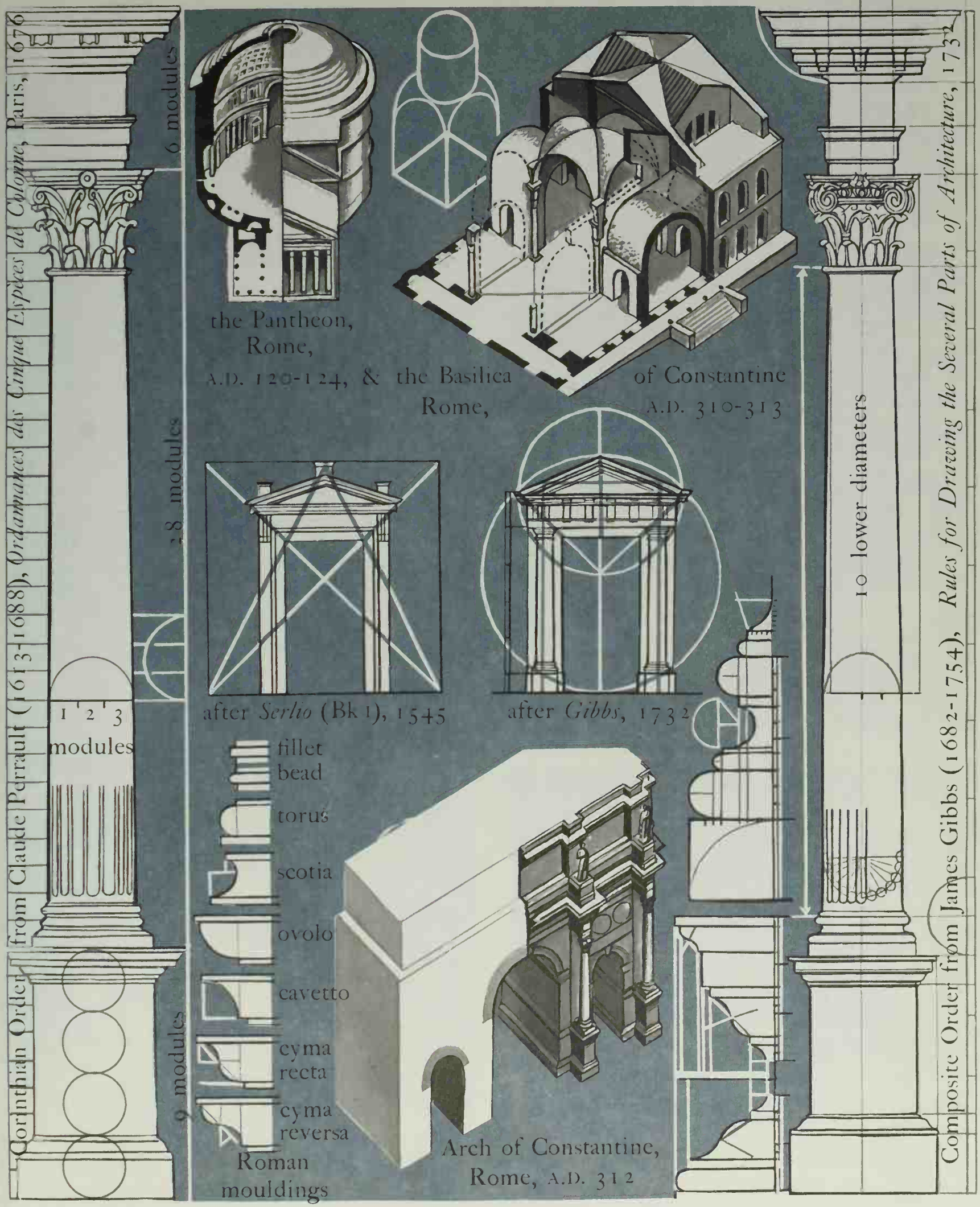
The Ionic arch with pedestal: the Colosseum after *Palladio*, 1570



Doric Order from Vignola (1507-1573), *Regola delli Cinque Ordini d'Architettura*, 1562

Ionic Order from Andrea Palladio (1508-1580), *I Quattro Libri dell' Architettura*, Venice, 1570

ROMAN SOURCES AND RULES

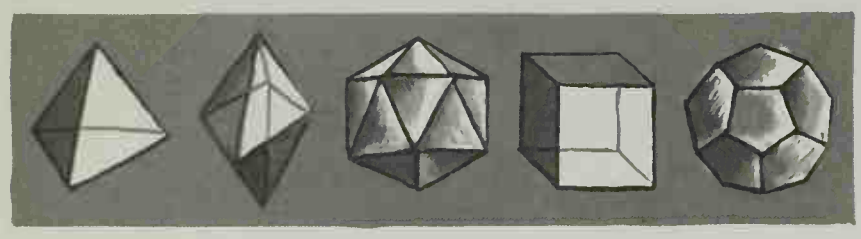


RENAISSANCE - BAROQUE

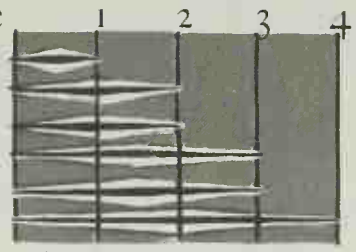
Sources of Italian architectural theory:
1. The study of Roman buildings.
2. The Platonic-Aristotelian description of God and the Universe as a perfect circle.
3. The Pythagorean, and Medieval, idea of Man as the microcosm of the Universe (the macrocosm). 4. The linking of Geometry and Music, two of the Seven Liberal Arts: 'Geometry makes visible the musical consonances' (Boethius, *De Musica*, *c.*500).

In Florence Cosimo de Medici (1389-1462) founded the Platonic Academy.

The Timaeus Plato 427-347 B.C. gives an account of the creation and geometrical form of the universe. He represents the four basic elements and the cosmos as:

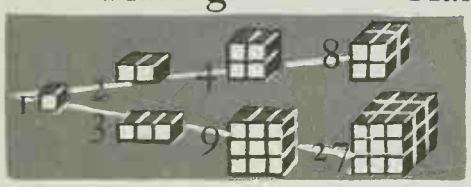


these 'Platonic' bodies are the 5 regular solids. The elements of the cosmos, as well as its soul-substance & its motion, were created proportionate to musical ratios based on Pythagoras (582-*c.*507 B.C.) He 'regarded numbers as the elements of all things and the whole heaven as a numerical scale' (Aristotle), & found that tones could be measured by striking cords proportionate in length.



1:2 octave
2:3 fifth
3:4 fourth

Plato gives the 'Harmonic' scale as:

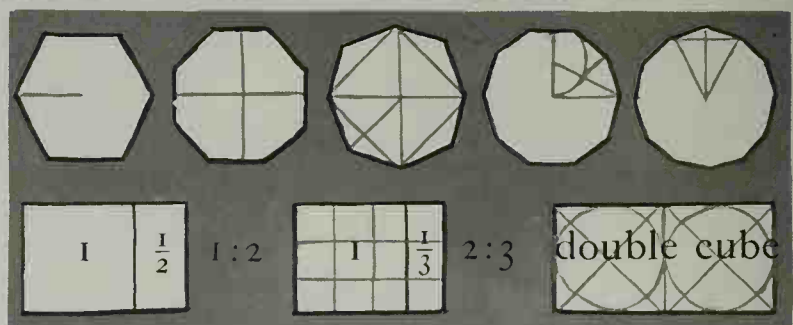


which contain the musical consonances 1:2, 2:3, 3:4.

For Renaissance architect-theorists, churches based upon these axioms, would be microcosms of the universe of God: '. . . the little temples we make ought to resemble this very great one' (Palladio).

Marcus Vitruvius Pollio
The Ten Books on Architecture
Roman architect & engineer 1st century B.C.

Vitruvius (edited by Fra Giocondo) Venice, 1511

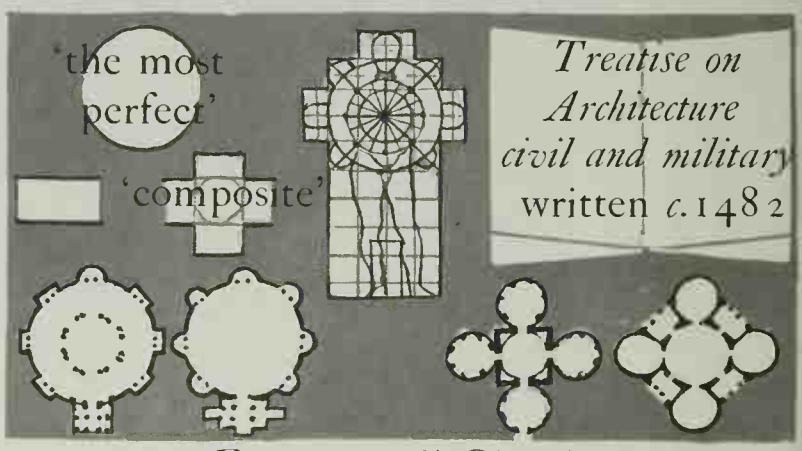


Ideal plans for churches (VII, 4)

'Of all these numbers. . . (1:2 octave, *diapason*; 2:3 fifth, *sesquialtera*; 3:4 fourth, *diatessaron*) . . . the architects make very convenient use' (IX, 5)

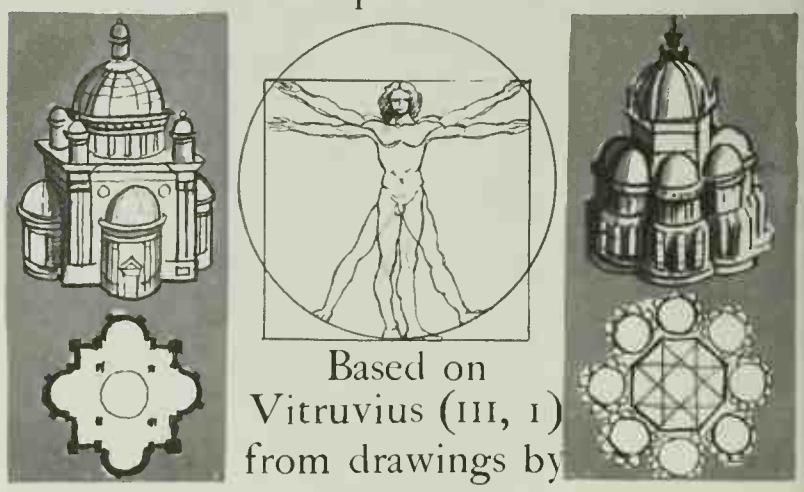
Ten Books on Architecture Florence 1485 England 1726

1404—— Leon Battista Alberti ——1472
Florentine architect and theorist



Treatise on Architecture civil and military written *c.*1482

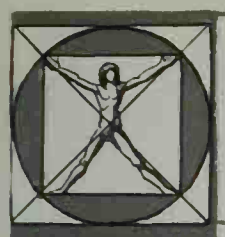
1439—— Francesco di Giorgio ——1502
Sienese sculptor and architect



Based on Vitruvius (III, 1) from drawings by

1452—— Leonardo da Vinci ——1519

THE DIVINE PROPORTIONS



Vitruvius (edited by Cesarino), Como, 1521

Vitruvius (edited by Barbaro, illustrated by Palladio), Venice, 1556

Architecture de Vitruve ou Art de bien bâtir mis en français Jean Martin 1546

Vitruvius First English translation 1692

Plans from the fifth book 1547

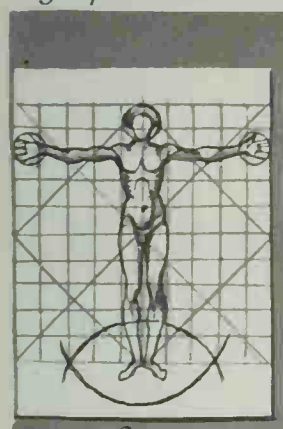
Seven Books on Architecture 1537-1575

1475——Sebastiano Serlio——1554
Born Bologna. Architect, worked in France

The Five Orders of Architecture 1562

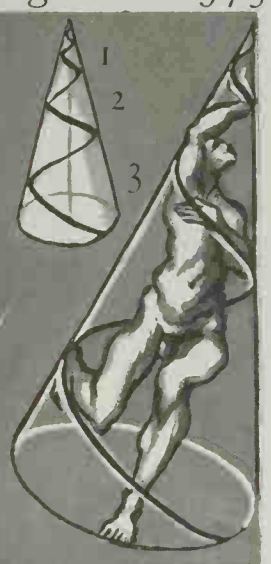
S. Andrea Rone, 1550

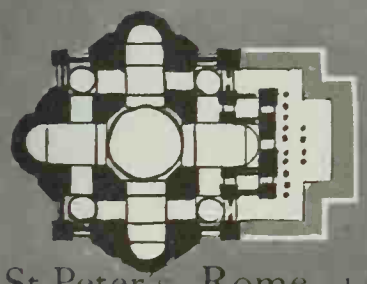
1507—Giacomo Barazzo Da Vignola—1573



from Cesarino's Vitruvius 1521

Michelangelo stated that a figure should be made 'pyramidal, serpent-like and multiplied by one, two and three',





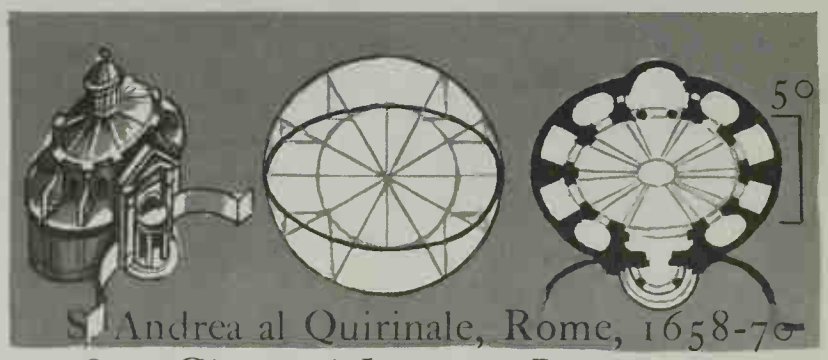
and wrote in a letter: '. . . the architectural members derive from human members'.

St Peter's, Rome, 1506

1475——Michelangelo——1564

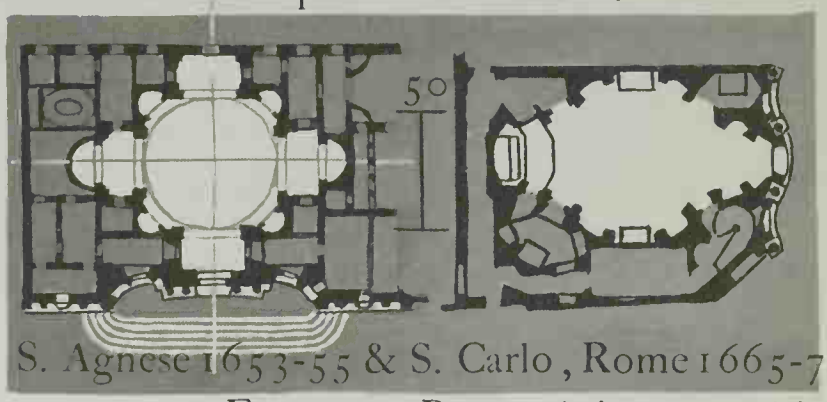
1508—Andrea Palladio (pp.128-9)—1580

In Baroque churches musical ratios were resolved into an orchestration of visual forces comparable to the fugue, & measured by the eye and the mind of the beholder



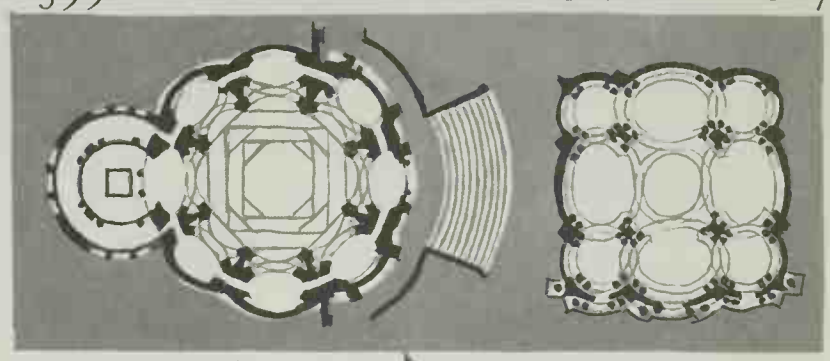
S. Andrea al Quirinale, Rome, 1658-70

1598—Giovanni Lorenzo Bernini—1680
sculptor and architect



S. Agnese 1653-55 & S. Carlo, Rome 1665-7

1599——Francesco Borromini——1667



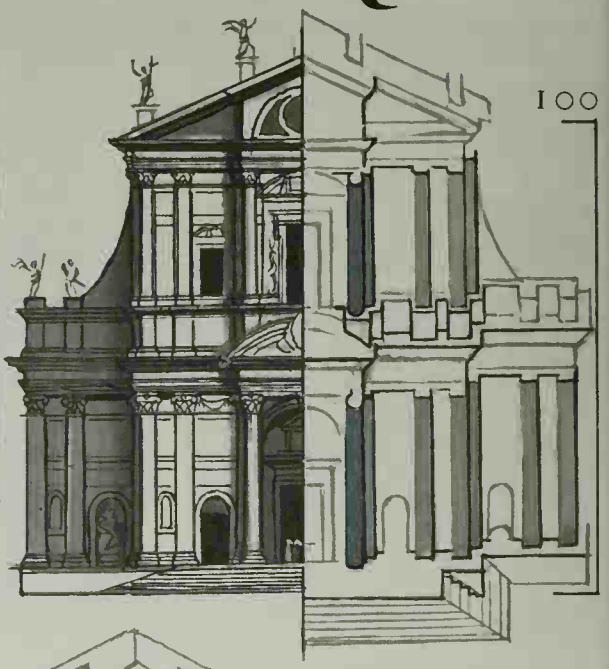
designs from

Dell' Architettura civile Turin 1737

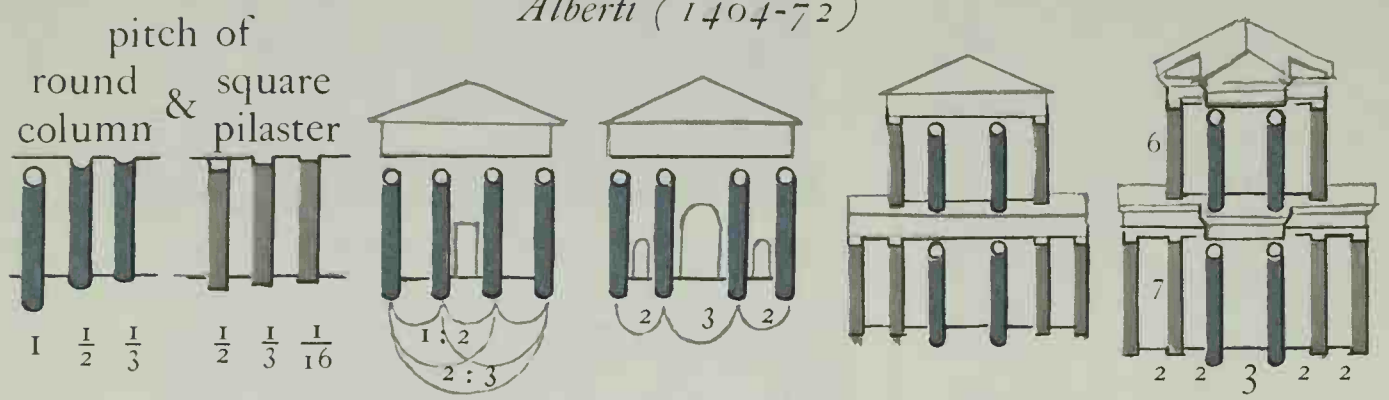
1624——Guarino Guarini——1683
mathematician & architect, mostly at Turin

RENAISSANCE - BAROQUE

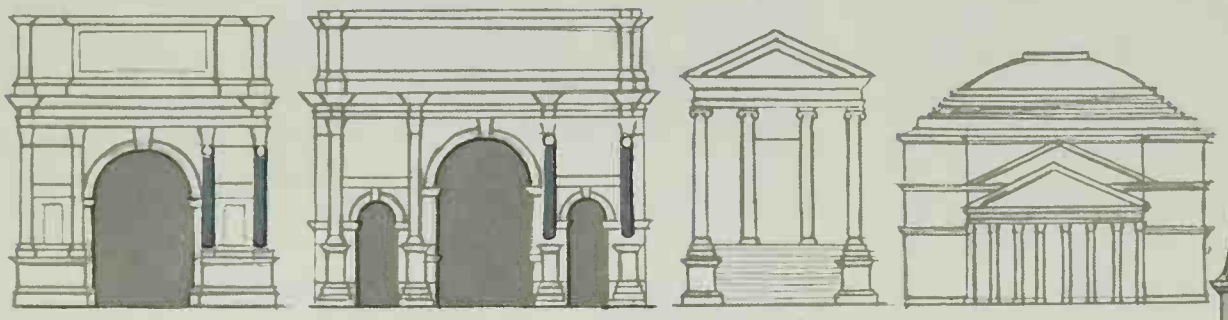
Baptistery, S. Miniato, S. Maria Novella, Florence, *c.*1456
Alberti (1404-72)



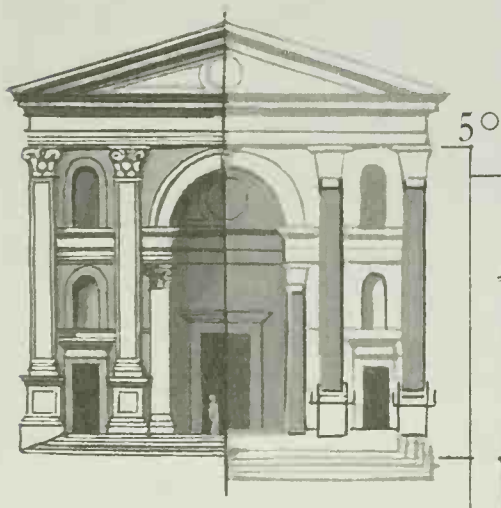
The Gesù, Rome, 1568-75
Vignola (1507-73)
(p.122)



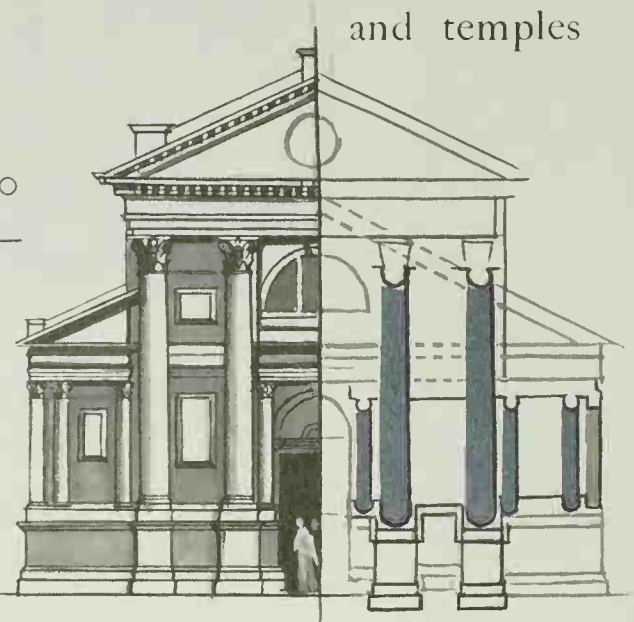
Arrangement & permutations of columns & pilasters to compose a visual 'overture'



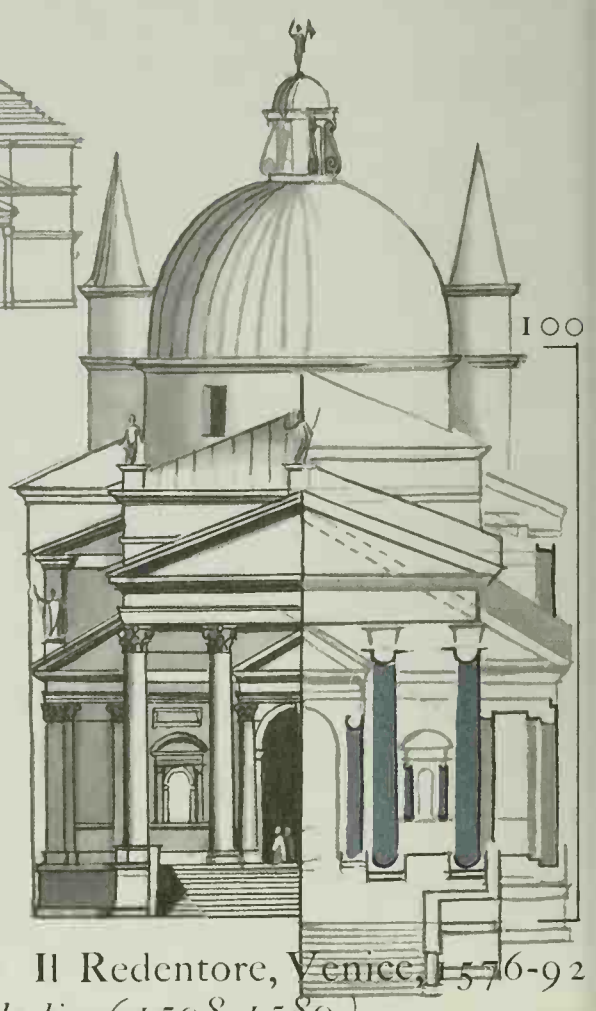
Roman arches and temples



S. Andrea, Mantua, 1470
Alberti (p.122)



S. Francesco della Vigna, Venice, 1562
Andrea Palladio (1508-1580)



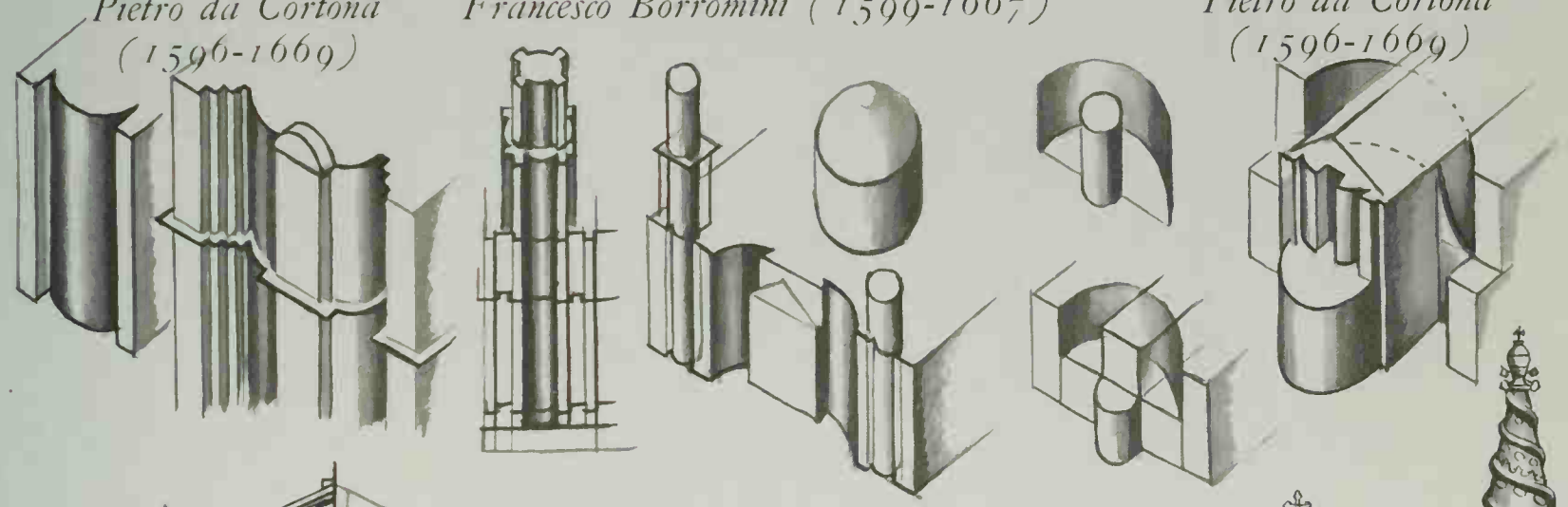
Il Redentore, Venice, 1576-92

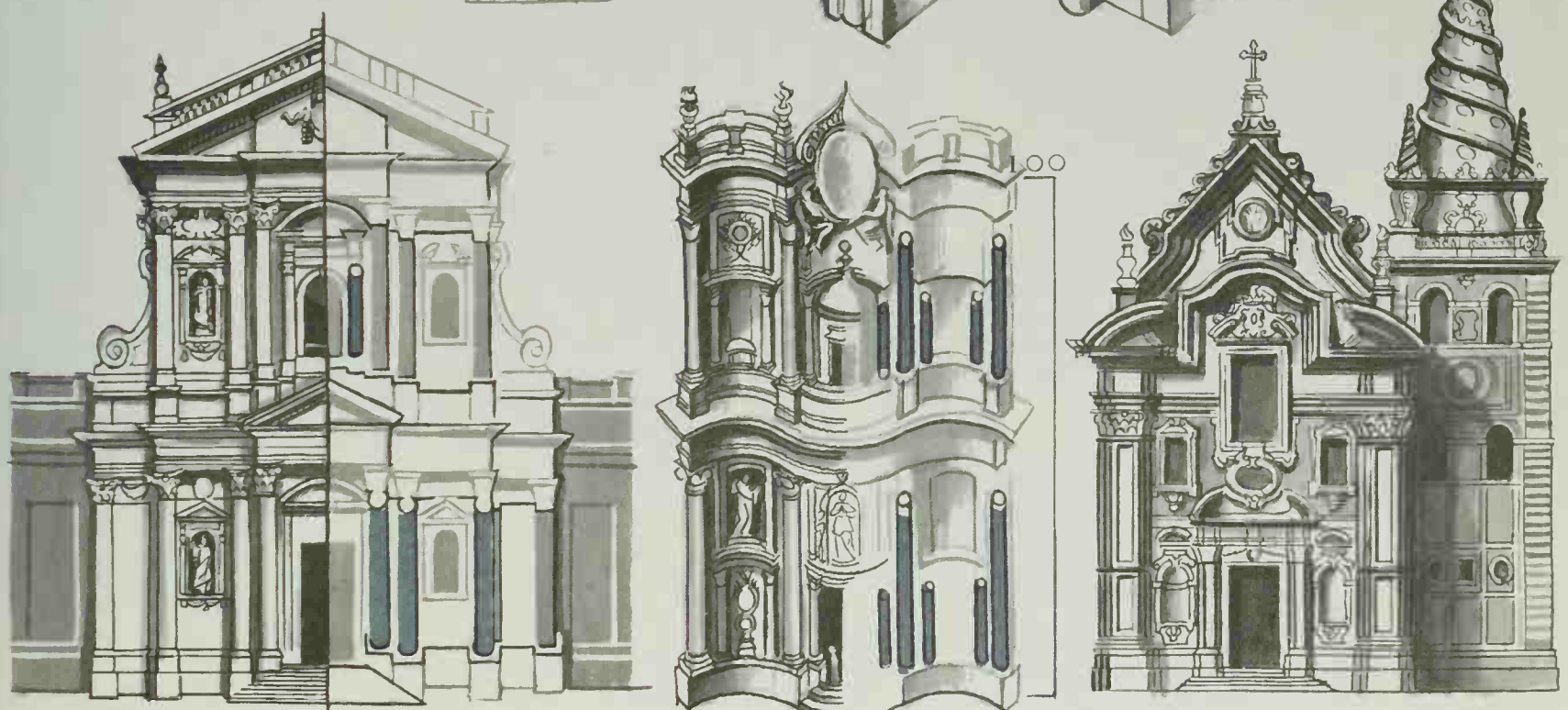
ITALY, CHURCH FACADES

SS. Martina e Luca, Rome, 1635-50
Pietro da Cortona (1596-1669)

S. Agnese in Piazza Navona, Rome, 1653-55
Francesco Borromini (1599-1667)

S. Maria della Pace, Rome, 1656-57
Pietro da Cortona (1596-1669)



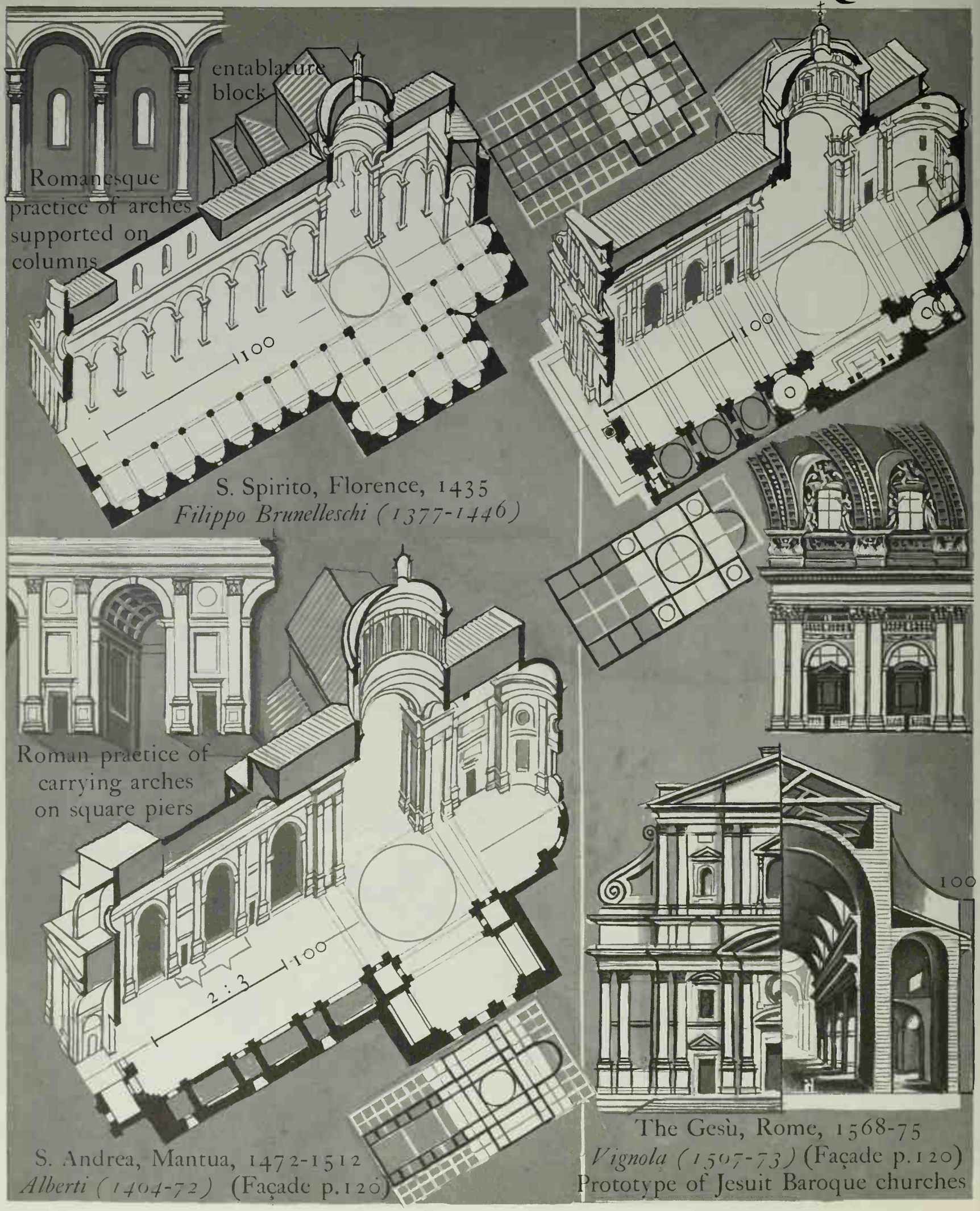


S. Susanna, Rome, 1597-1603
Carlo Maderna (1556-1629)

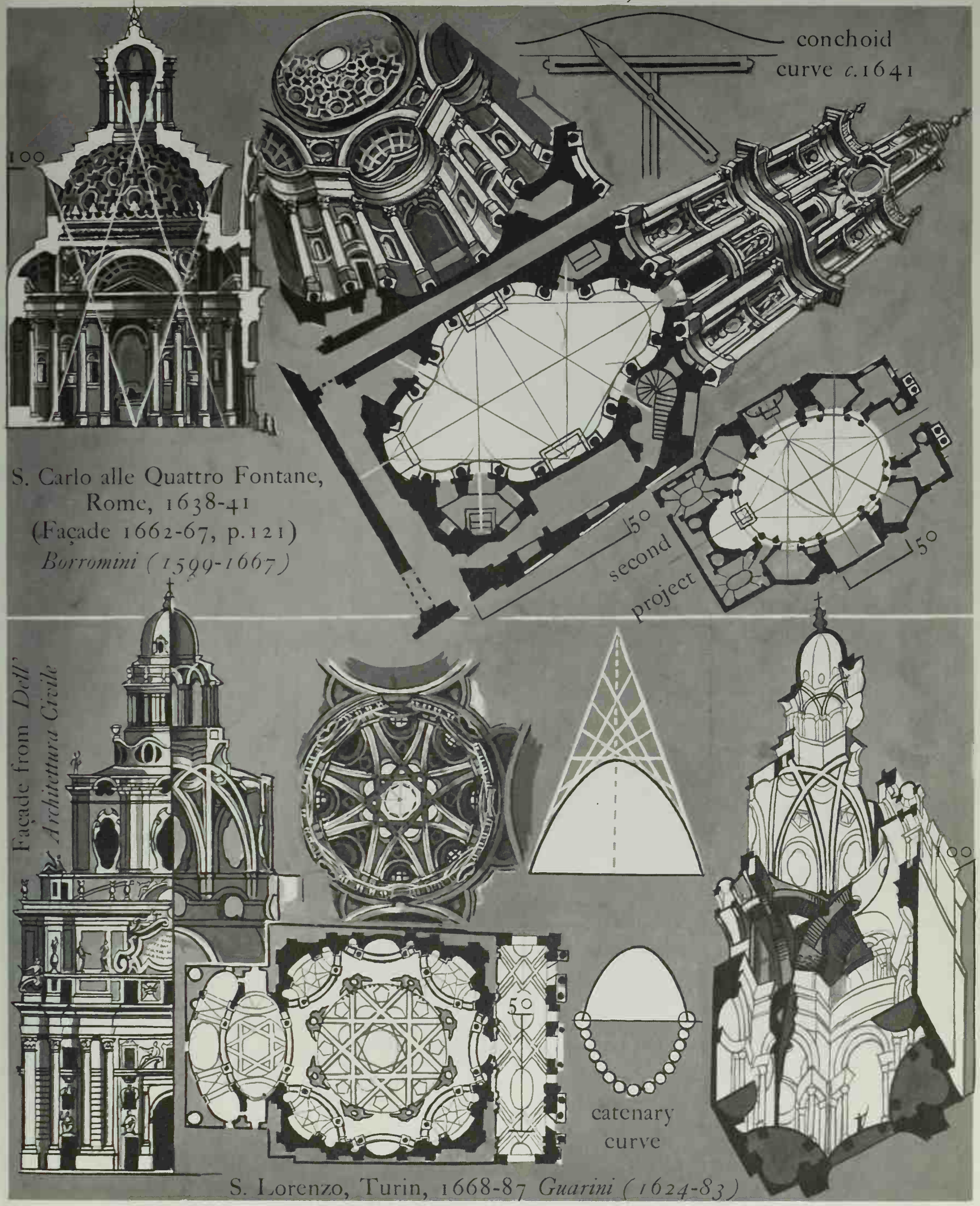
S. Carlo, Rome, 1665-7
Borromini (p.123)

S. Gregorio, Messina, 1660
Guarini (1624-1683)

RENAISSANCE - BAROQUE



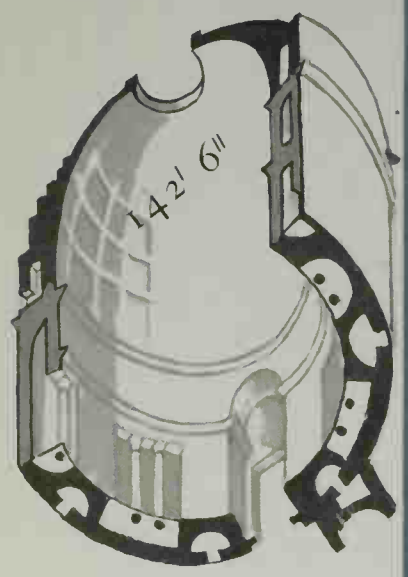
ITALY, CHURCHES



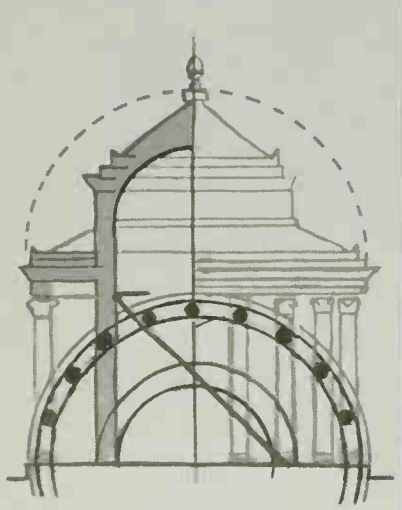
S. Carlo alle Quattro Fontane,
Rome, 1638-41
(Façade 1662-67, p.121)
Borromini (1599-1667)

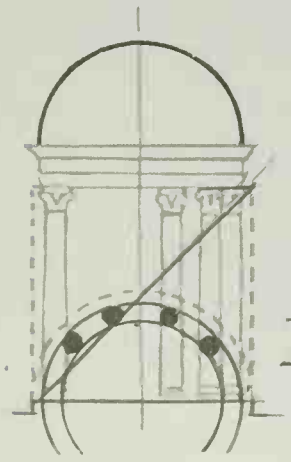
S. Lorenzo, Turin, 1668-87 *Guarini (1624-83)*

RENAISSANCE - BAROQUE

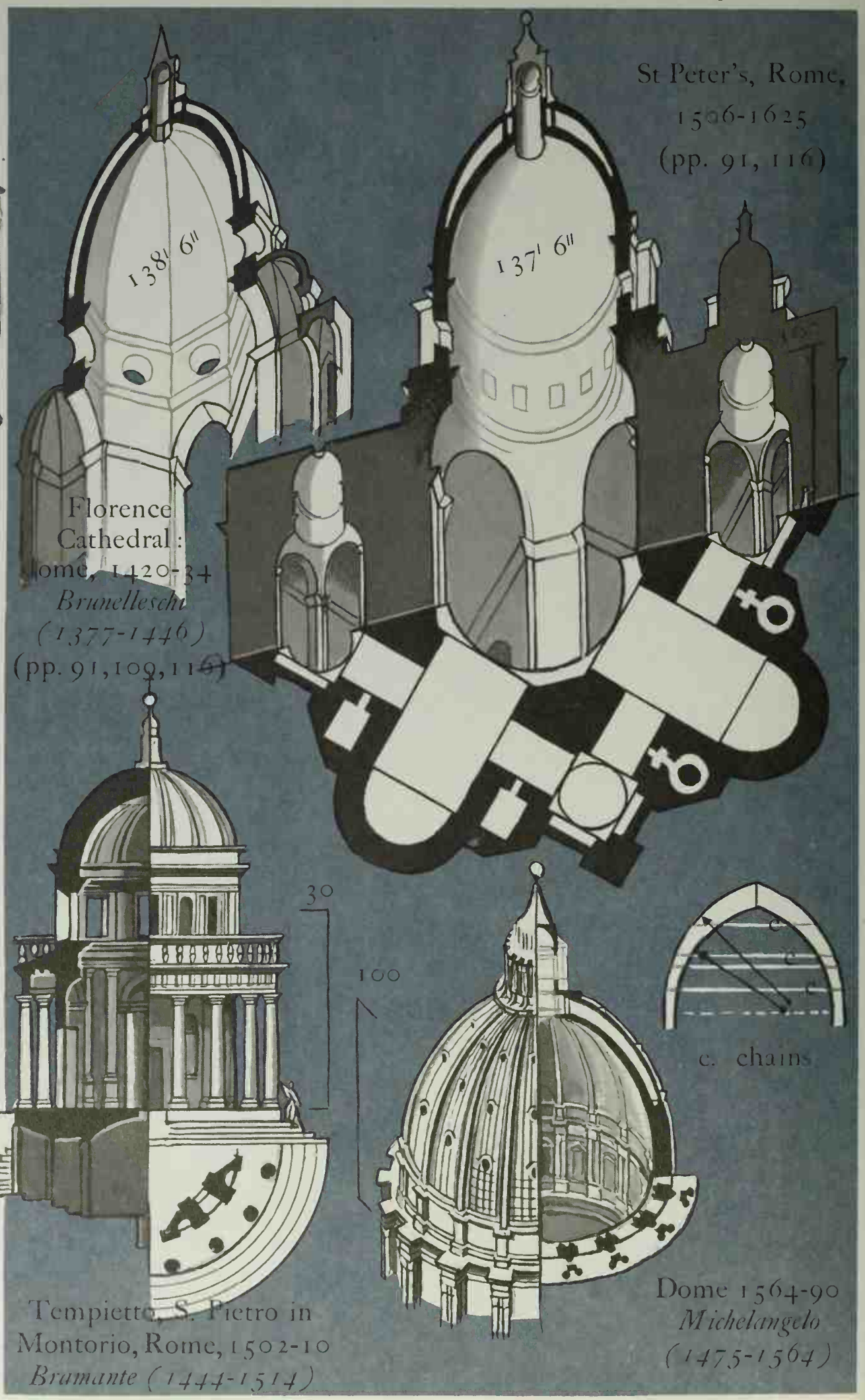


The Pantheon,
Rome, A.D. 120-124



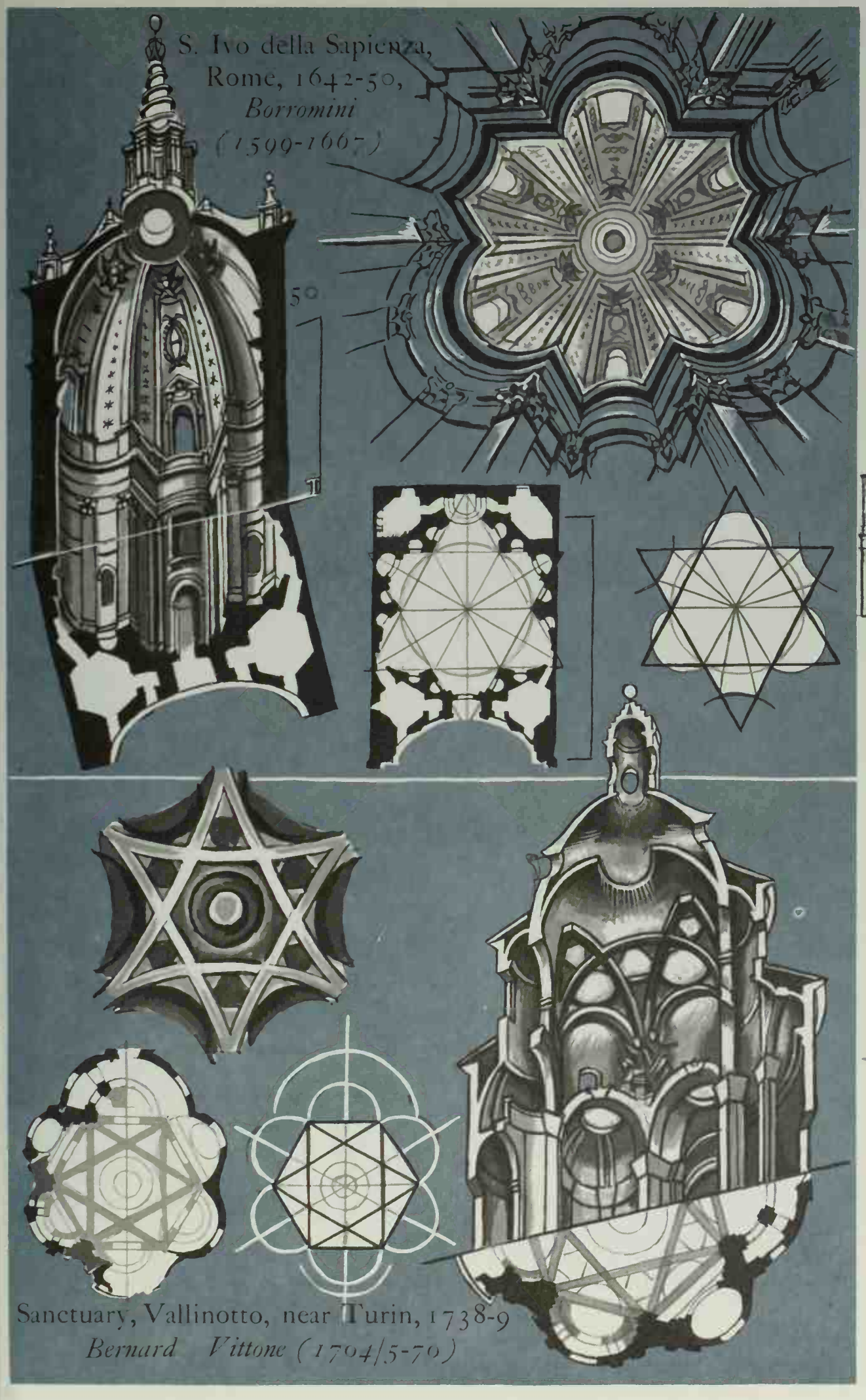


Circular temples,
Vitruvius (IV, 9)

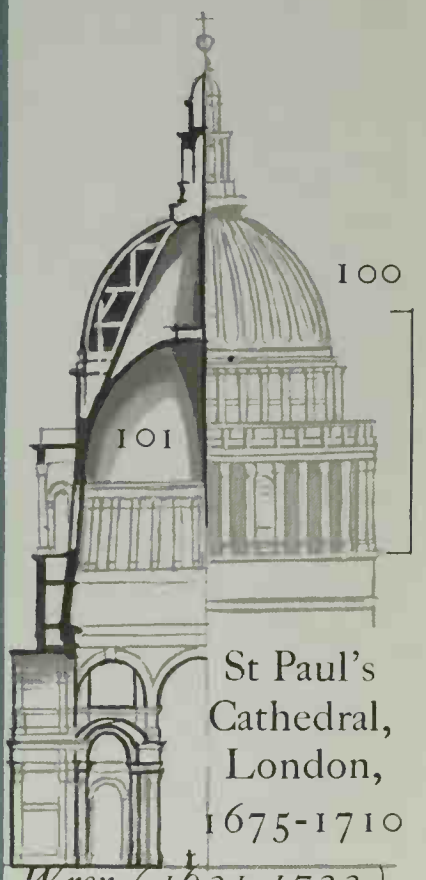


ITALY, DOMES

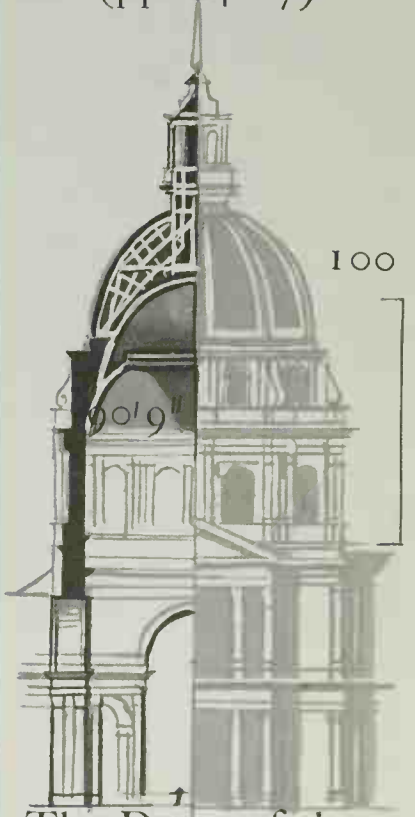
S. Ivo della Sapienza, Rome, 1642-50, *Borromini (1599-1667)*



Sanctuary, Vallinotto, near Turin, 1738-9
Bernard Vittone (1704/5-70)

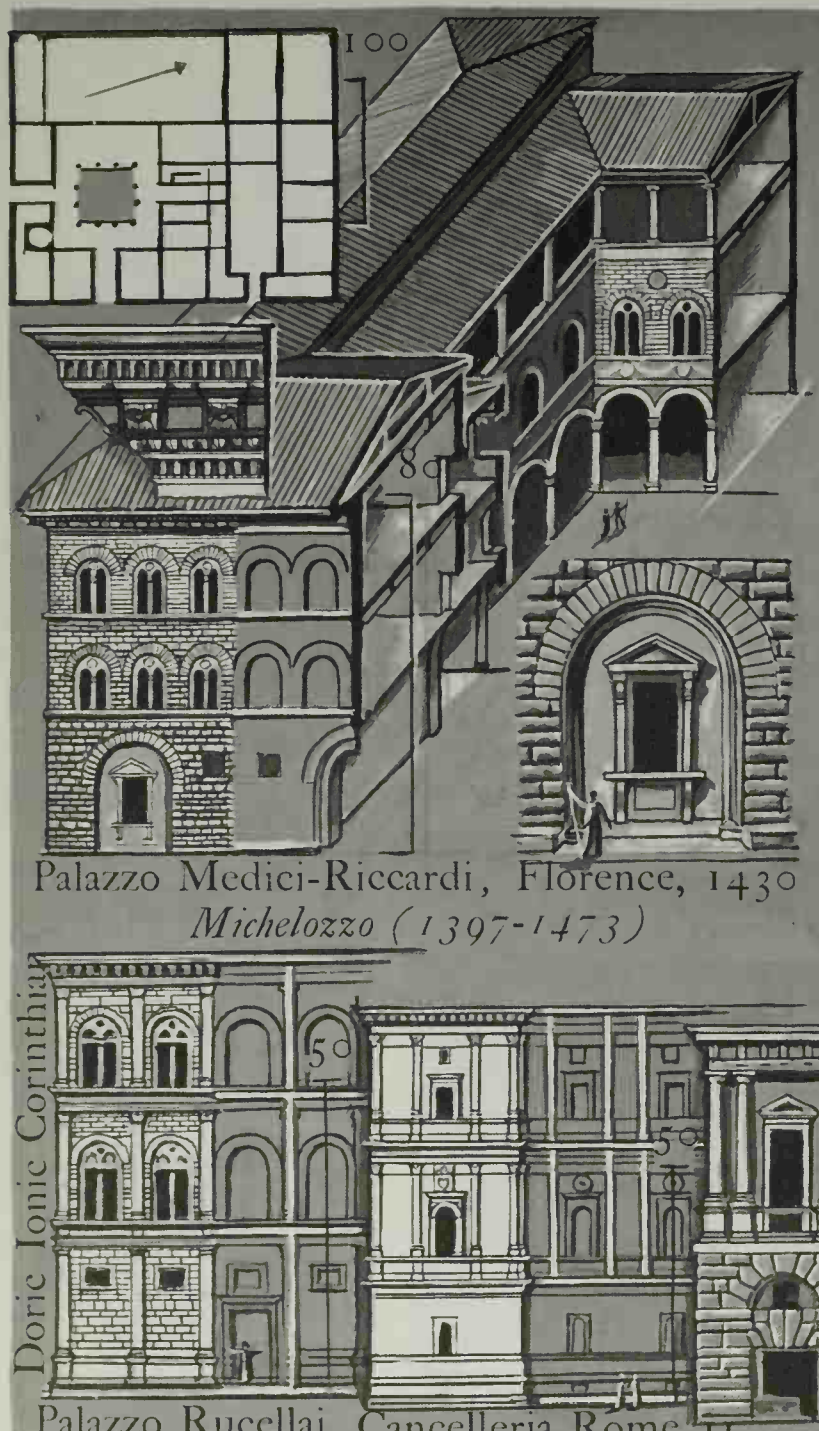


St Paul's Cathedral, London, 1675-1710
Wren (1631-1723)
(pp. 146-7)

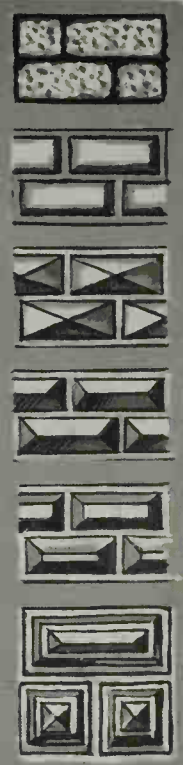


The Dome of the Invalides, Paris, 1693-1706 *Jules Hardouin-Mansart (1646-1708)*
(p.131)

RENAISSANCE - BAROQUE

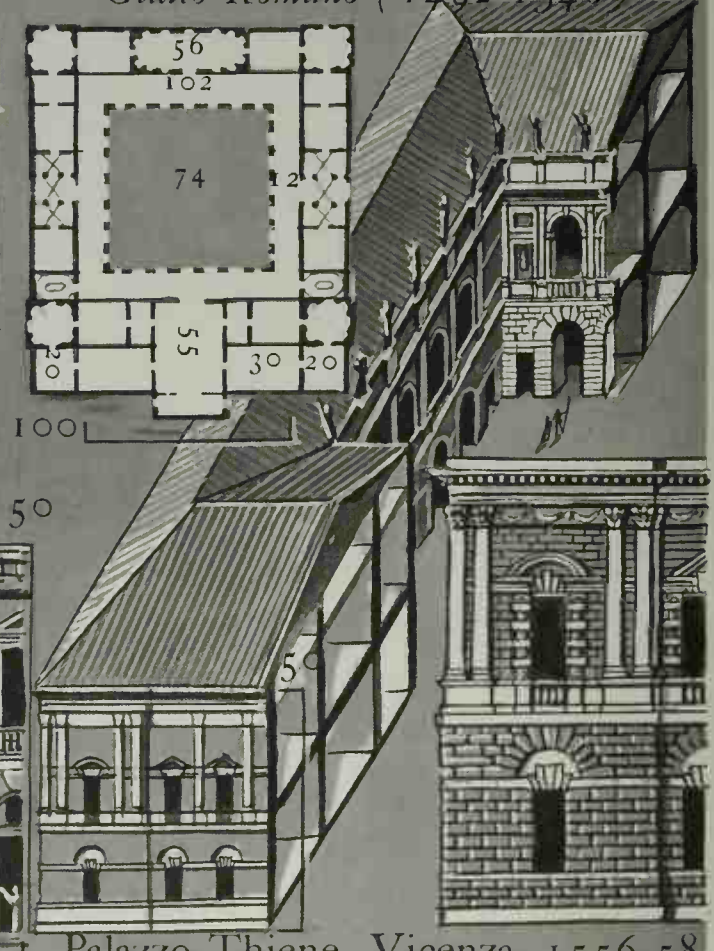


Palazzo Medici-Riccardi, Florence, 1430
Michelozzo (1397-1473)



rusticated masonry after *Serlio*

Palazzo del Tè, Mantua, 1526-35
Giulio Romano (1492-1546)



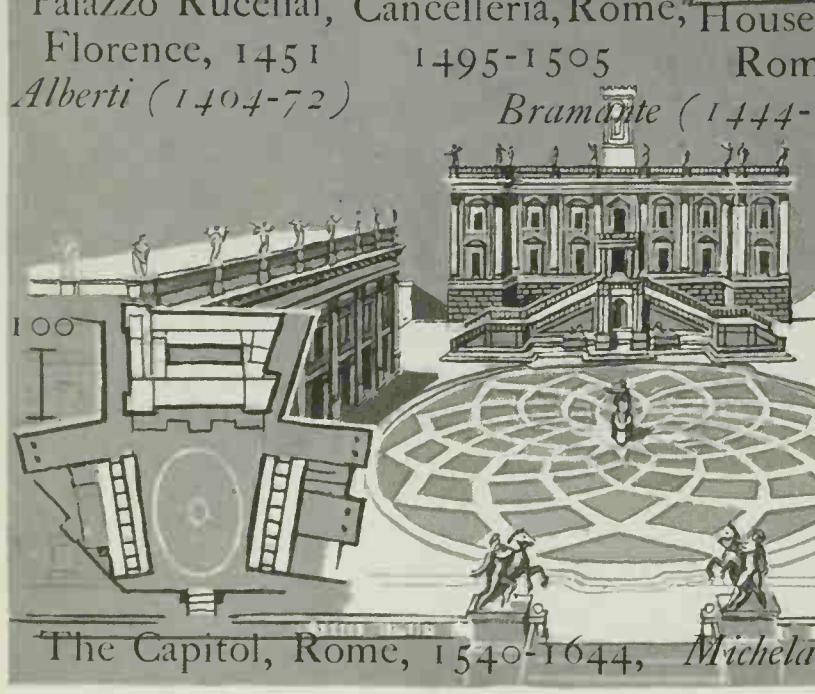
Doric Ionic Corinthian

Palazzo Rucellai, Florence, 1451
Alberti (1404-72)

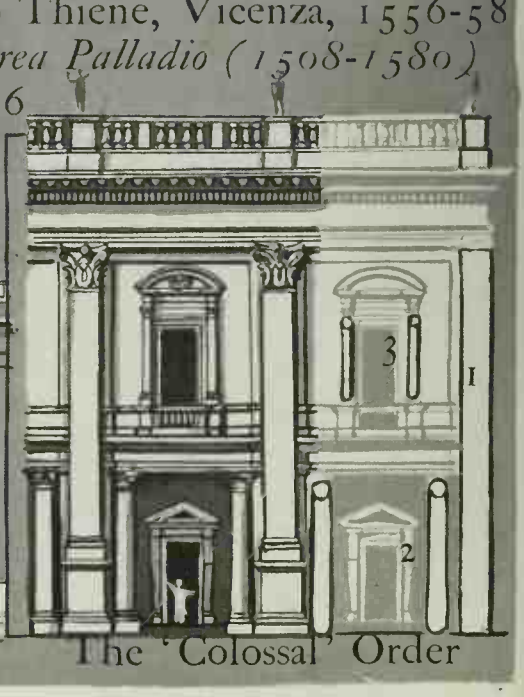
Cancelleria, Rome, 1495-1505
Bramante (1444-1514)

House of Raphael, Rome *c.*1512

Palazzo Thiene, Vicenza, 1556-58
Andrea Palladio (1508-1580)

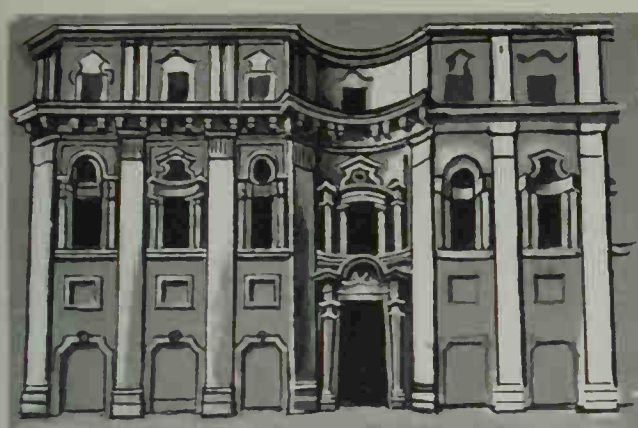


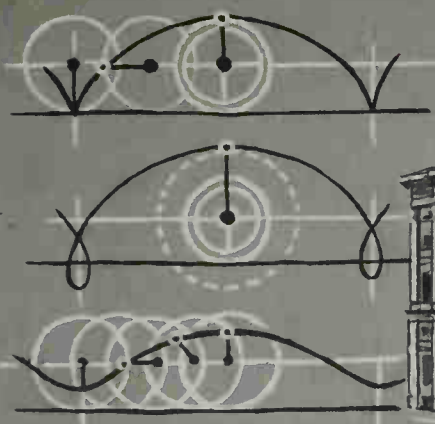
The Capitol, Rome, 1540-1644, *Michelangelo (1475-1564)*



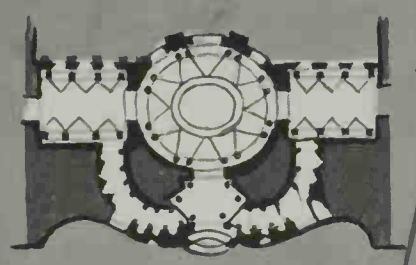
The 'Colossal' Order

ITALY, PALACES



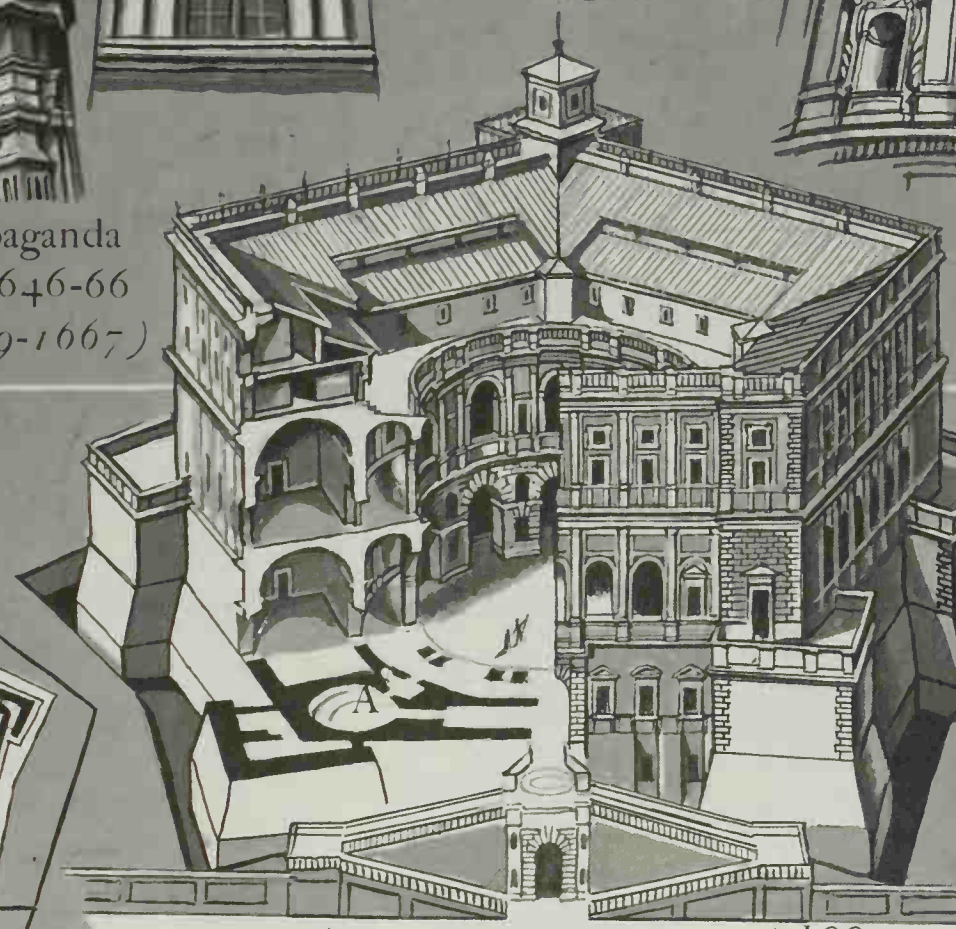


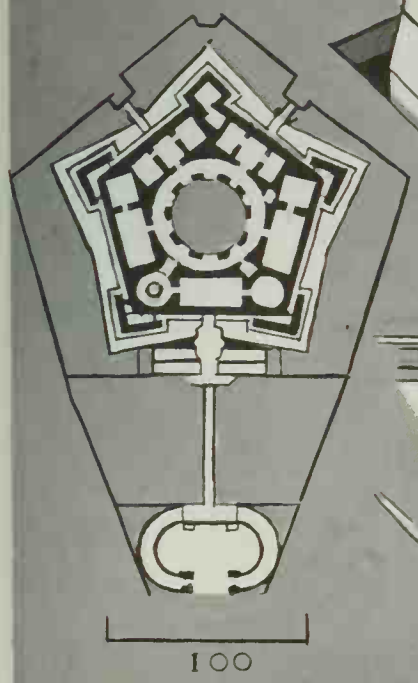
cycloidal curves
Pascal (1623-1662)

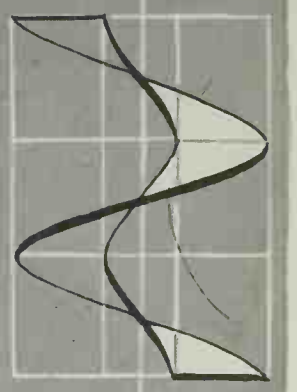


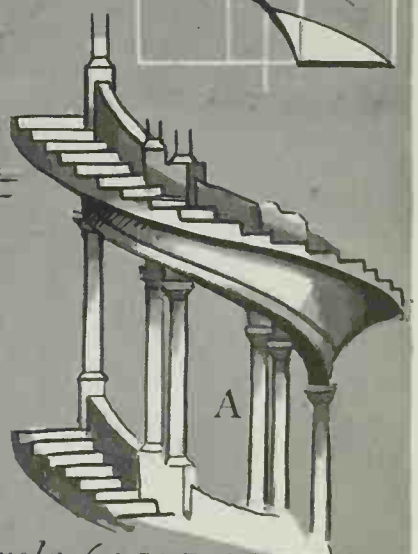
Collegio Propaganda
Fide, Rome 1646-66
Borromini (1599-1667)

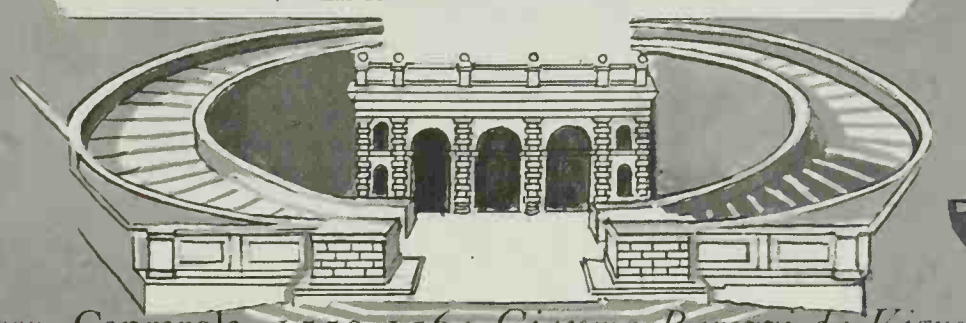
Palazzo Carignano,
Turin, *c.*1678-80
Guarini (1624-1683)





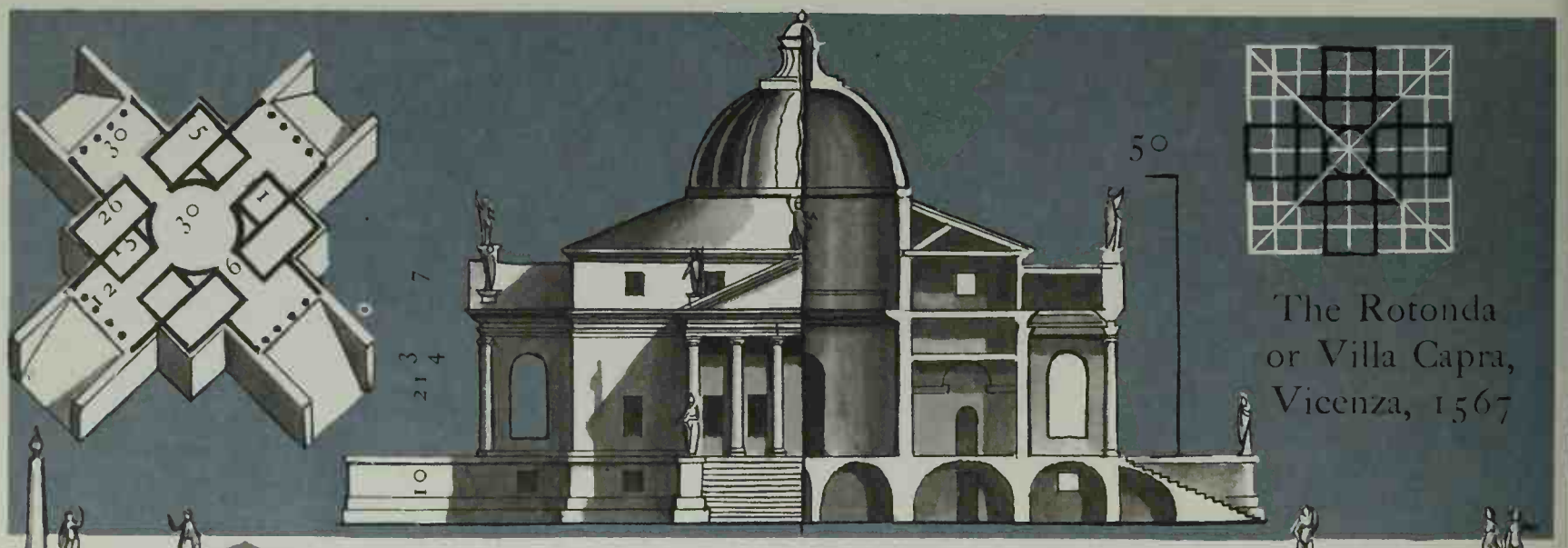




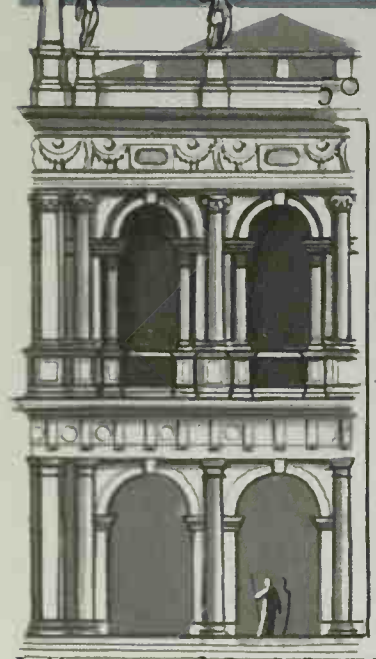


Palazzo Farnese, Caprarola, 1559-1564 *Giacoma Barozzi da Vignola (1507-1573)*

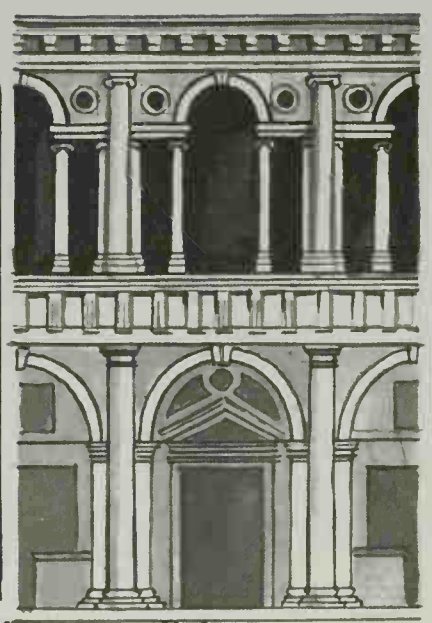
RENAISSANCE - BAROQUE



The Rotonda
or Villa Capra,
Vicenza, 1567

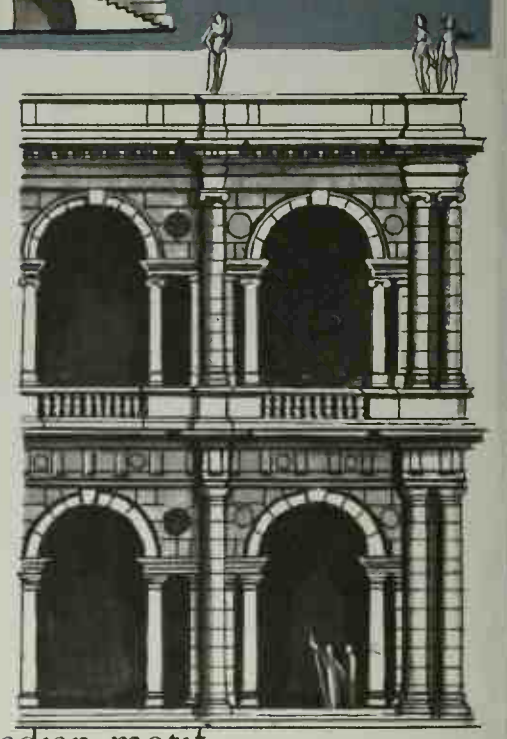


Library of St Mark's,
Venice, 1536
Sansovino (1486-1570)

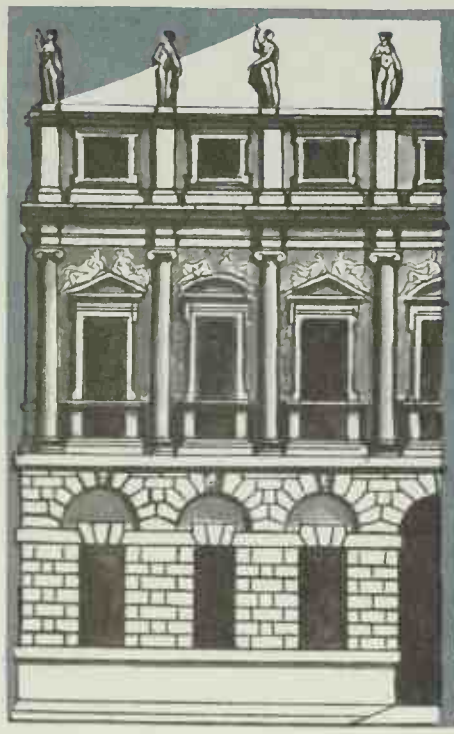


Palace
after *Serlio*
(Bk IV), 1540

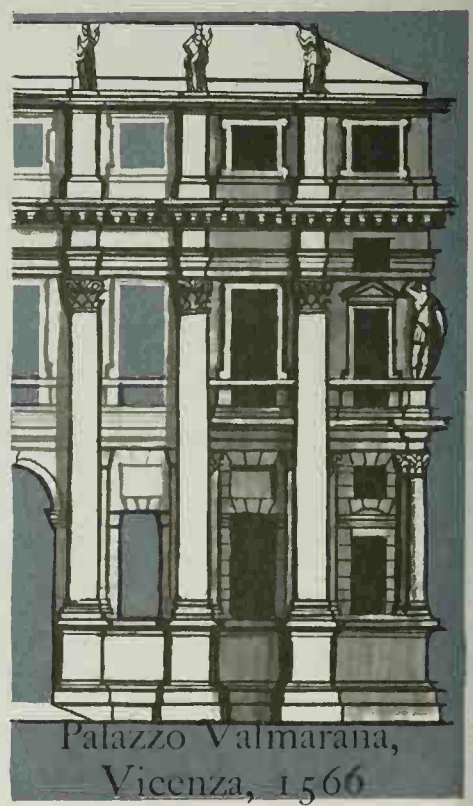
The Basilica, Vicenza;
arcading added 1545
by *Palladio*



The Palladian motif

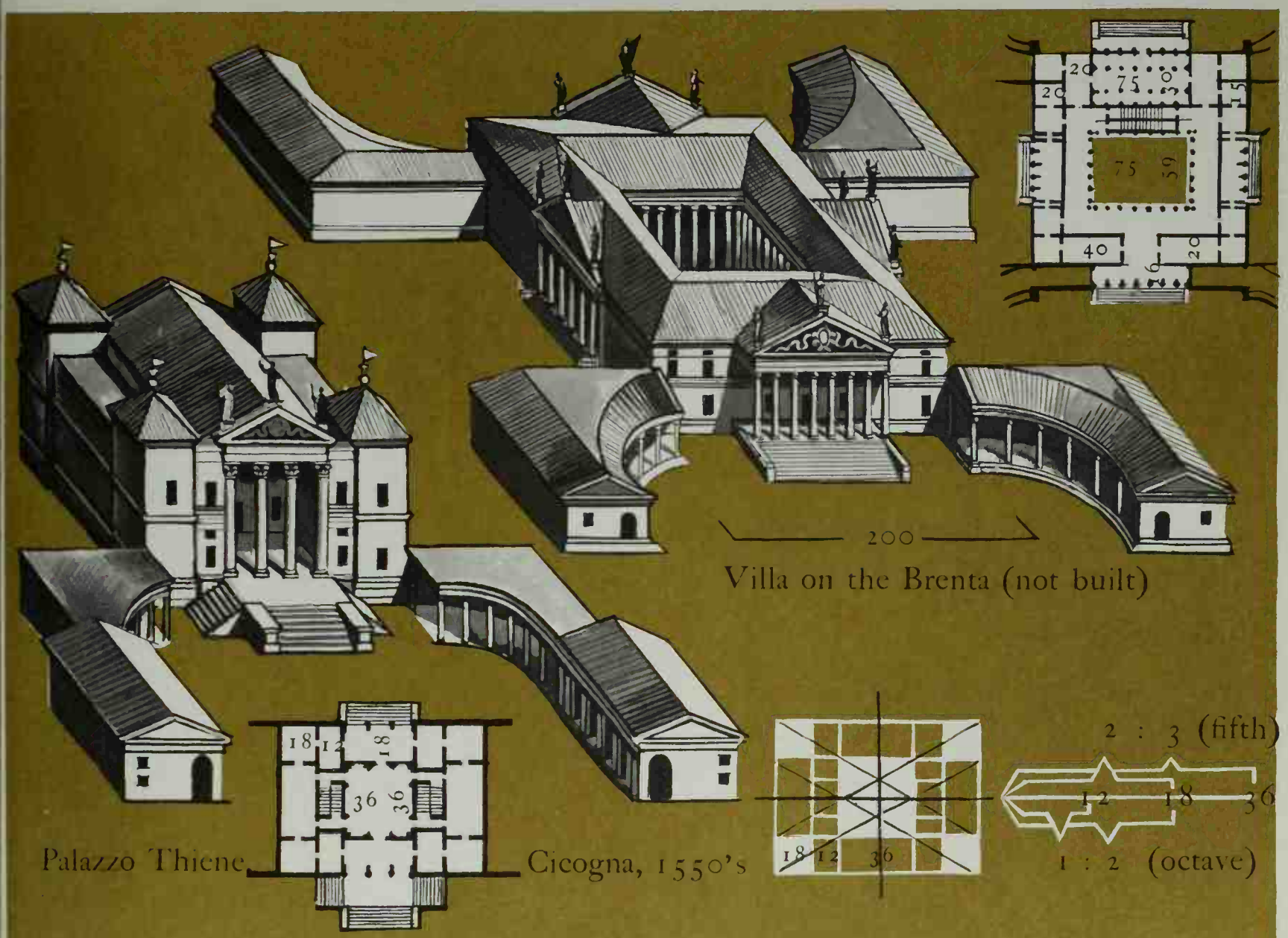


Palazzo
Iseppo
dei Porti,
Vicenza,
1552



Palazzo Valmarana,
Vicenza, 1566

ITALY, THE PALLADIAN MOTIF

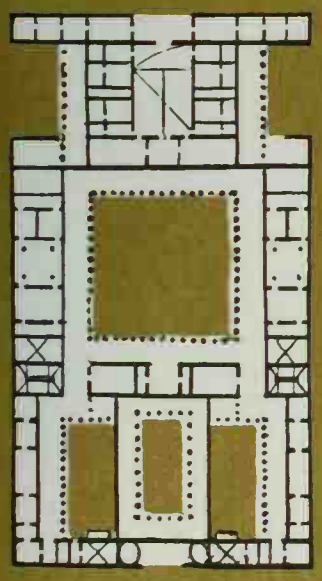


Villa on the Brenta (not built)

Palazzo Thiene

Cicogna, 1550's

Palladio placed numbers in the plans of his villas to indicate the ratios of all the rooms in the building; these often followed the ratios given by Vitruvius and Alberti



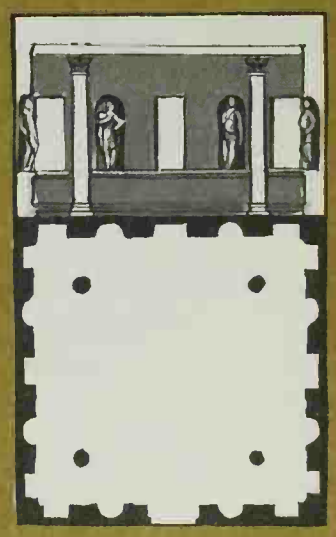
Plan of
a Roman house
Palladio (II, 7)

Andrea Palladio (1508-1580)

designed many buildings in and around his native Vicenza, mostly of brick faced with stucco. He studied classical architecture in Rome 1545-47. His treatise

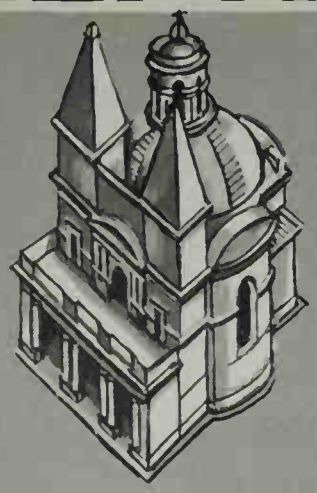
I Quattro Libri dell' Architettura, Venice, 1570

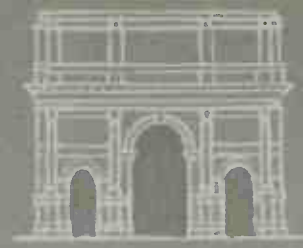
influenced the design of buildings in Europe, especially in England



Hall of four columns
or Roman tetrastyle
Palladio (II, 8)

RENAISSANCE-BAROQUE

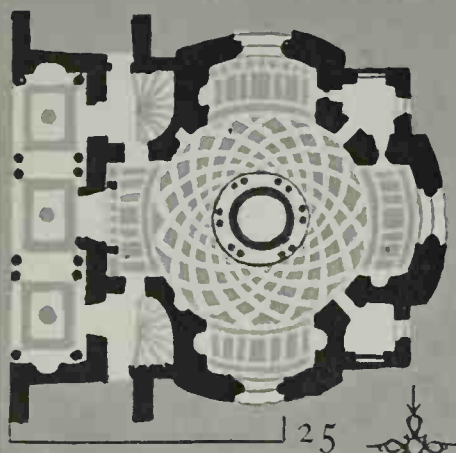




(p.117)

after *Serlio*
1537

150



125

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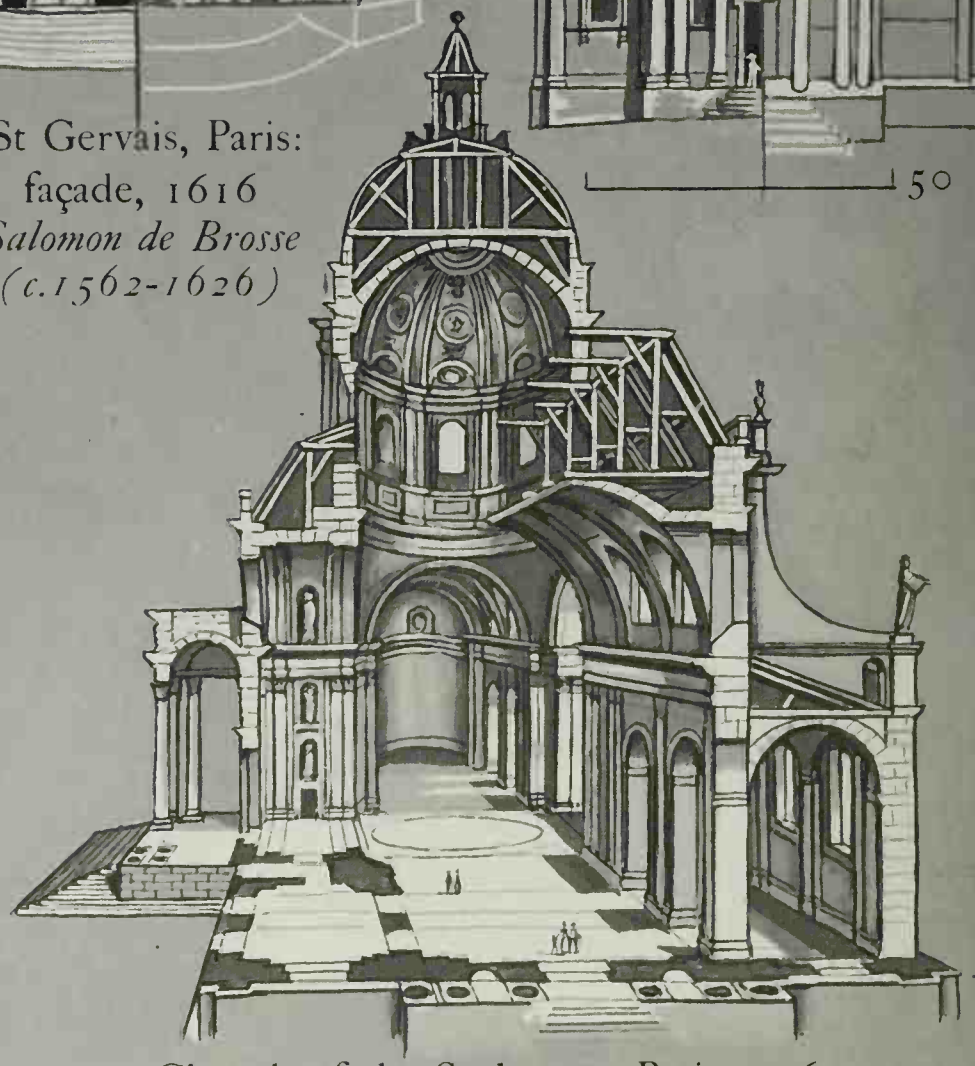
St Gervais, Paris:
façade, 1616
Salomon de Brosse
(c.1562-1626)



150

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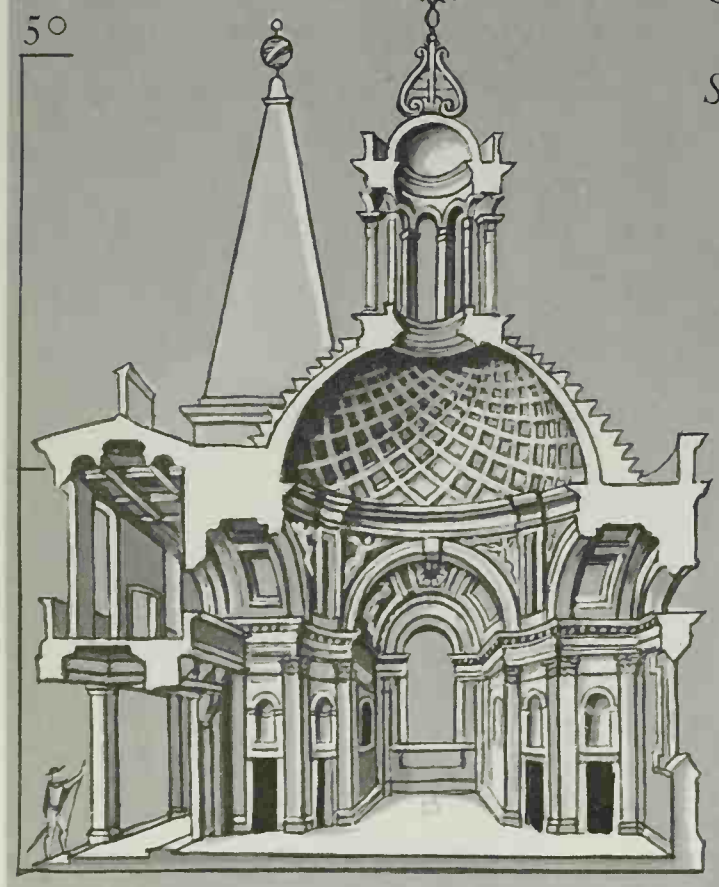
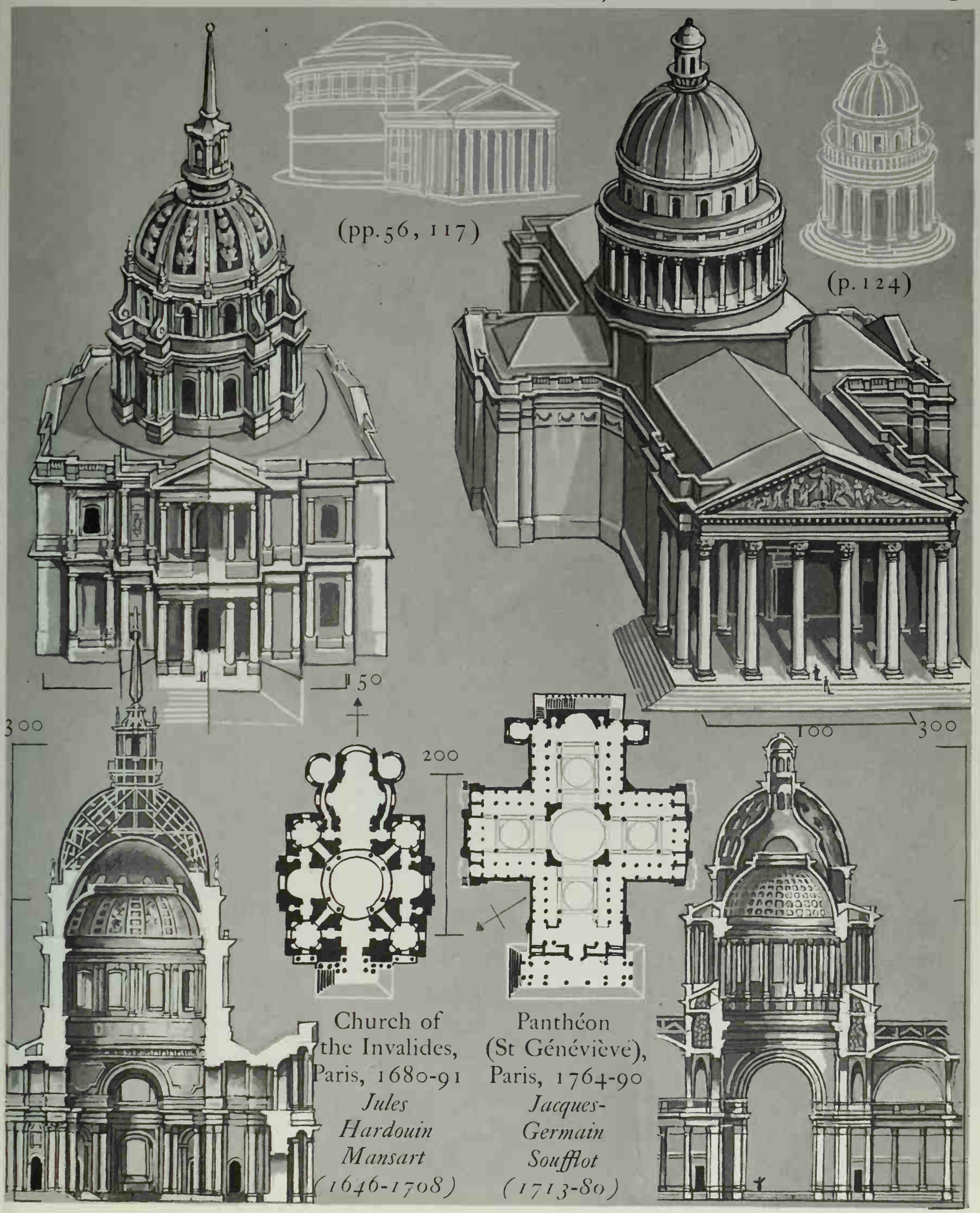


Château d'Anet: chapel, 1549-53
Philibert de l'Orme (c.1510-1570)

Church of the Sorbonne, Paris, *c.*1635
Jacques Lemercier (c.1580/5-1654)

The Italian campaigns of the French Kings, Charles VIII (1483-98), Louis XII (1498-1515) and Francis I (1515-47), failed in their aims; instead France was invaded by the ideas and the arts of the Italian Renaissance.

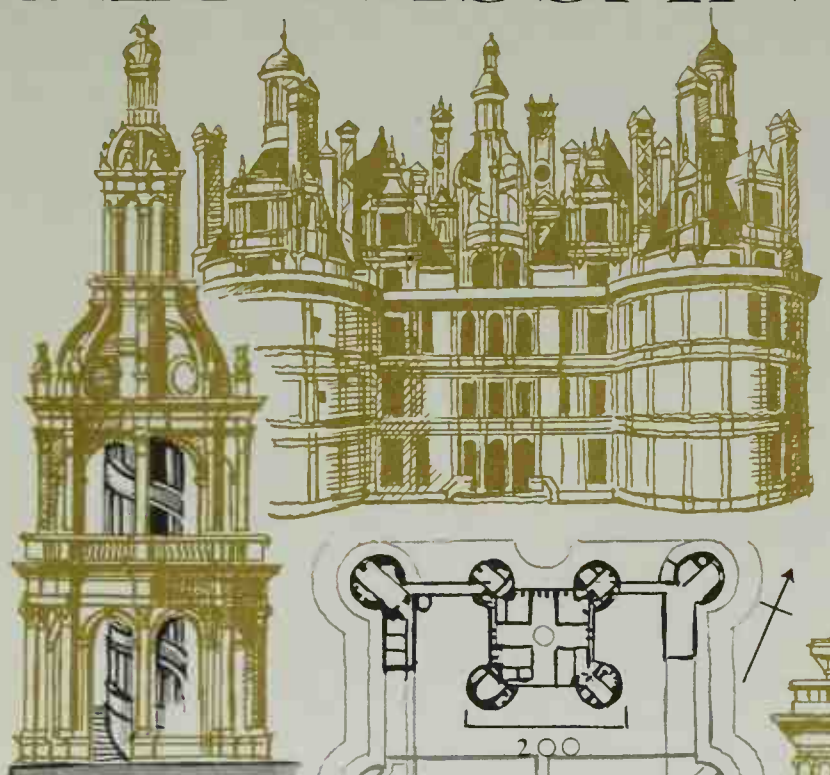
FRANCE, CHURCHES

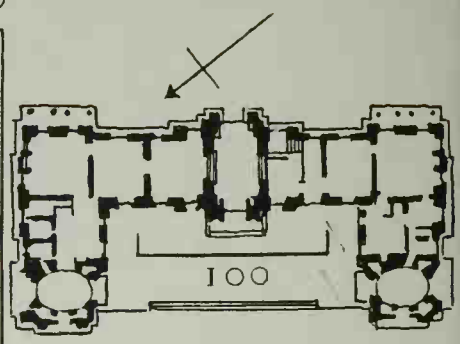


Church of the Invalides, Paris, 1680-91
Jules Hardouin Mansart (1646-1708)

Panthéon (St Génévieve), Paris, 1764-90
Jacques-Germain Soufflot (1713-80)

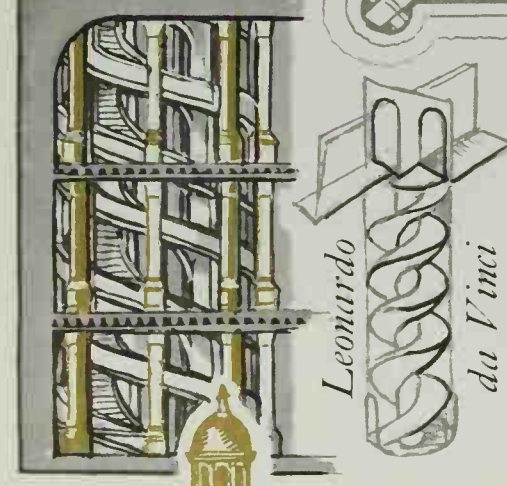
RENAISSANCE-BAROQUE



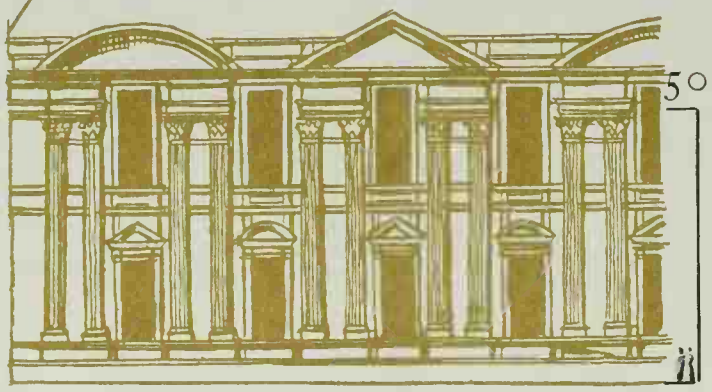


Château de Maisons,
1642-46
François Mansart
(1598-1666)

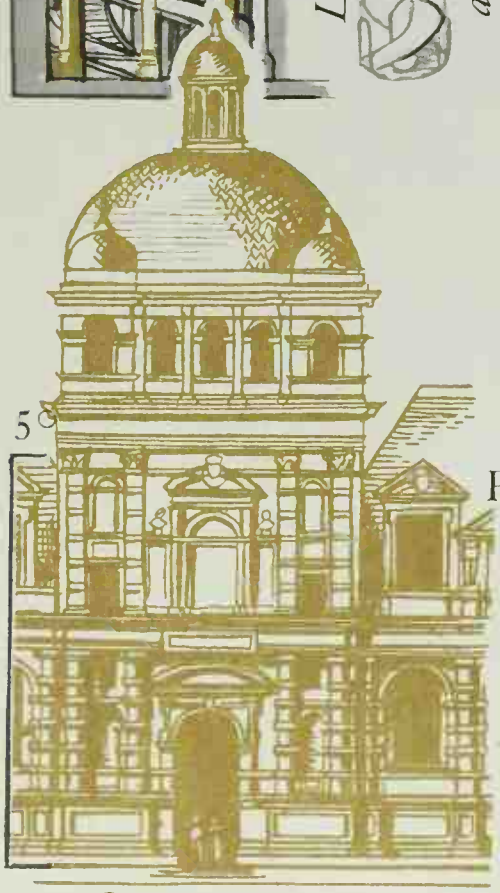
Château
de Chambord,
1519-1547

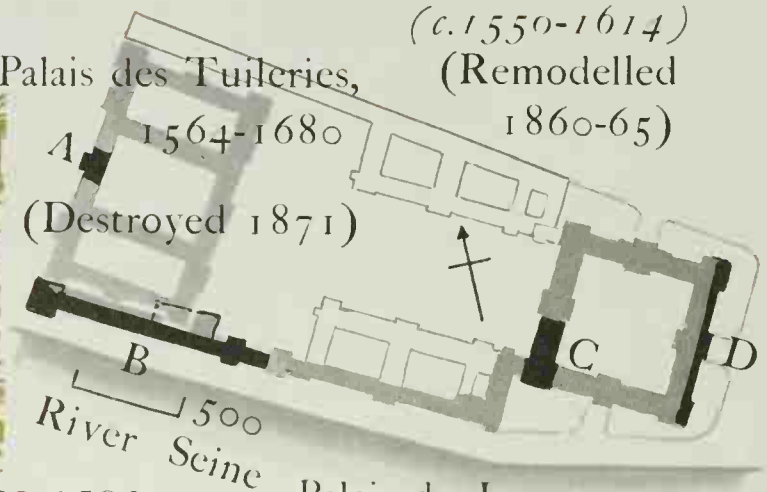


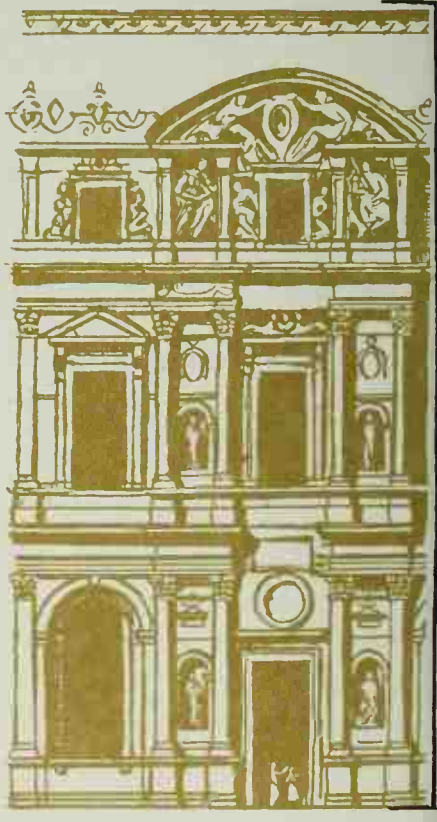
Leonardo
du Vinci



B. 1600-09 *Jacques du Cerceau*
(c.1550-1614)







A. Central pavilion, 1570-1592
Philibert de l'Orme (c.1515-1570)

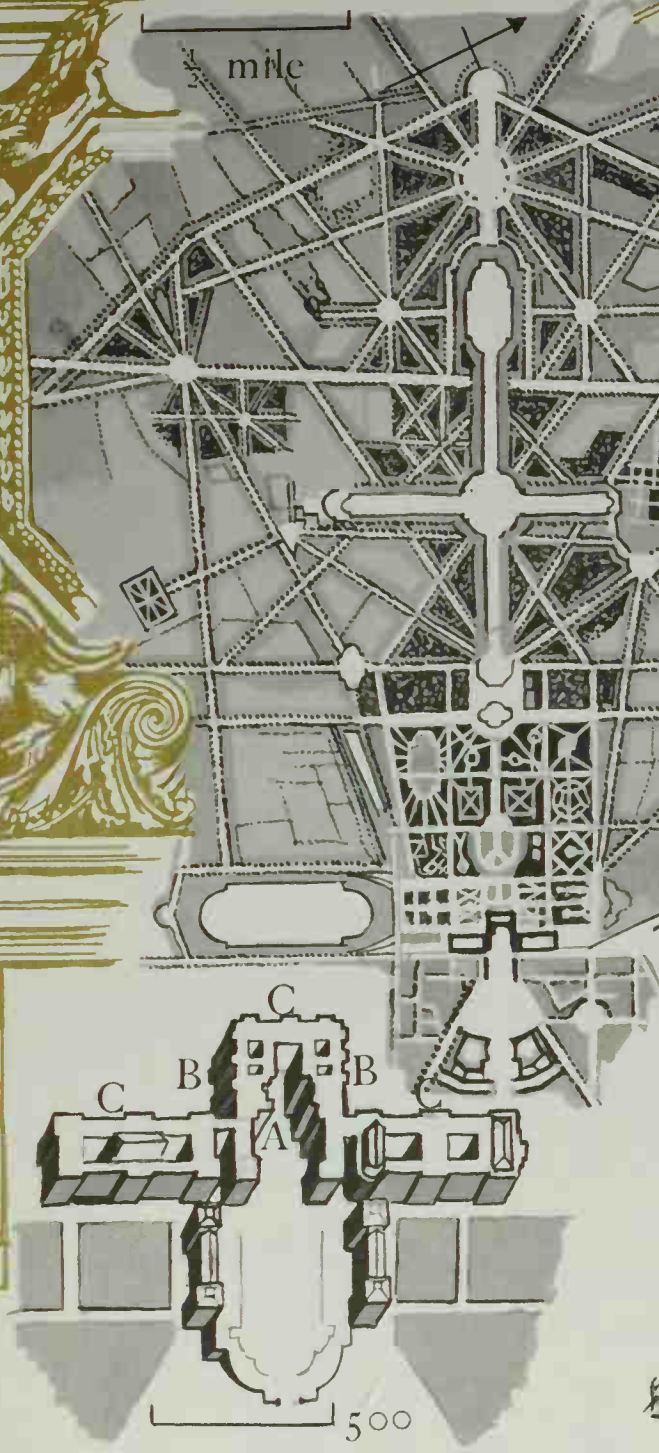
Palais du Louvre,
Paris, 1546-1878

(Remodelled
1860-65)

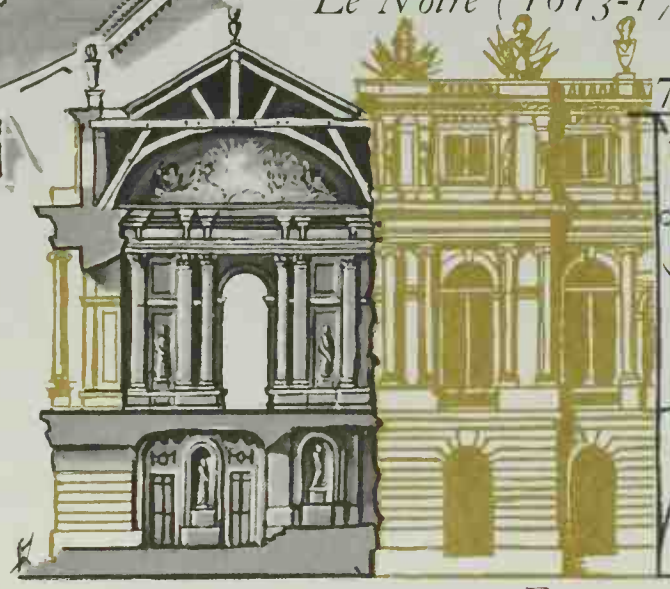
C. Course du Vieux
Louvre, begun 1546
Pierre Lescot (c.1510-78)

FRANCE, CHÂTEAU TO PALACE

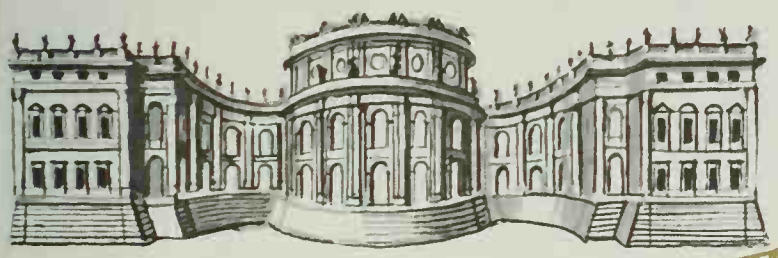
Baroque: detail of mantelpiece *Jean le Pautre, engraver (1612-82)*



Palais de Versailles
A. Small château, 1624-26
De Brosse (c.1562-1626)
B. Enlarged 1669-83
for Louis XIV *(1643-1715)*
Louis le Vau (1612-70)
decoration, *Le Brun*
(1619-90); gardens,
Le Nôtre (1613-1708)

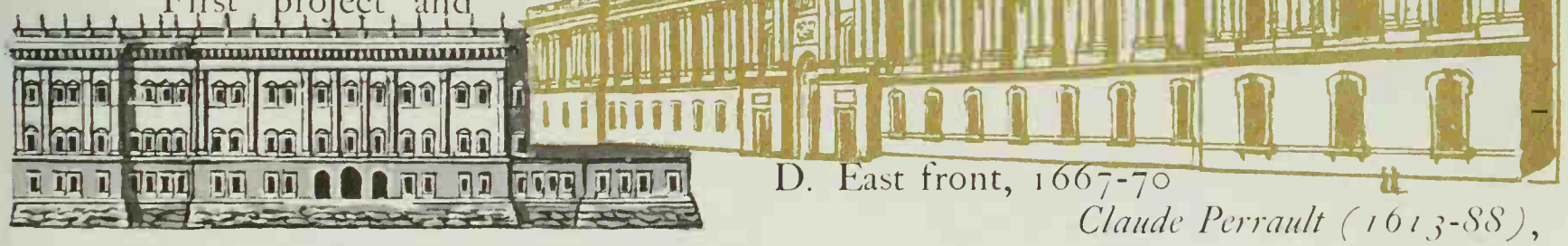


Rococo: detail of room *c.1700-50 Jules Aurèle Meissonier (1695-1750)*



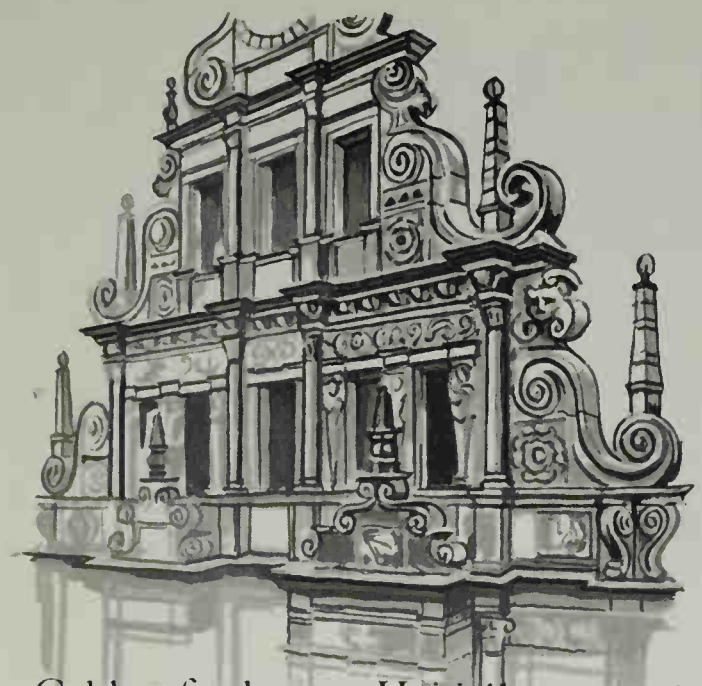
First project and
final project made by *Bernini (1598-1680)*
in Paris, 1665 for the East Front of the Louvre

C. Galerie des Glaces, & Façade 95
1679-82 *J. H. Mansart*
(1646-1708)

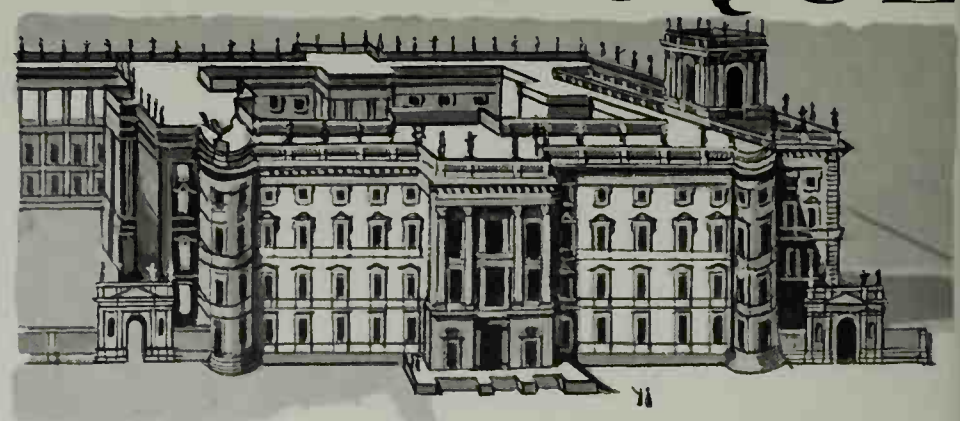


D. East front, 1667-70
Claude Perrault (1613-88),
Louis Le Vau (1612-88) &
Charles Le Brun (1619-90)

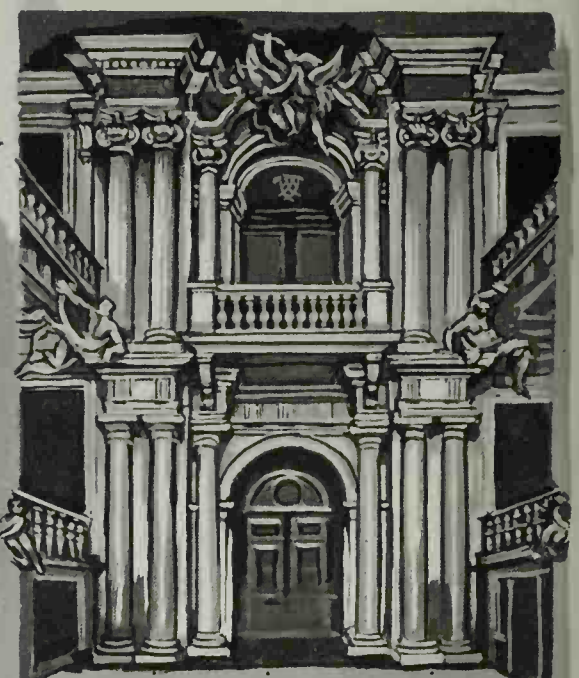
RENAISSANCE-BAROQUE



Gable of a house, Heidelburg, *c.*1600

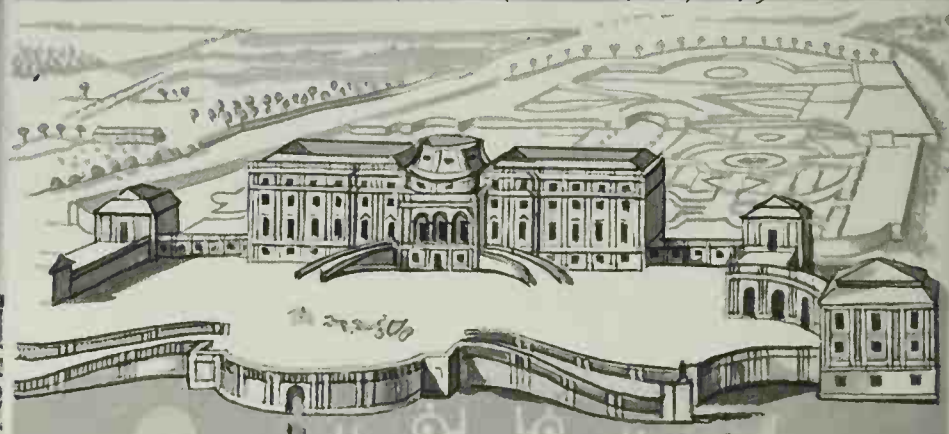


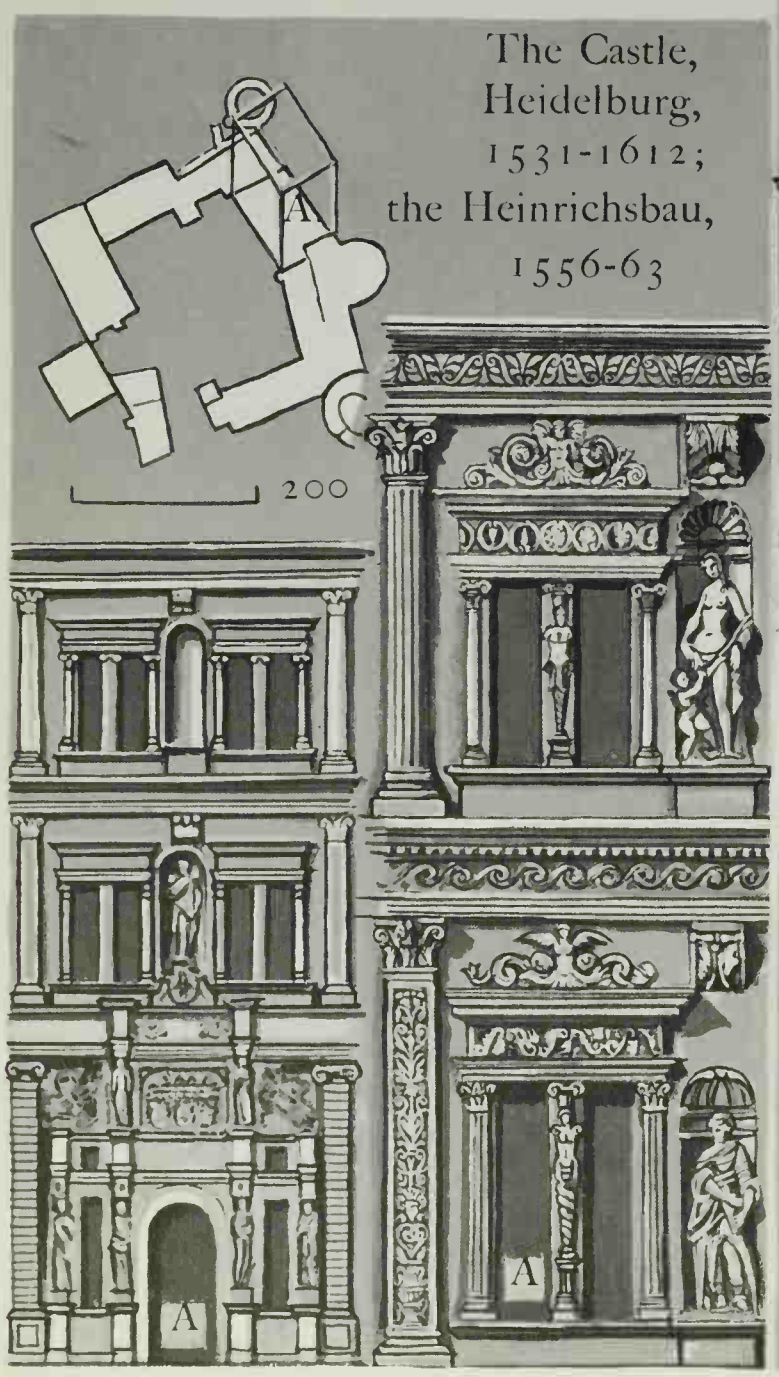
main entrance



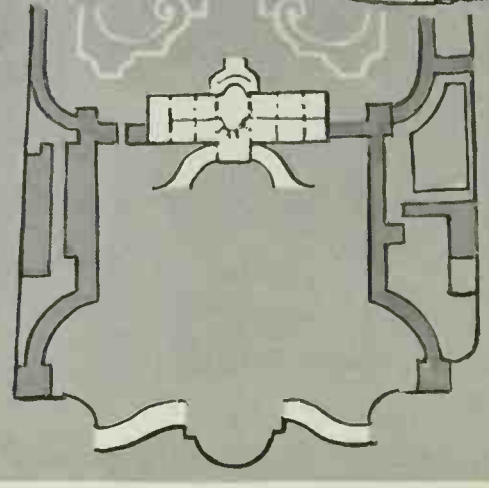
staircase in east wing

Palace, Berlin, 1698-1706
Andreas Schluter (c.1664-1714)





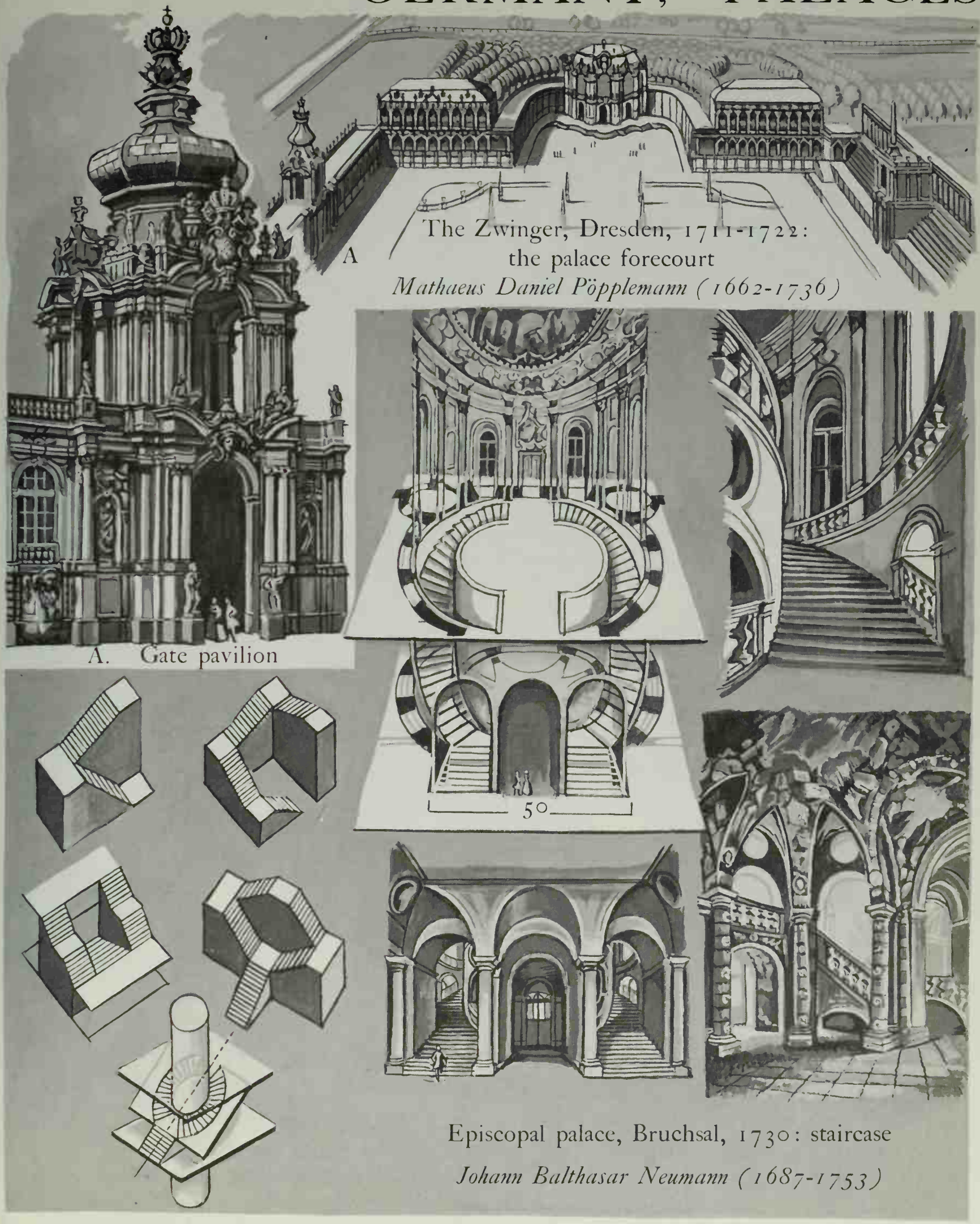
The Castle, Heidelburg, 1531-1612; the Heinrichsbau, 1556-63



Palace Schwarzenberg, Vienna, 1706-1725

Johann Berhard Fischer von Erlach (1656-1723)

GERMANY, PALACES



A. Gate pavilion

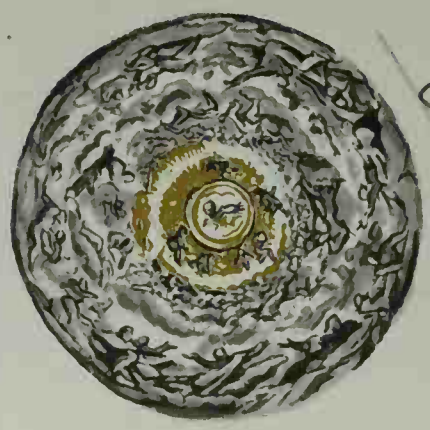
The Zwinger, Dresden, 1711-1722:
the palace forecourt
Mathaeus Daniel Pöpplemann (1662-1736)

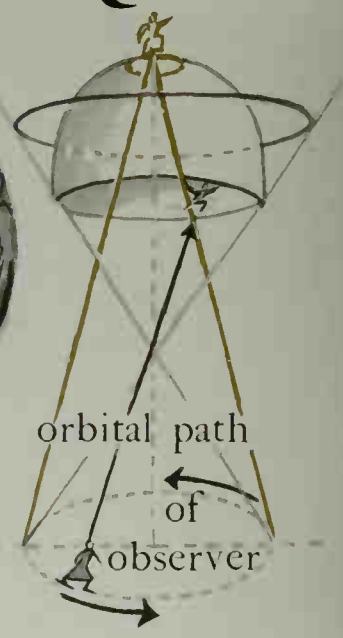
50

Episcopal palace, Bruchsal, 1730: staircase
Johann Balthasar Neumann (1687-1753)

RENAISSANCE-BAROQUE

The Gesù, Rome, 1668-83 (p.122): fresco and stucco figures on nave vault, 1674-79, 'Adoration of the Name of Jesus'
Giovanni Battista Gaulli (1639-1709)

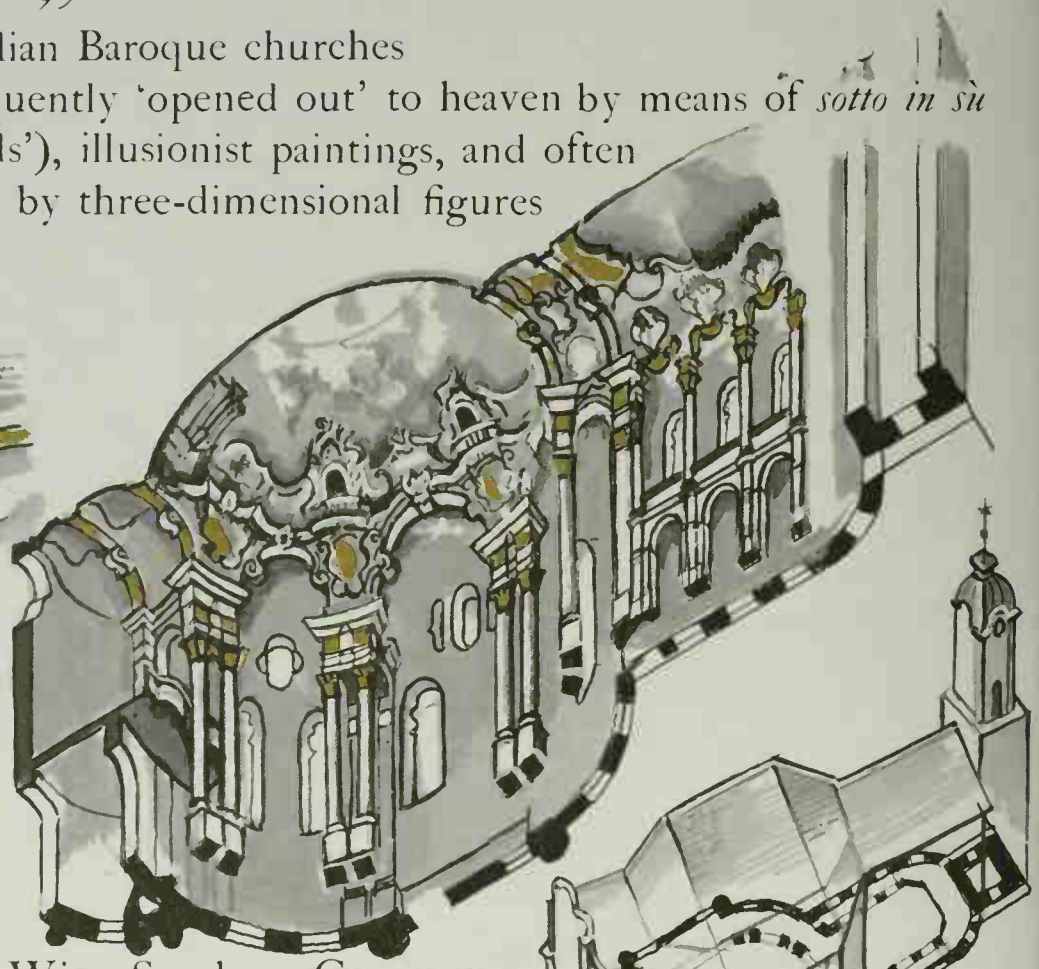




S. Andrea in Valle, Rome, 1591-1623: fresco in dome, 'The Virgin in Glory'
Giovanni Lanfranco (1582-1647)

Italian Baroque churches

Vaults, domes and apses were frequently 'opened out' to heaven by means of *sotto in sù* (Italian: 'from below upwards'), illusionist paintings, and often reinforced by three-dimensional figures

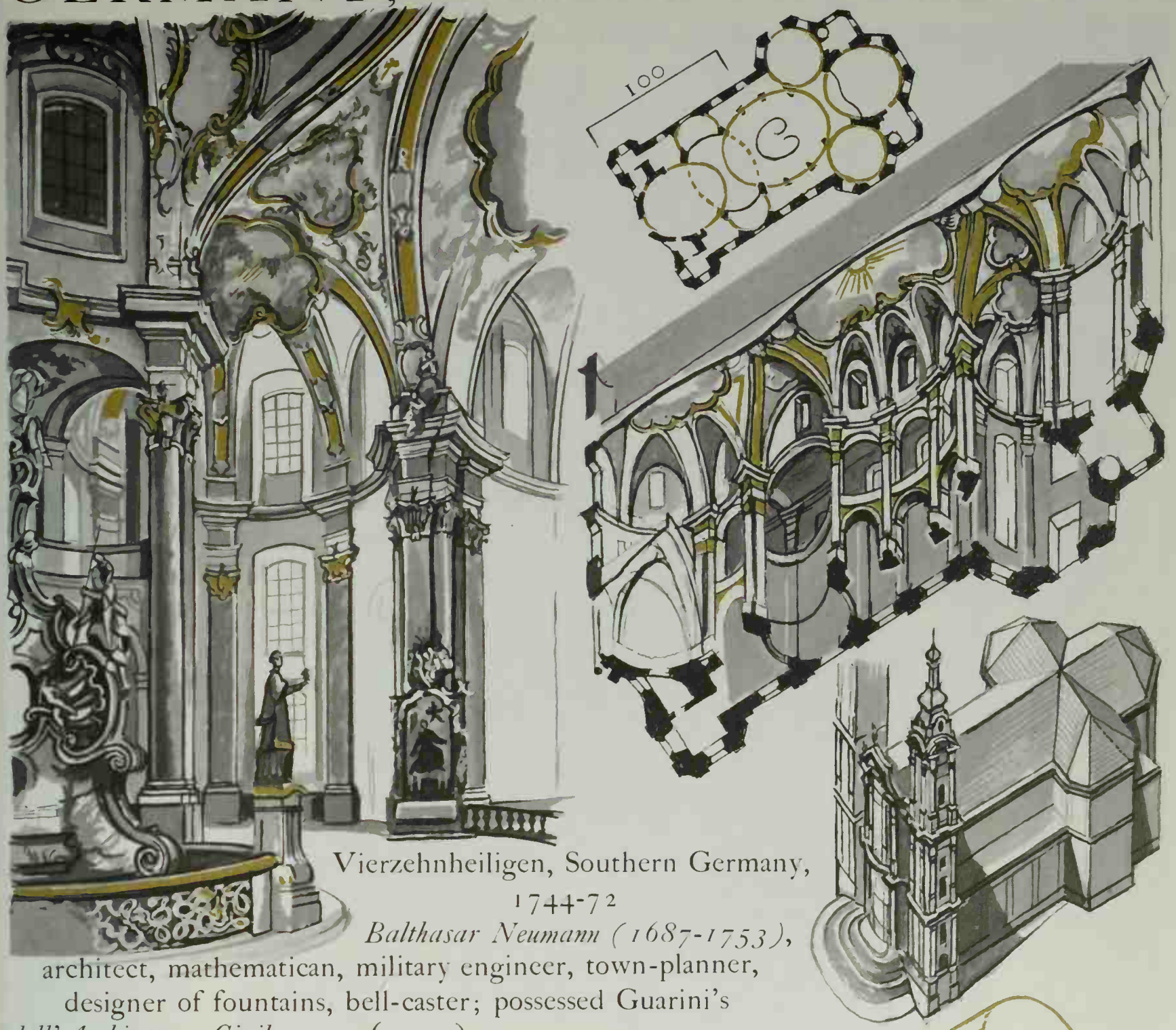


Die Wies, Southern Germany, 1745-54
Dominikus Zimmerman (1685-1766)

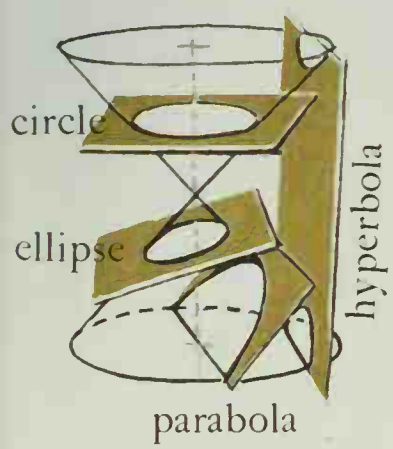
In Southern Germany and Austria many Jesuit Baroque churches were built in the style of the Gesù (p.122).

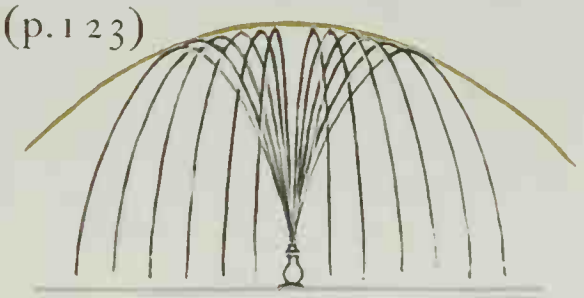
The Thirty Years' War (1618-48) was followed by a resurgence of church-building in which all the arts—architecture, sculpture, painting and music—were fused into Rococo.

GERMANY, ROCOCO CHURCHES

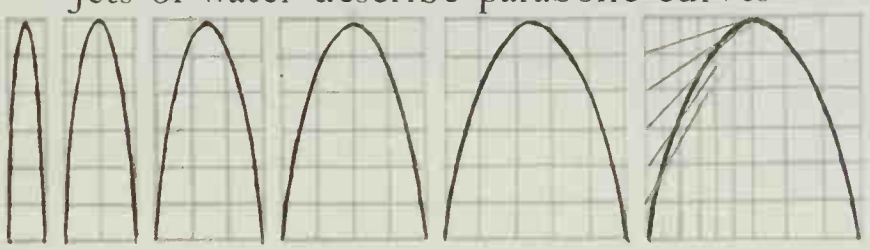


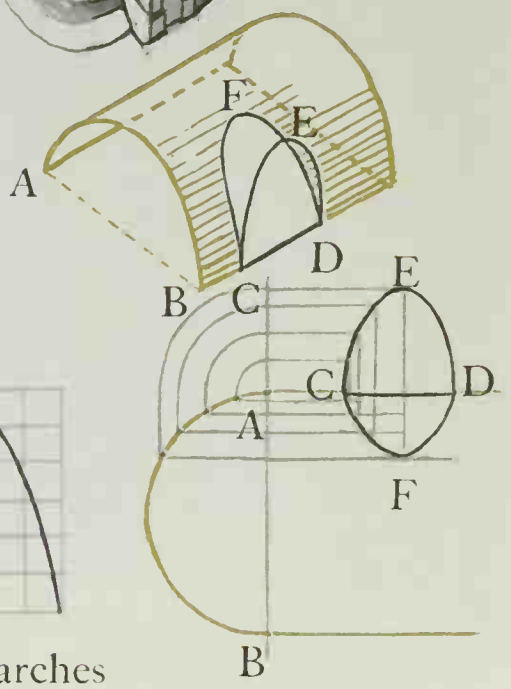
Vierzehnheiligen, Southern Germany,
1744-72
Balthasar Neumann (1687-1753),
architect, mathematican, military engineer, town-planner,
designer of fountains, bell-caster; possessed Guarini's
dell' Architettura Civile, 1737 (p.123)





jets of water describe parabolic curves

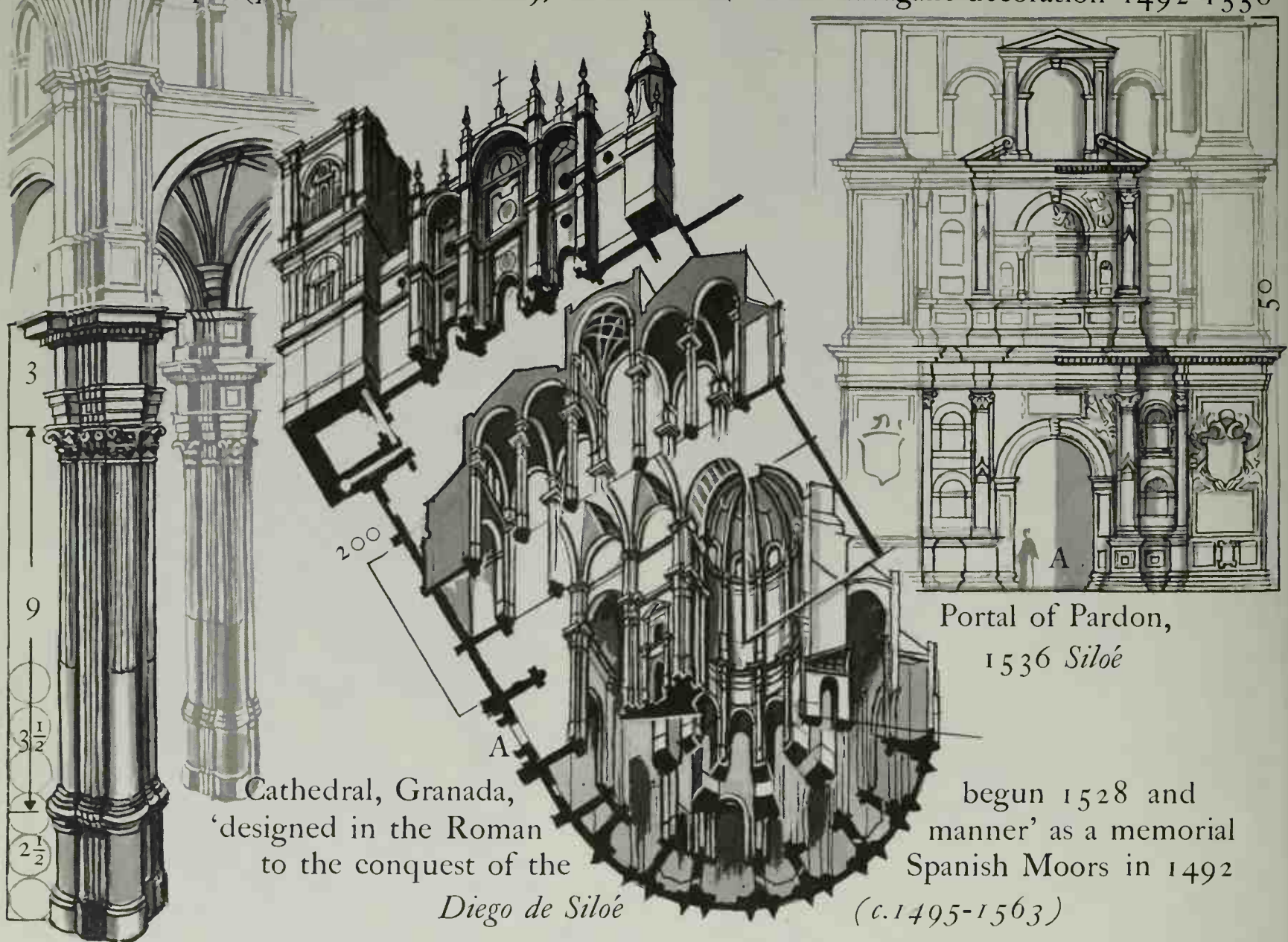




parabolic, forward tilted, three-dimensional arches

RENAISSANCE-BAROQUE

I 'Plateresque' (*platero* = silversmith), from the use of extravagant decoration 1492-1556

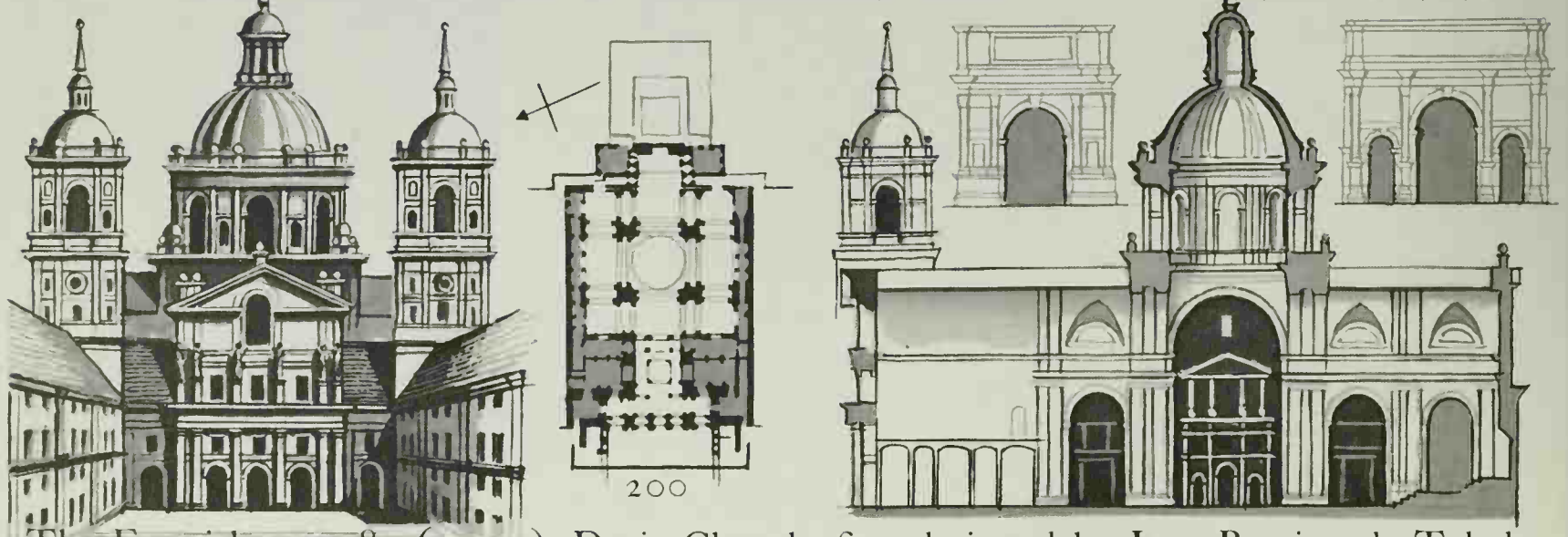


Portal of Pardon, 1536 *Siloé*

Cathedral, Granada, begun 1528 and 'designed in the Roman manner' as a memorial to the conquest of the Spanish Moors in 1492

Diego de Siloé (c.1495-1563)

II Herreran style or '*Estilo desornamentado*' (plain style), 1556-1650: adaptation of the design of the Italian High Renaissance by *Juan de Herrera (c.1530-97)*



The Escorial 1574-82 (p.115), Doric Church, first designed by Juan Bautista de Toledo *(d.1567)*, philosopher and mathematician, who worked under Michelangelo; redesigned by *Juan de Herrera (c.1530-97)* built in yellow-grey granite, in 2 : 3 ratios

III 'Churrigueresque', named after *José de Churriguera (1665-1723)*

Cathedral, Santiago de Compostella: west façade, known as 'El Obradoiro', *c.*1738
Fernando de Casas y Novoa (fl. 1711-94)

Charterhouse sacristy, Granada, 1713-47.
Designed by *Francisco Hurtado (1669-1725)*, begun 1730 by *Luis de Arévalo (1727-64)*, stonemason; plasterwork by *Luis Cabello*

The Alhambra, Granada, 1309-54: Moorish stalactite capitals in plasterwork

RENAISSANCE - BAROQUE

Treatises on Architecture known in Elizabethan England:

ITALIAN

Vitruvius
Alberti, 1485
Vignola, 1562
Serlio, 1537-75
(pp.118-119)
Palladio, 1570
(p.129)

FRENCH

Philibert de l'Orme
(*c.*1510-1570)
Nouvelles Inventions
Paris, 1561
Architecture Paris, 1568

J. A. du Cerceau
(*c.*1510-85)
Architecture, 1559
Les Plus Excellents Bâtiments de France,
1576-1579

GERMAN & FLEMISH

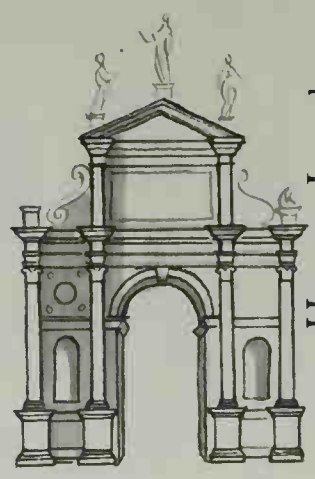
Hans Blum
Quinque Columnarum, *etc.* Zurich, 1550

Vreedman de Vries
(1527-1604)
Architectura
Antwerp, 1563
Compartimenta
Antwerp, 1566

Wendel Dietterlin
(*c.*1550-1599)
Architectura
Nuremberg, 1594-98

Hampton Court Palace

*c.*1525



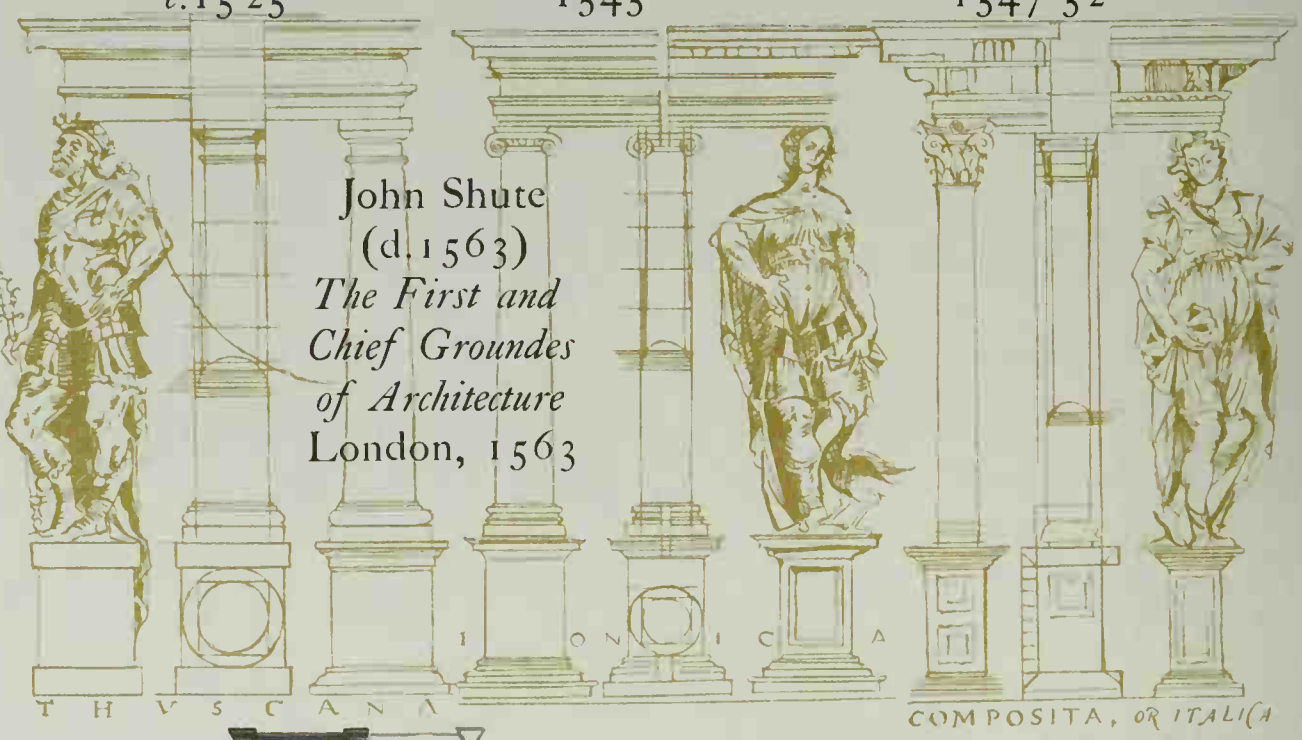
Serlio

1545

Somerset House, London (demolished *c.*1777)

John Thorpe (c.1563-1655)

1547-52

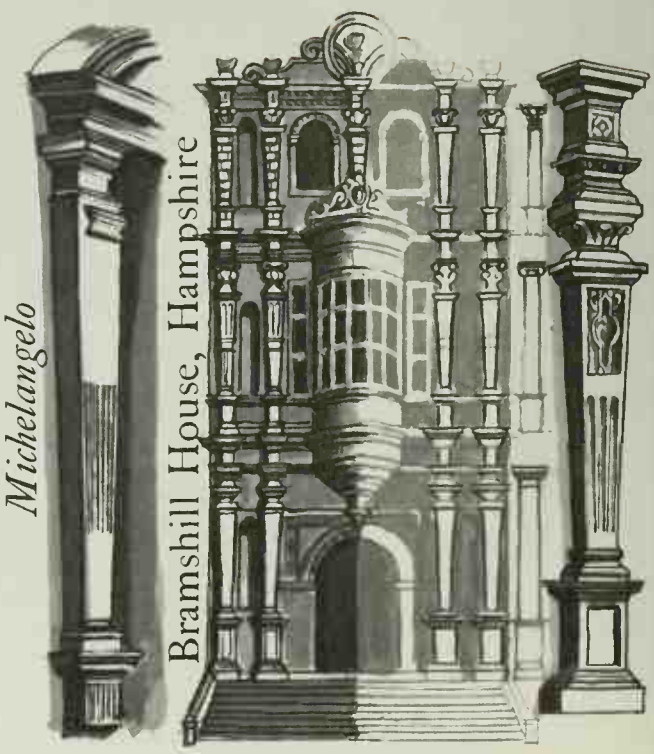


John Shute
(d.1563)
The First and Chief Groundes of Architecture
London, 1563

Dietterlin

Charlton House, Greenwich

*c.*1610



Michelangelo

Bramshill House, Hampshire

1605-12

ENGLAND & THE ROMAN ORDERS

Gonville & Caius College, Cambridge

1572-73

Raynham, Norfolk

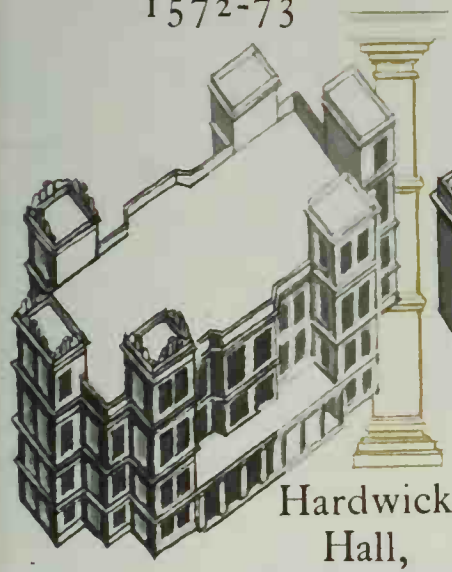
*c.*1635

Amesbury, Wilts: original façade *John Webb (1611-72)*

1661

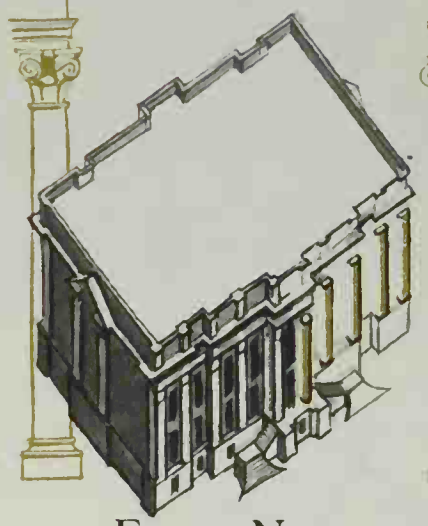
Blenheim Palace, Oxfordshire *Sir John Vanbrugh*

1705-24

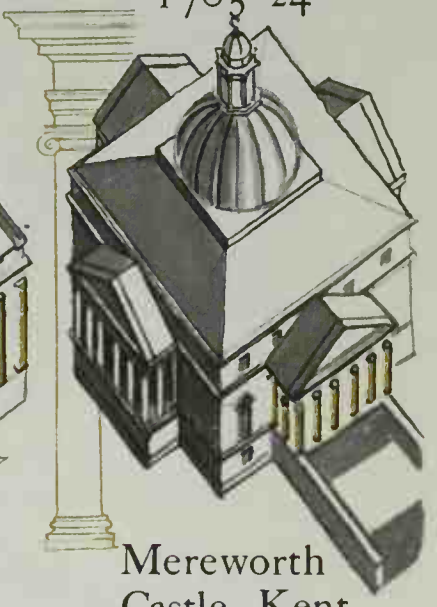


Hardwick Hall, Derbyshire, 1590-97
Probably by Robert Smythson (c.1536-1614)

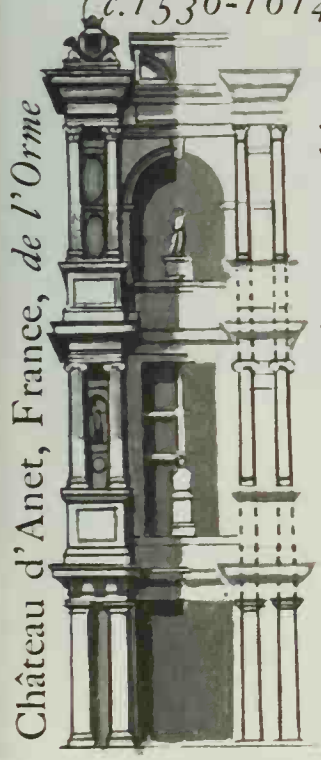
Queen's House, Greenwich, 1616-35
Inigo Jones



Easton Neston, Northants, 1669-*c.*1712
N. Hawksmoor

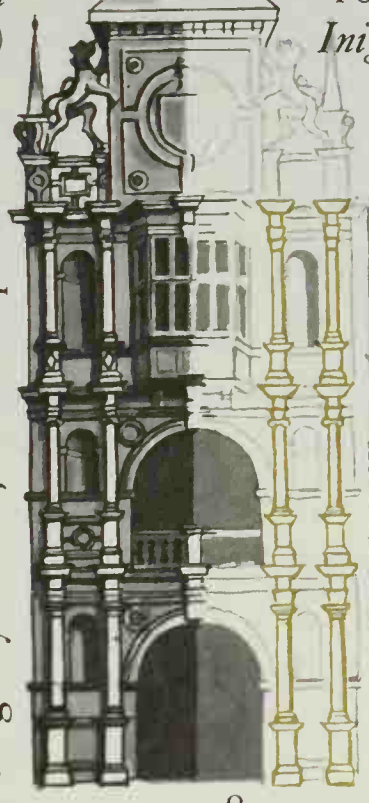


Mereworth Castle, Kent, 1723
Colen Campbell



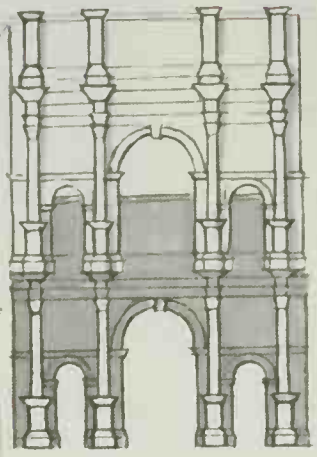
Château d'Anet, France, *de l'Orme*

*c.*1550

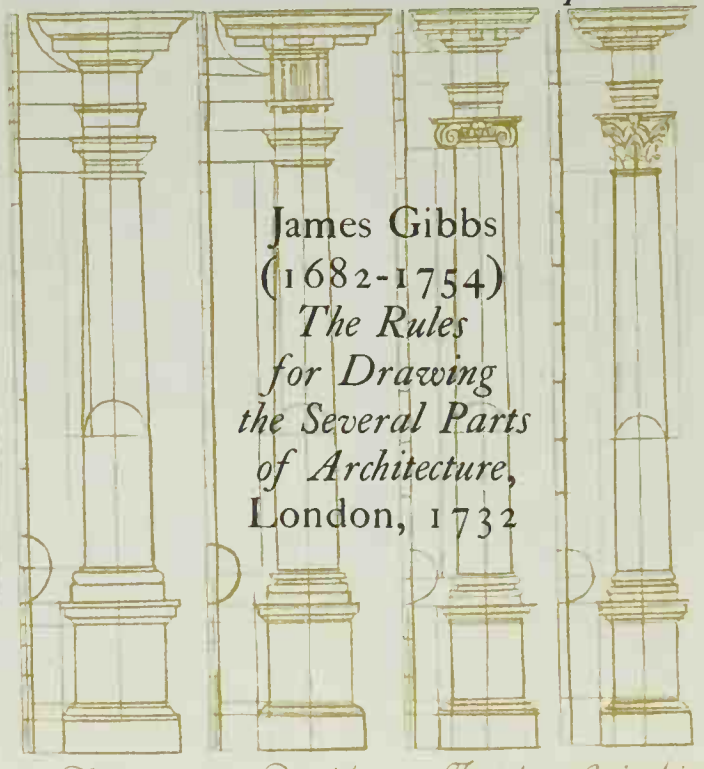


Burghley House, Northamptonshire

1577-83

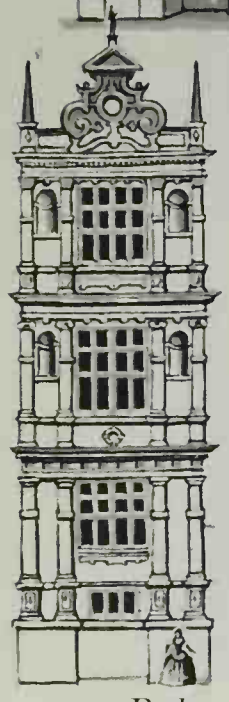


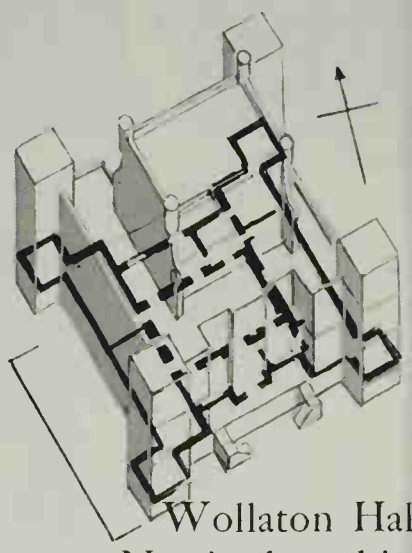
Arch of Constantine, Rome



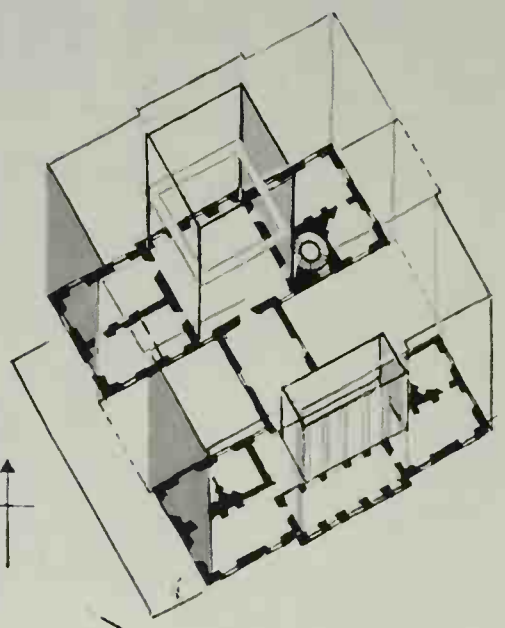
James Gibbs (1682-1754)
The Rules for Drawing the Several Parts of Architecture, London, 1732

RENAISSANCE-BAROQUE



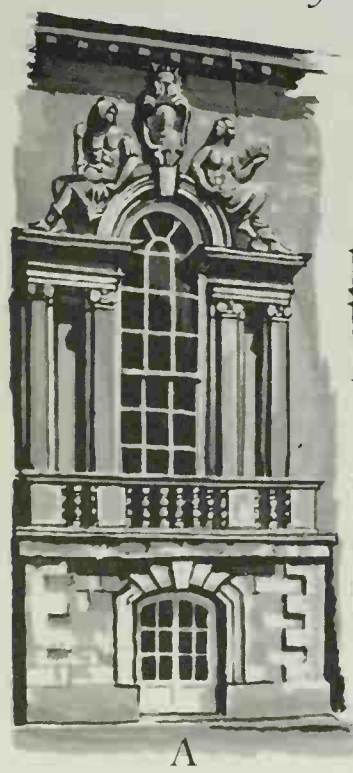


Wollaton Hall,
Nottinghamshire;
1580-88
Robert Smythson (c. 1536-1614)



The Queen's House,
Greenwich, 1616-35.

The first Classical
house in England



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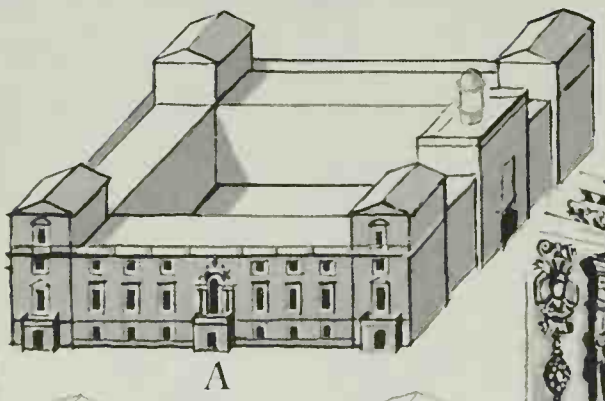

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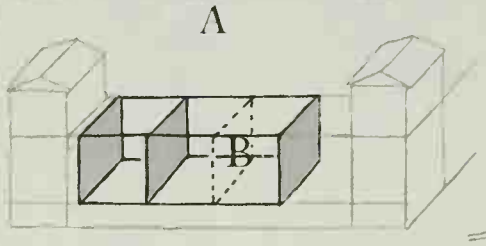
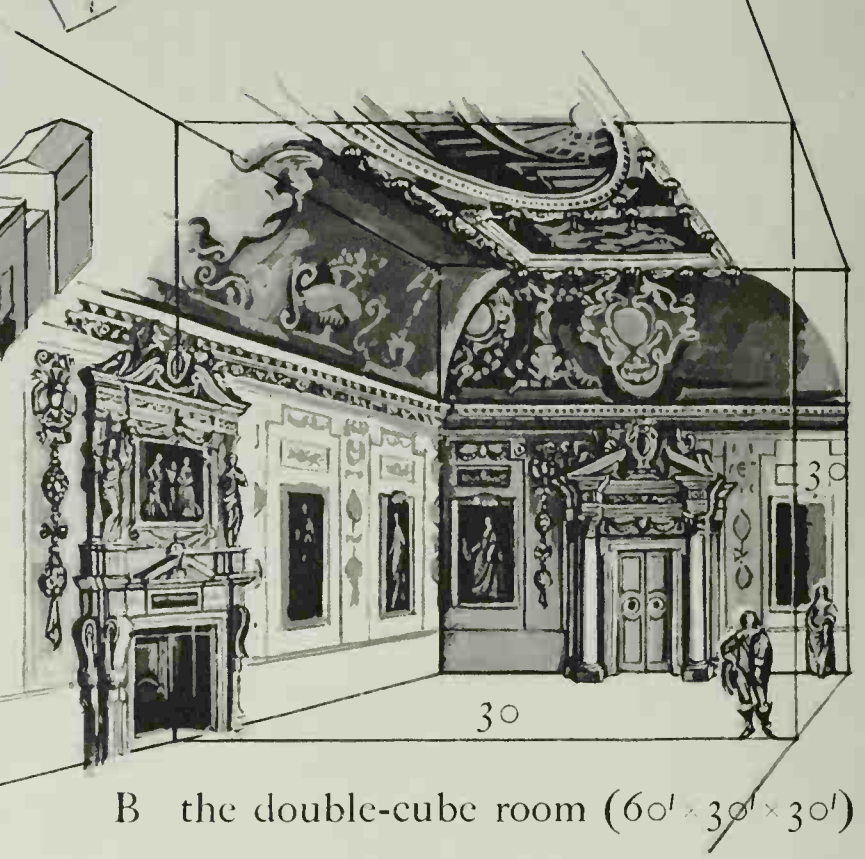


B



30

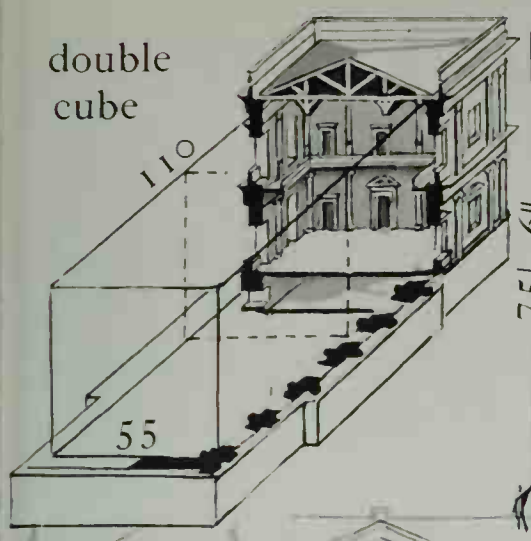
30

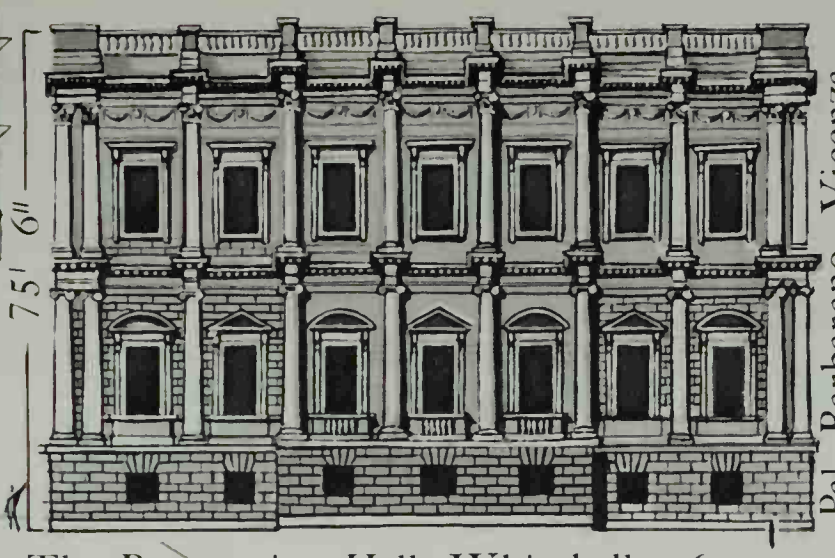
Wilton House,
Wiltshire, 1649-53:

B the double-cube room (60′ × 30′ × 30′)

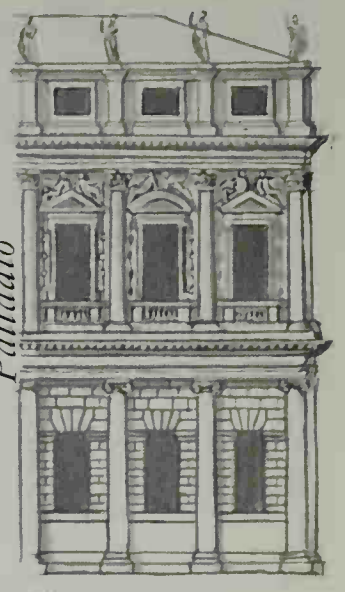
Inigo Jones (1573-1642) 'picture-maker' and architect; visited Italy *c.* 1601-03;
designed court-masques, often collaborating with Ben Jonson until 1631.
Visited Italy again 1613-14; annotated a copy of Palladio's *Architecture*.

ENGLAND, INIGO JONES & ITALY

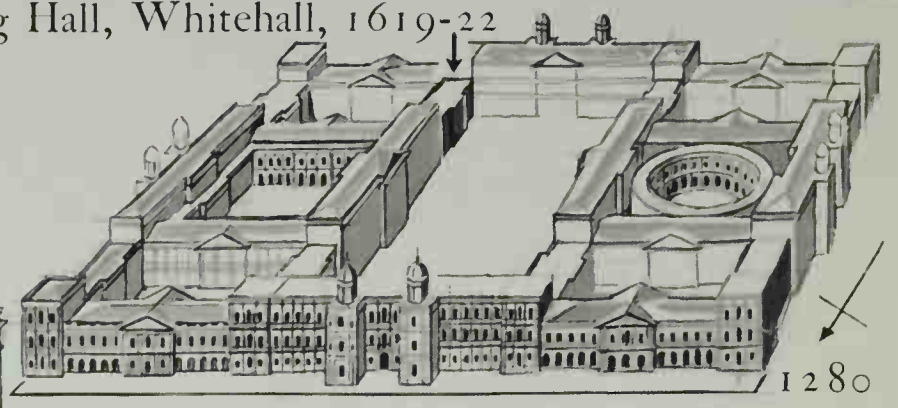




Pal. Barbarano, Vicenza, *Palladio*

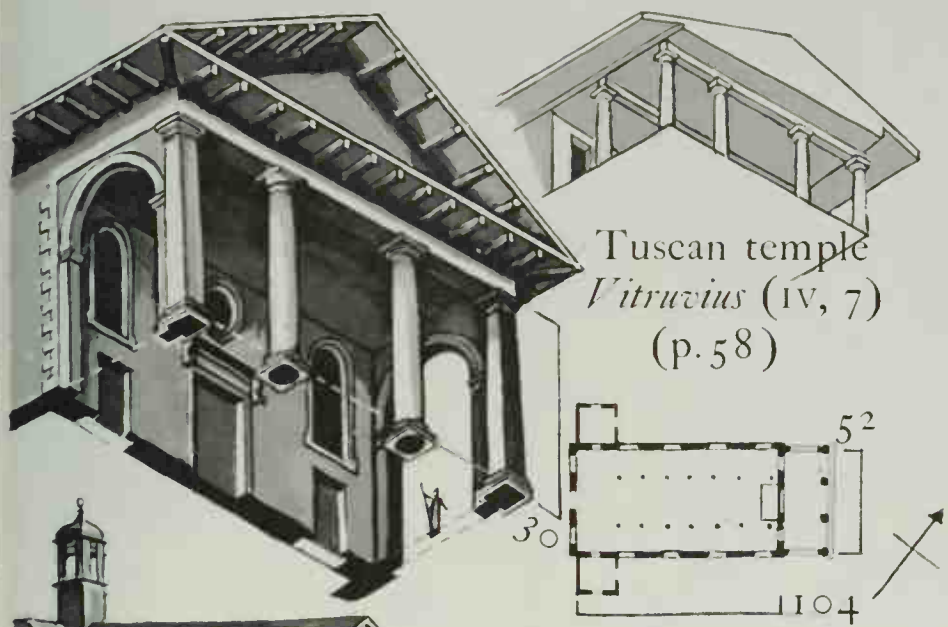


The Banqueting Hall, Whitehall, 1619-22



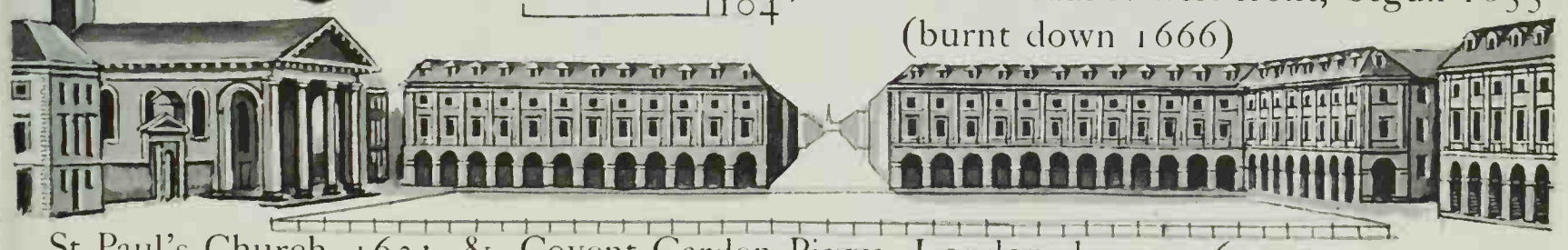
Project for Whitehall Palace
John Webb (1611-72)
assistant to
Inigo Jones

Preliminary designs for the Banqueting Hall



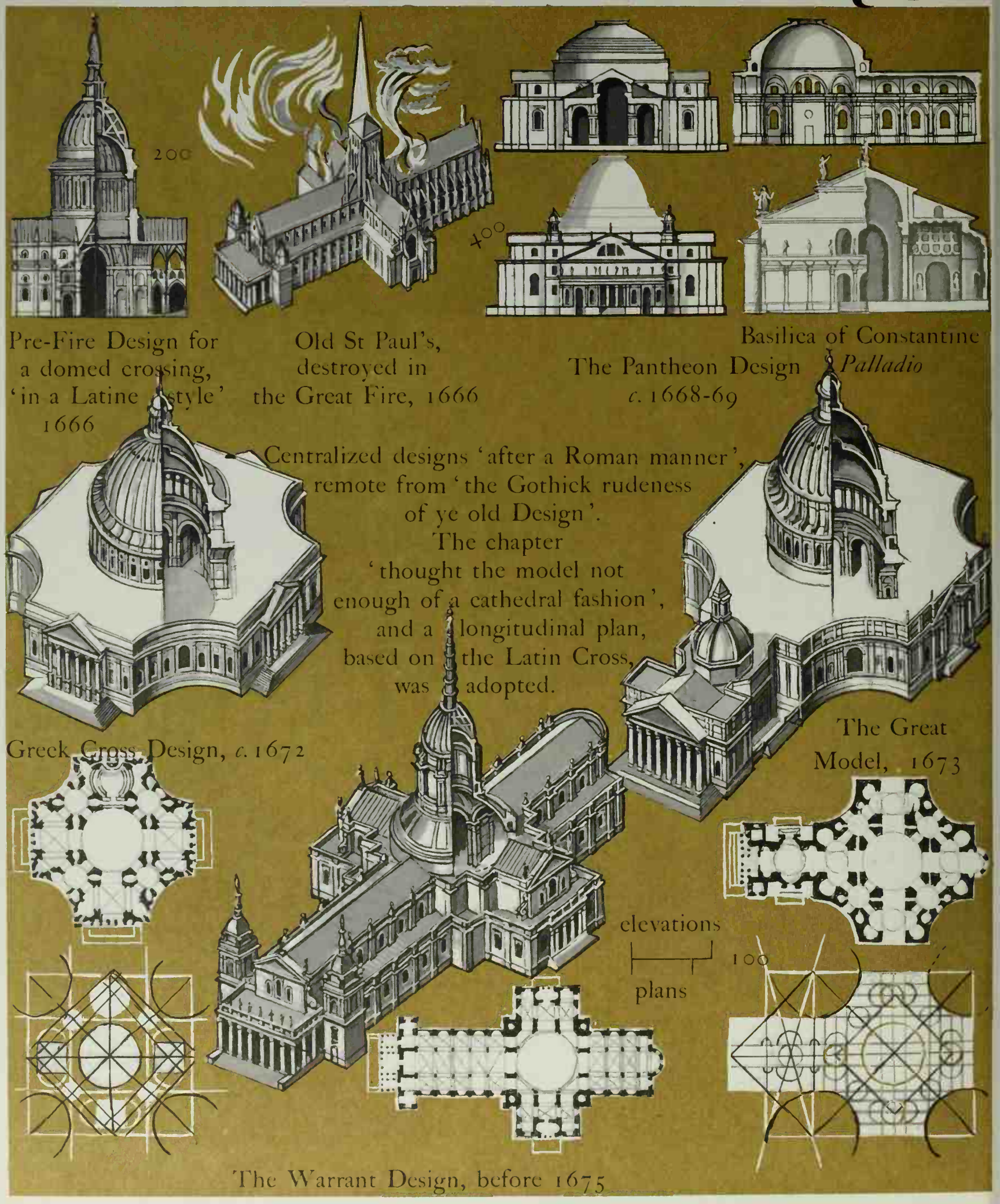
Tuscan temple
Vitruvius (IV, 7)
(p. 58)

Old St Paul's: west front, begun 1633
(burnt down 1666)



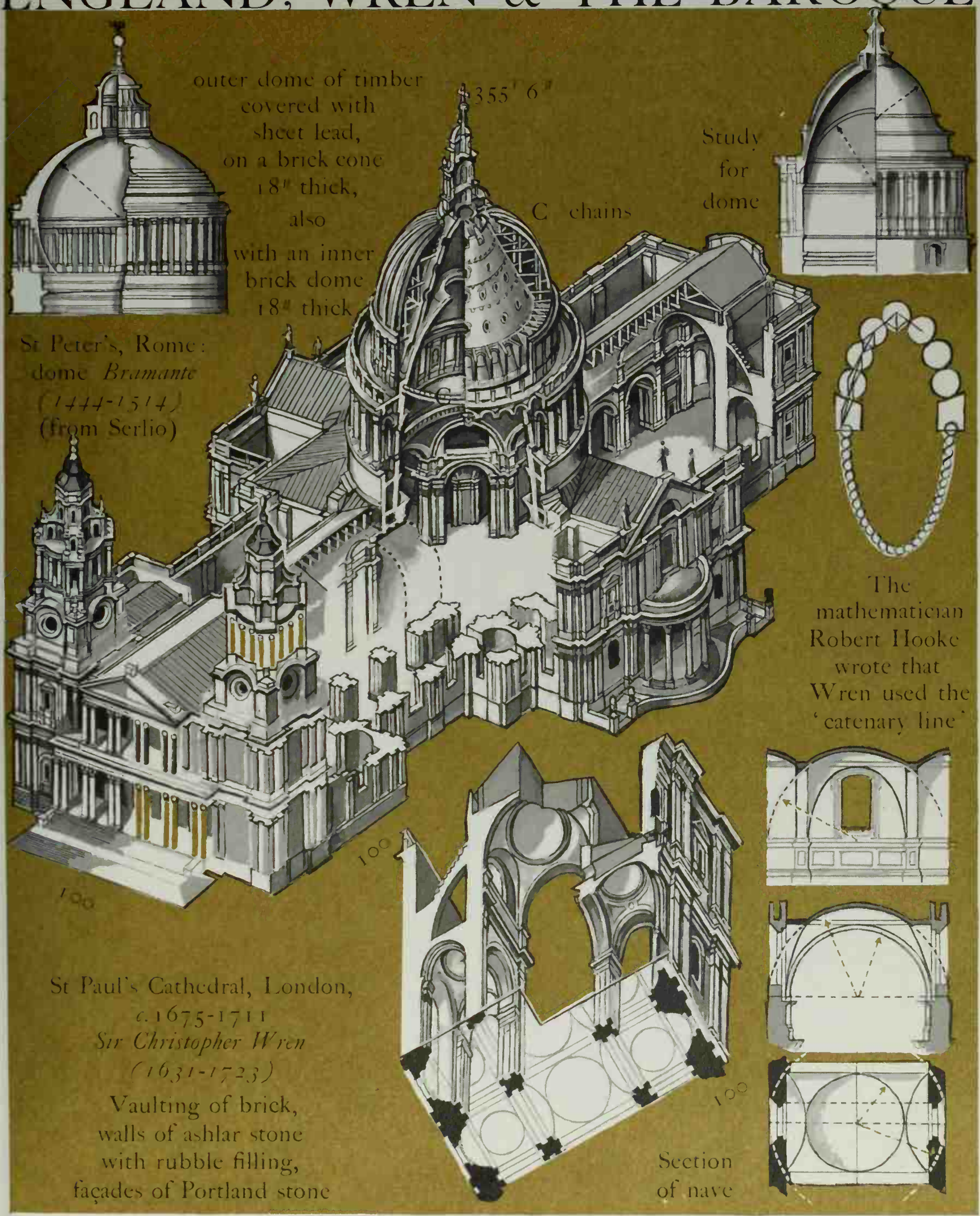
St Paul's Church, 1631 (rebuilt 1795) & Covent Garden Piazza, London, begun 1630 (later demolished)

RENAISSANCE-BAROQUE



Projects for St Paul's Cathedral, London, by *Sir Christopher Wren*

ENGLAND, WREN & THE BAROQUE



St Peter's, Rome: dome *Bramante (1444-1514)* (from Serlio)

St Paul's Cathedral, London, *c.*1675-1711 *Sir Christopher Wren (1631-1723)*
Vaulting of brick, walls of ashlar stone with rubble filling, façades of Portland stone

The mathematician Robert Hooke wrote that Wren used the 'catenary line'

Section of nave

RENAISSANCE - BAROQUE

Sir Christopher Wren (1632-1723).

Early scientific pursuits: optics, hyperbolic lenses & a treatise on cycloids.
Newton in the *Principia* described Wren as 'one of the greatest geometers of our times'.
Professor of Astronomy, London 1657 and Oxford 1661.
First architectural works 1662.
Studied buildings in and around Paris 1665; met F. Mansart, Le Vau, Bernini and probably Guarini.

226' 11"

215' 1"

100

50

50

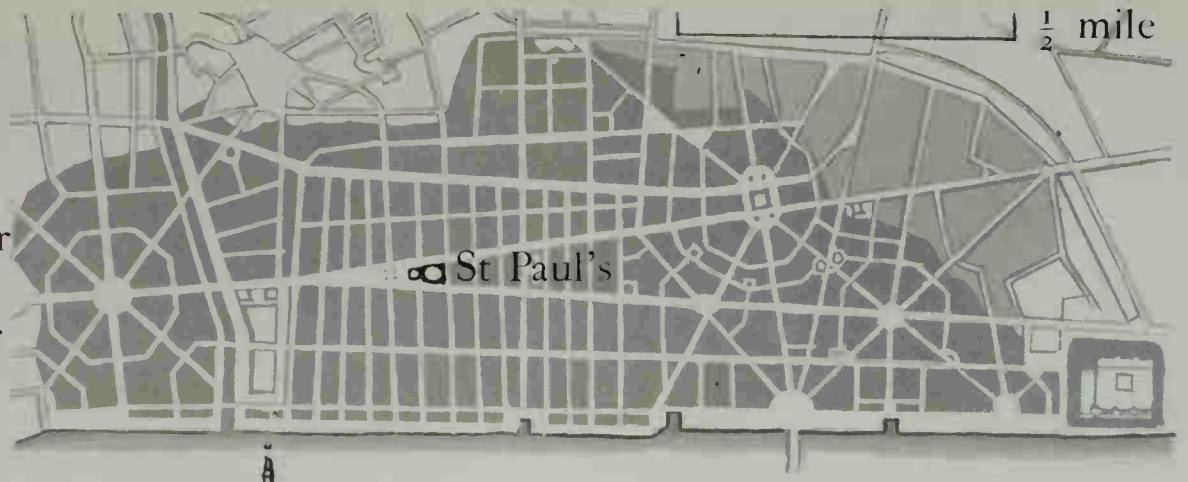
100

St Bride, Fleet Street, 1670-84; spire, 1701-3

St Mary-le-Bow, Cheapside, 1670-83

ENGLAND, WREN'S CITY CHURCHES

The fire of London lasted from 2-5 September 1666. On 11 September

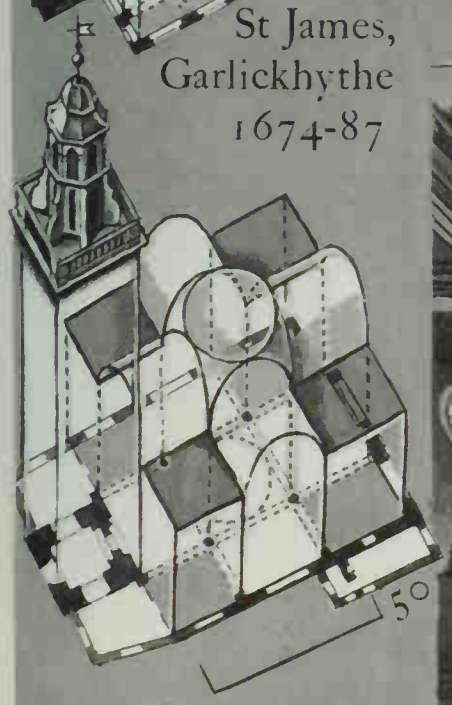


Wren submitted a plan for rebuilding the City of London.

Though this plan was later abandoned, of the 87 churches destroyed 52 were redesigned by Wren as preaching halls for Protestant services.

St James, Garlickhythe 1674-87

St Mary, Abchurch, 1681-86



St Mary-at-Hill, 1670-76

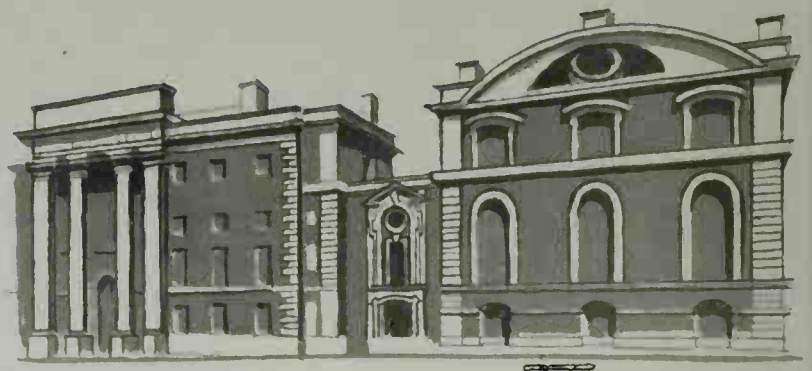
St Stephen, Walbrook, 1672-77

St Antholin, 1682 (Demolished 1874)

RENAISSANCE - BAROQUE

150

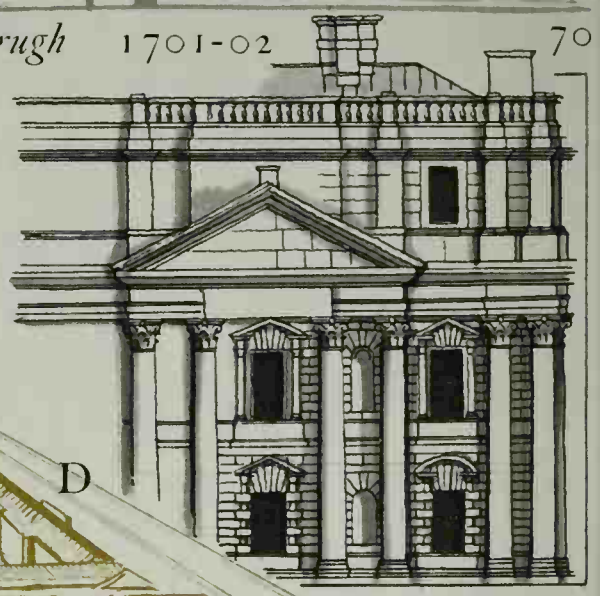
C *Webb* 1662-69



D *Vanbrugh* 1701-02

70

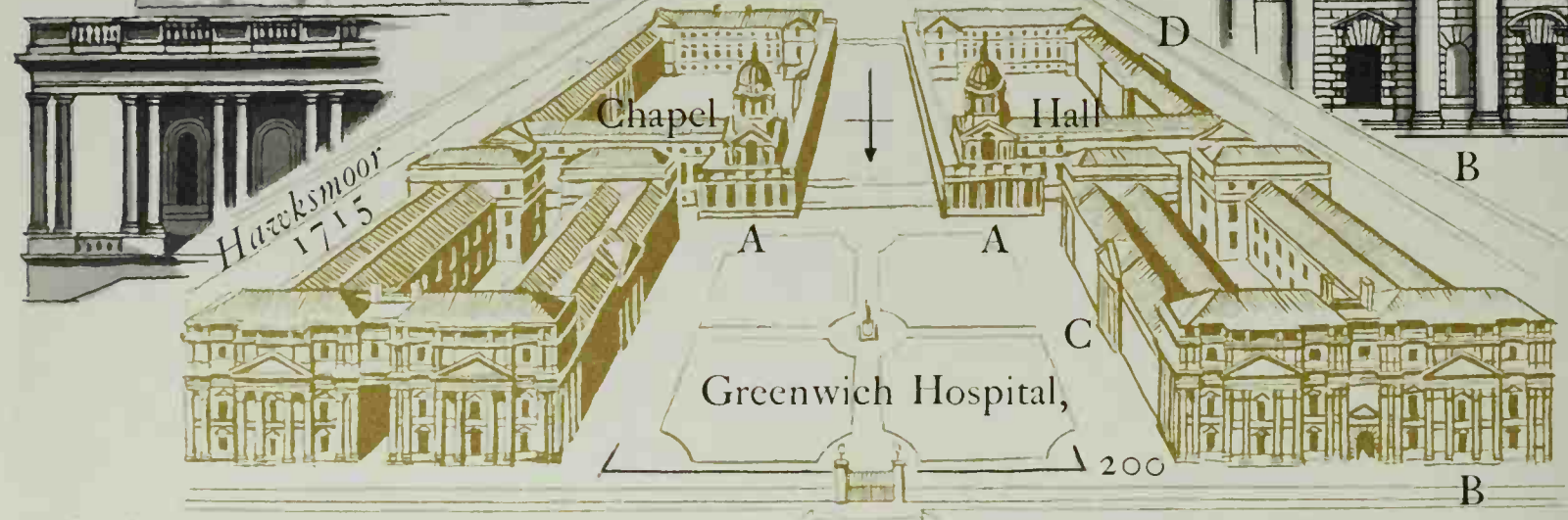
A
Wren



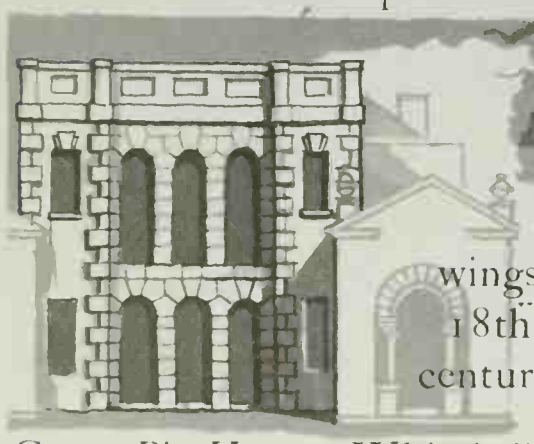
B

The Queen's House,
Inigo Jones 1616-35

D



Commenced as a palace, 1662-69 by *John Webb (1611-74)* a pupil of Inigo Jones, was incorporated into an extensive scheme for a Hospital by *Wren*



wings
18th
century

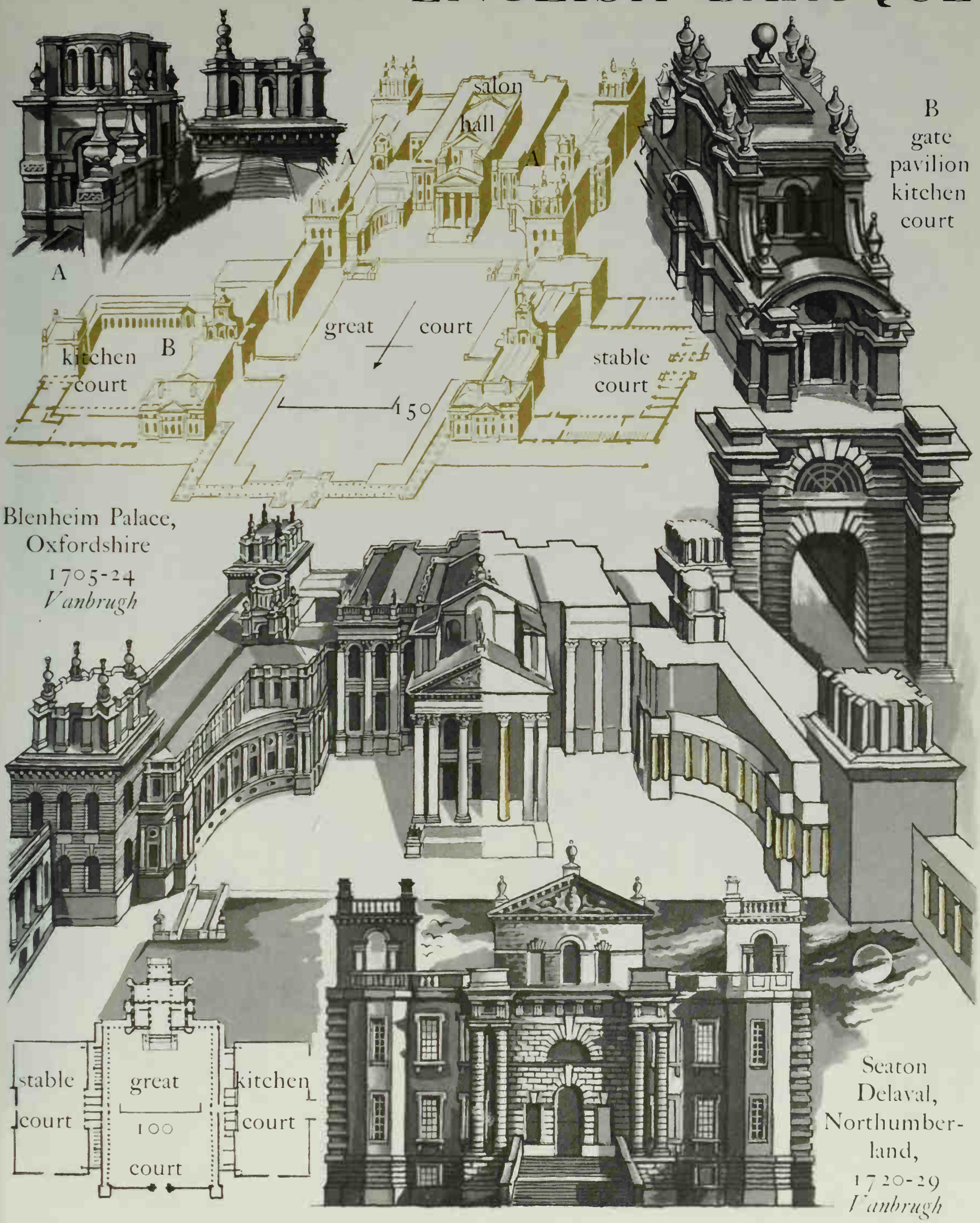
Goose Pie House, Whitehall: Vanbrugh's House, *c.*1700

Vanbrugh's House, Esher, 1711 'the embattled manner'

Vanbrugh Castle, Greenwich, *c.*1717

Sir John Vanbrugh (1664-1726) commissioned in the army; playwright 1696-1705; became an architect 1699. Hawksmoor worked with Vanbrugh on his four great houses.

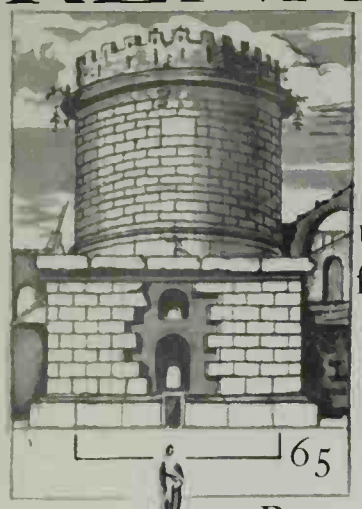
ENGLISH BAROQUE



Blenheim Palace,
Oxfordshire
1705-24
Vanbrugh

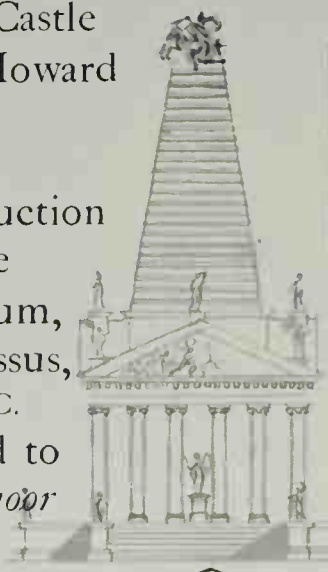
Seaton
Delaval,
Northumber-
land,
1720-29
Vanbrugh

RENAISSANCE - BAROQUE

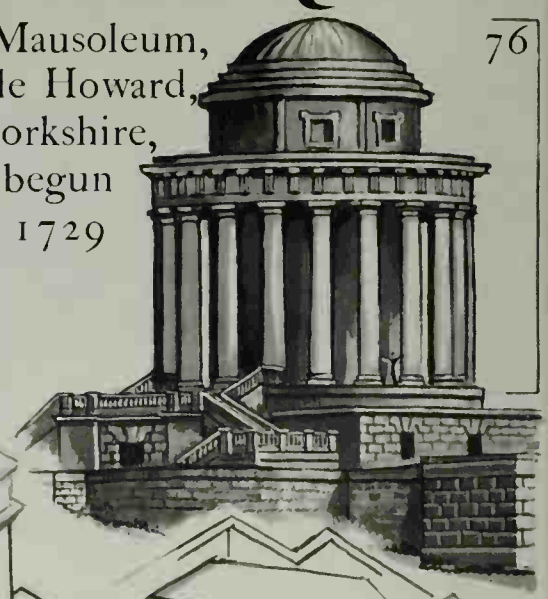


65

Tomb of Metella, Rome, *c.* 10 B.C.: engraving by *Bartoli* 1697, used by *Hawksmoor* for the Mausoleum, Castle Howard



Reconstruction of the Mausoleum, Halicarnassus, 353 B.C. ascribed to *Hawksmoor*



76

the Mausoleum, Castle Howard, Yorkshire, begun 1729

St George, Bloomsbury, London, 1720-30

100

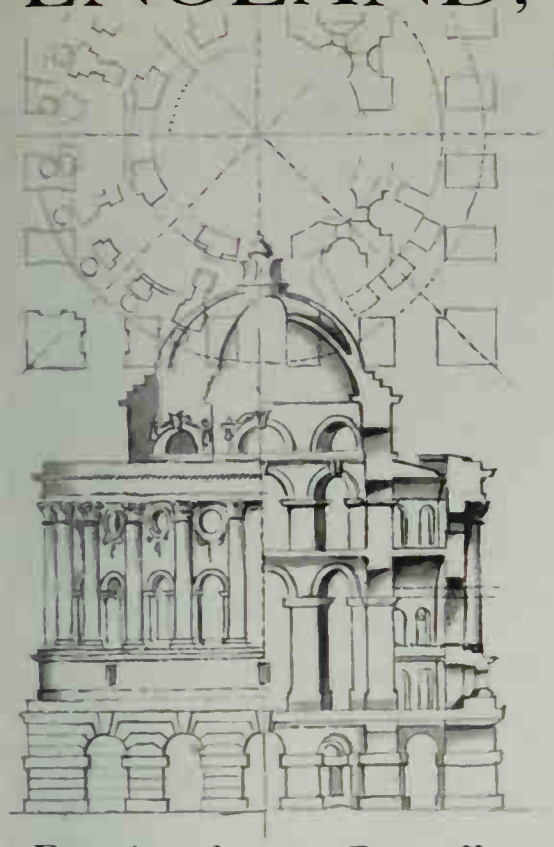
St Anne, Limehouse, London, 1712-24 *Hawksmoor*

100

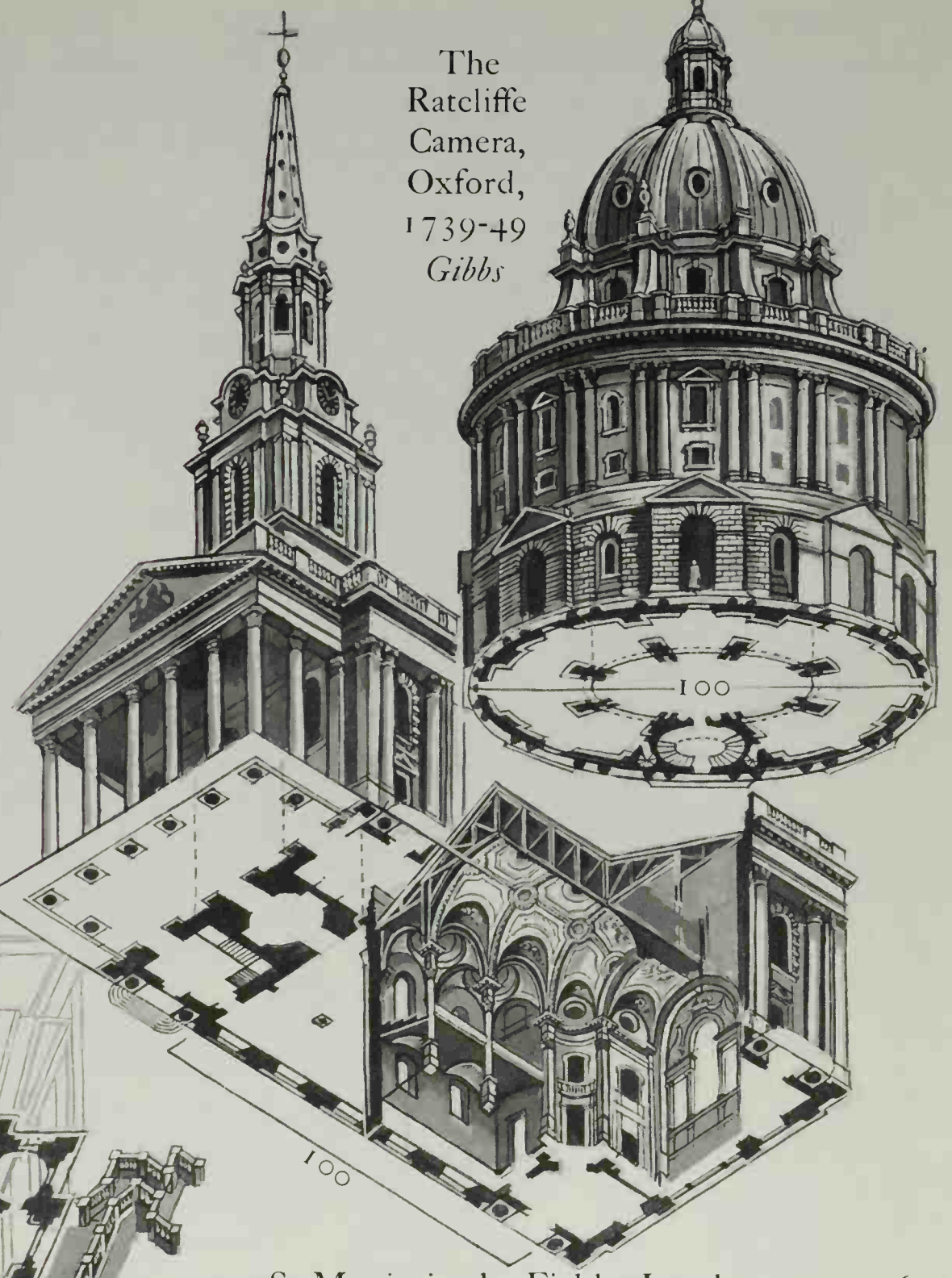
St Mary Woolnoth, 1716-27

Nicholas Hawksmoor (1661-1736) clerk and assistant to Wren, worked with Vanbrugh until the latter's death in 1726. Built six London churches under the Act for 'Building... fifty new churches', 1711, had schemes for replanning Oxford and Cambridge in a Roman manner

ENGLAND, THE ROMAN MANNER

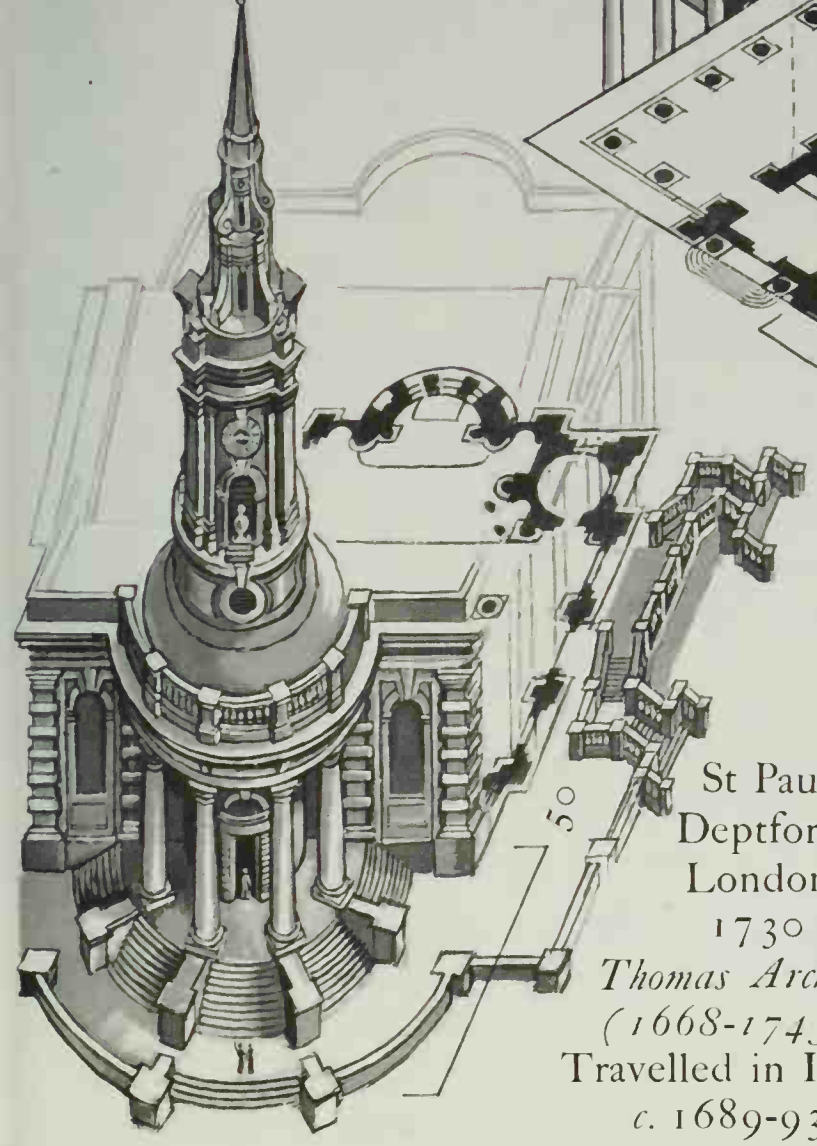


Drawing for the Ratcliffe Camera, Oxford, by *Hawksmoor*, *c.*1714



The Ratcliffe Camera, Oxford, 1739-49 *Gibbs*

St Martin-in-the-Fields, London, 1721-26
James Gibbs
(1682-1754)
Travelled in Holland, France & Italy 1694-1709 & worked under *Carlo Fontana* *(1634-1714)* in Rome 1707-09

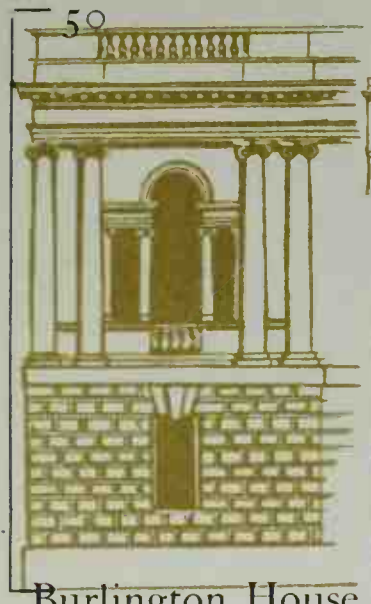


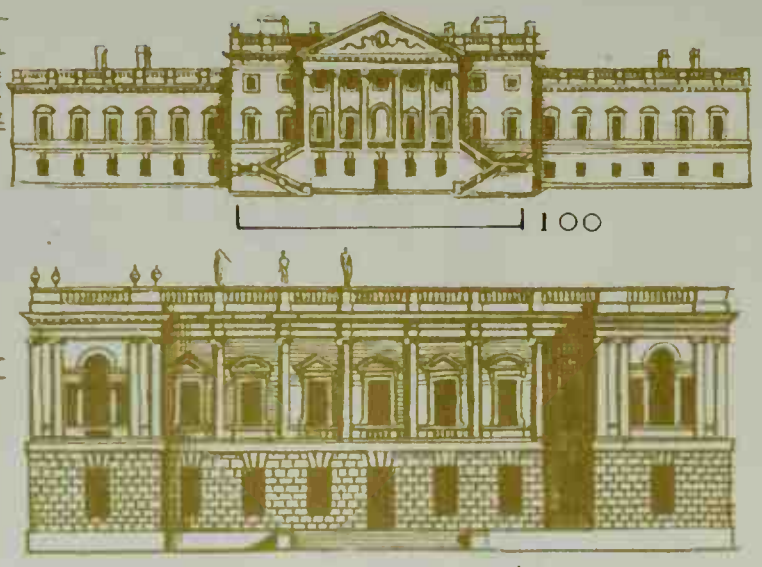
St Paul, Deptford, London, 1730
Thomas Archer
(1668-1743)
Travelled in Italy *c.* 1689-93

A Book of Architecture London 1728

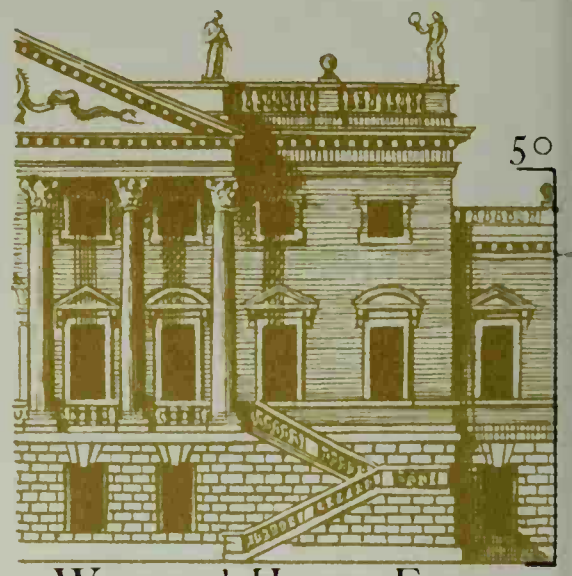
Rules for Drawing the Several Parts of Architecture London 1732

RENAISSANCE-BAROQUE

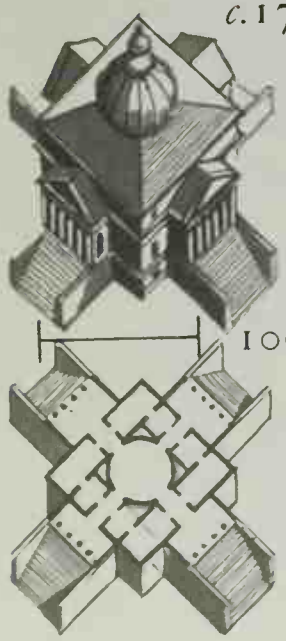




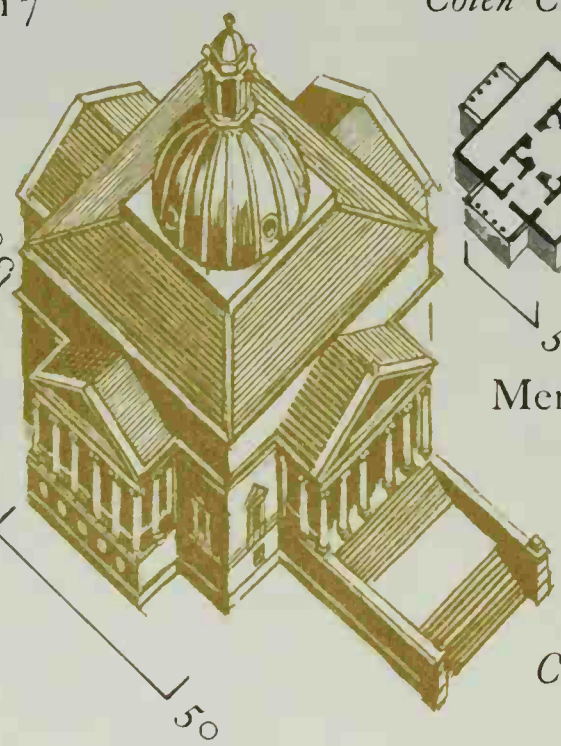
Burlington House, London, *c.*1717
Colen Campbell

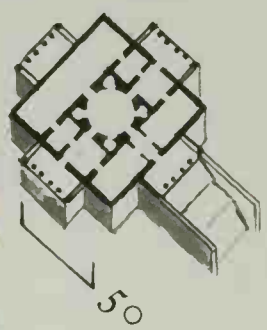


Wanstead House, Essex, 1715-20 (demolished 1822)

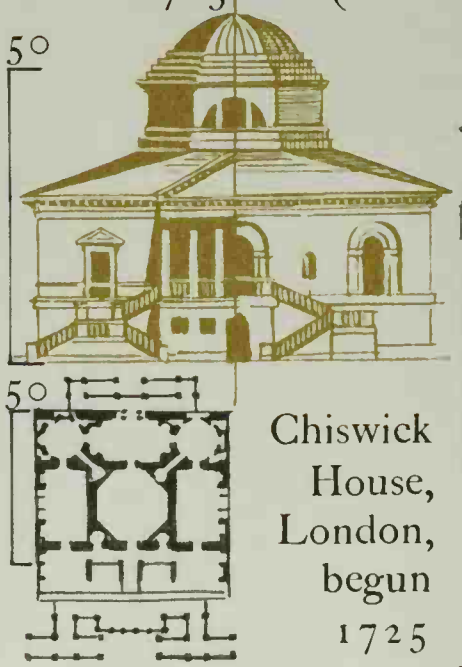


Villa Rotonda
Palladio

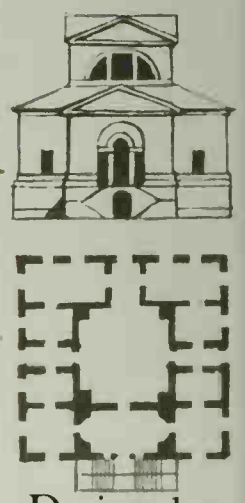




Mereworth Castle, Kent, 1723
Colen Campbell



Chiswick House, London, begun 1725
Lord Burlington



Design by *Palladio* or *Scammozzi* (1552-1616)

Palladio (pp.128-9)

I Quattro Libri dell' Architettura
Venice 1570

translated by Nicholas Dubois 1715-17, with plates by Giacomo Leoni

Colen Campbell (d.1729)

Vitruvius Britannicus
1715-17
100 engravings of classical houses in England. Praised both Palladio and Inigo Jones

William Kent (1685-1748)

Designs of Inigo Jones
1727

Lord Burlington (1694-1753)

Fabbriche antiche
1730
engravings from Palladio's drawings

Increase of trade & agricultural prosperity enriched the nobility, who built country houses which, in reaction to the Baroque, followed the classical rules of the Augustan Age, *c.*1680-1750. *Lord Burlington (1694-1753)* went on the Grand Tour to Italy in 1714-15 and 1719 to study Palladio's buildings, and, with *Colen Campbell*, *William Kent*, *Giacomo Leoni* and others, developed the Palladian style in England

ENGLAND, THE PALLADIAN HOUSE

Reconstruction of Vitruvius' Egyptian Hall by *Palladio*

Assembly Rooms, York, 1730: *Lord Burlington*

50

kitchen wing

guest wing

hall

chapel

library wing

hall

100

Holkham Hall, Norfolk, begun 1734 *Lord Burlington* and *William Kent*

50

40

Terrace with palace facade:

Queen Square, 1729 *John Wood the Elder*

The Circus, begun 1754

Royal Crescent, 1767-75

Bath

400

John Wood the Elder (1704-54) aimed to rebuild Bath as a Roman City

John Wood the Younger (1728-81)

RENAISSANCE - BAROQUE

Prior Park, Bath, 1735-43:
John Wood the Elder (1704-54)

Palladian bridge, 1756

Revival of Greek architecture *c.*1750

James Stuart (1713-88) & Nicholas Revett (*c.*1721-1804)
The Antiquities of Athens
1762

The Parthenon
The Antiquities of Athens

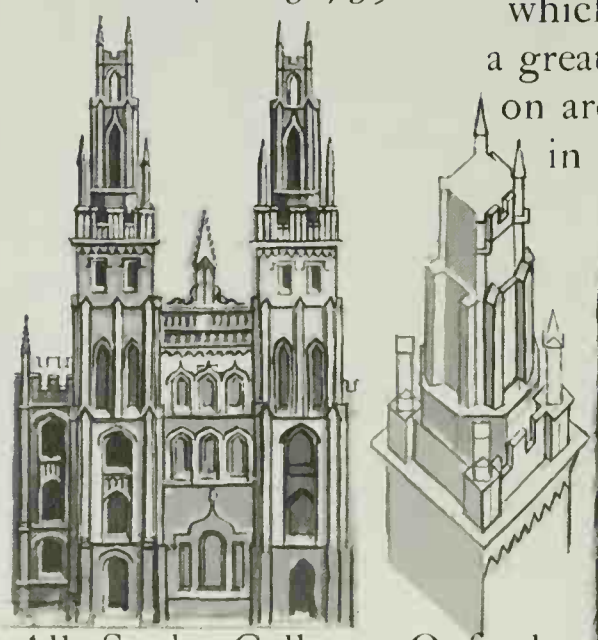
From c.1700 onwards, the Grand Tour was made through the Alps into Italy, and the 'beautiful' prospects of Claude, and the 'sublime' landscapes of Rosa were brought back to England

Claude Lorraine (1600-82)

Giovanni Battista Piranesi (1720-78)
Italian artist, published etchings of Roman magnificence, antique & Baroque, & prison interiors, which exerted a great influence on architecture in Europe.

Salvator Rosa (1615-73)

Belvedere, Claremont, Surrey, 1715 *Vanbrugh*



All Souls College, Oxford, *c.*1730 *Hawksmoor*

Landscape *Robert Adam (1728-92)*

ENGLAND, THE PICTURESQUE

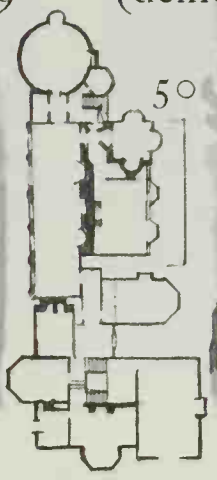
The High School, Edinburgh, begun 1825 *Thomas Hamilton (1785-1858)*

St Pancras, London, 1818-22 *H. W. Inwood (1794-1843)*

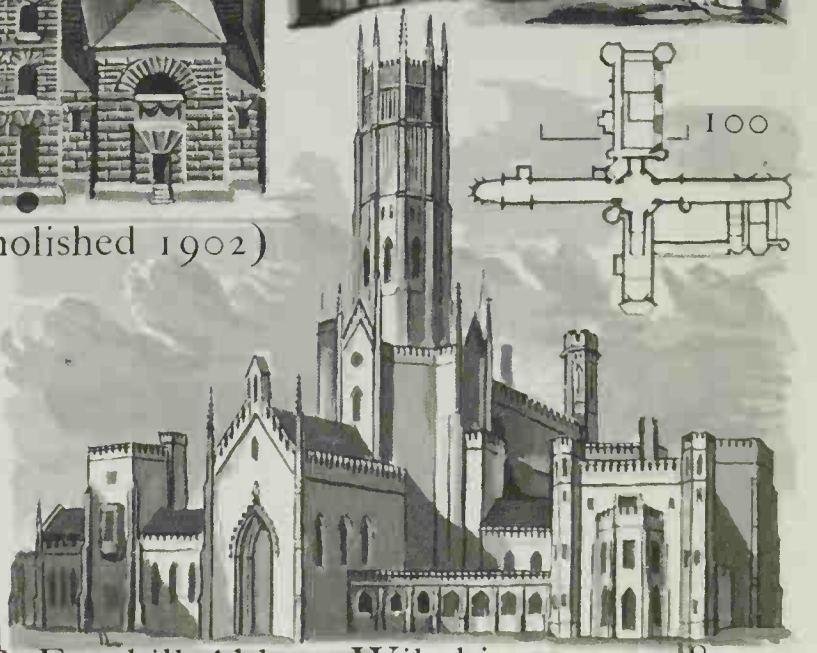
Somerset House, London: river front, 1776-86 *Sir William Chambers (1723-96)*

Rotunda, Bank of England, London, 1788-1808 *Sir John Soane (1753-1837)*

Newgate Prison, London, begun 1769 (demolished 1902) *George Dance II (1741-1825)*



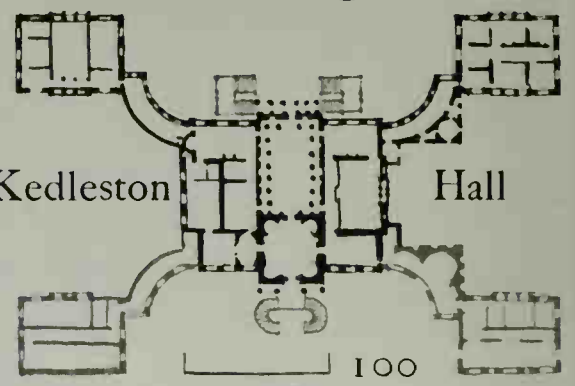
Strawberry Hill, Twickenham, begun 1748 *Horace Walpole (1717-97)*



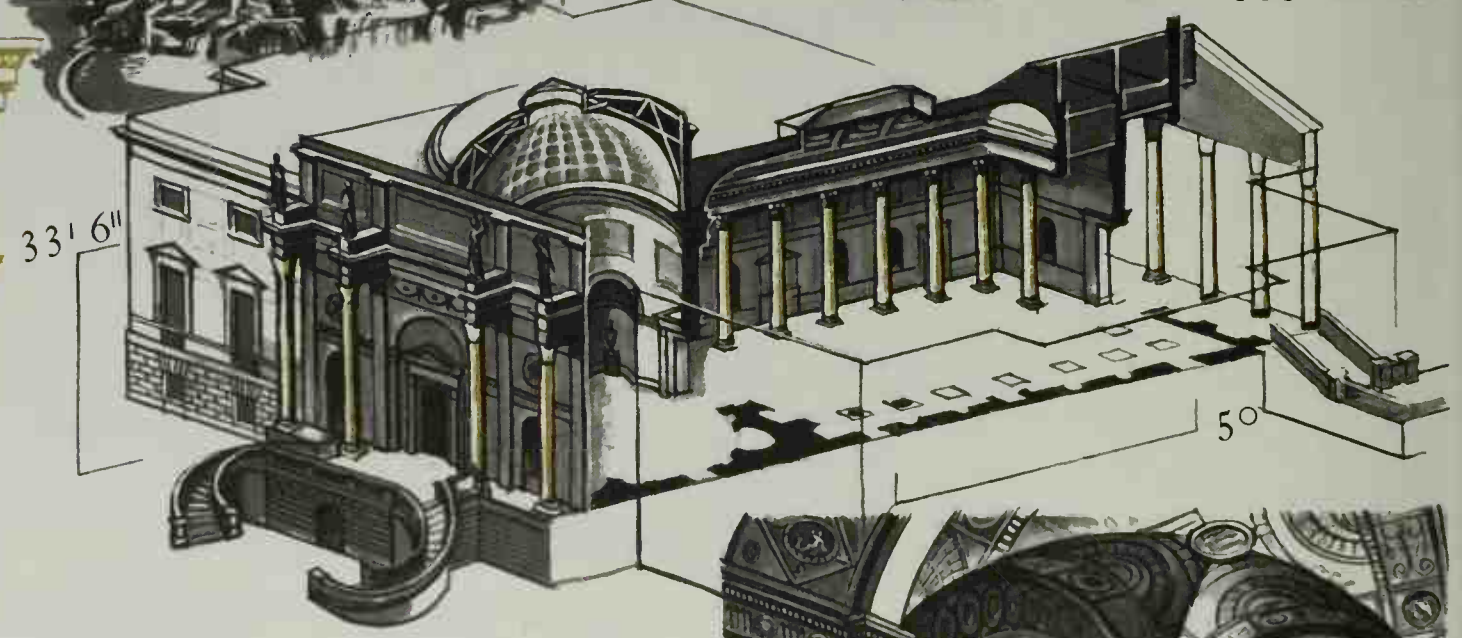
Fonthill Abbey, Wiltshire, 1795-1807 *James Wyatt (1747-1813)*

RENAISSANCE - BAROQUE

Fontana Trevi, Rome, 1732-1762 *Salvi*

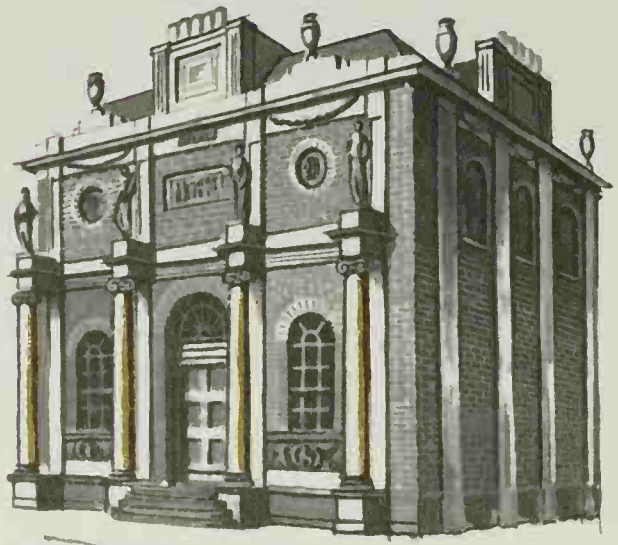


Gate column: Syon House, Middlesex, 1762-63 *Robert Adam*



Kedleston Hall, Derbyshire, 1756-70 designed by *James Paine (1725-89)*; south front & interior by *Robert Adam (1728-92)*. Studied in Italy 1754-58

26, Grosvenor Square, London, 1773-74 *Adam* (demolished 1862)

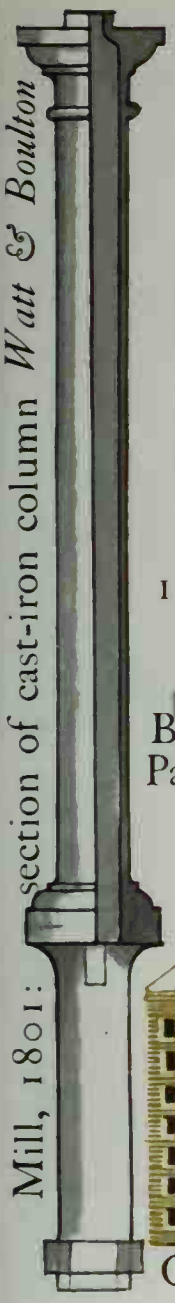


Pitzhanger Place, Middlesex, 1800-1803

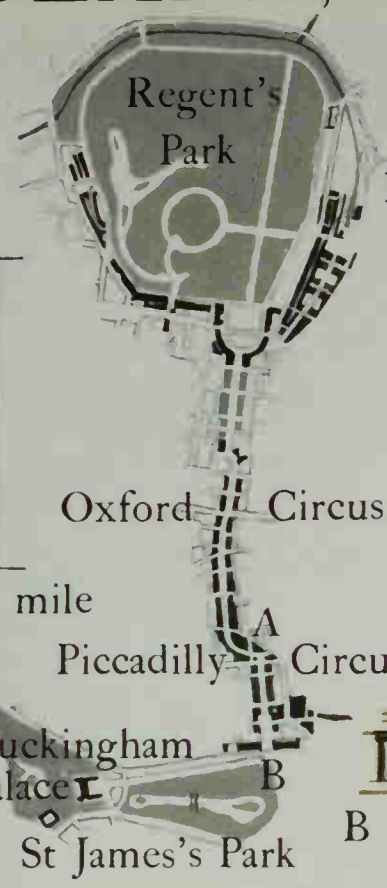
Bank Stock Office, Bank of England, 1792-93 (demolished 1927)

Sir John Soane (1753-1837) Visited Italy 1778-1780

ENGLAND, STONE, BRICK & IRON

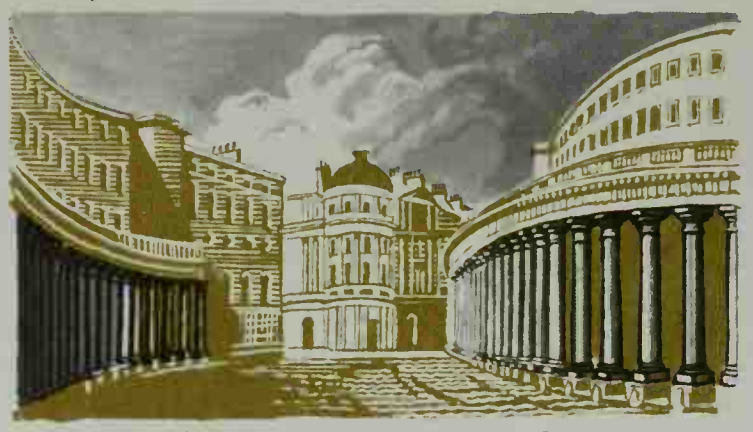

Section of cast-iron column *Watt & Boulton*

Mill, 1801:

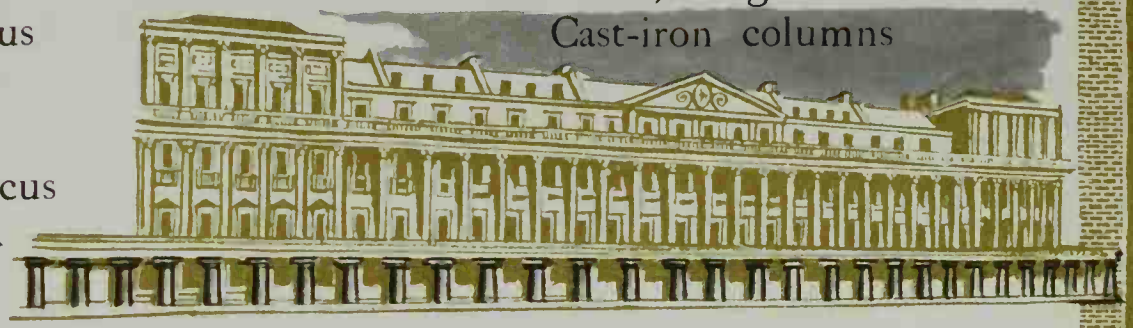


London's 'Metropolitan Improvements' 1812-1835

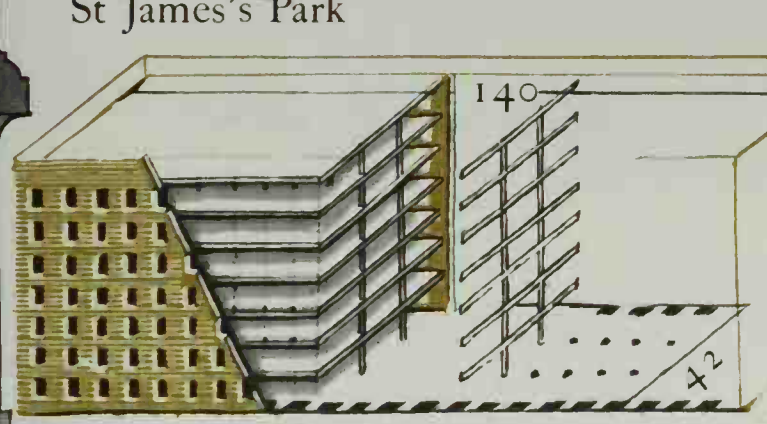
John Nash (1752-1835)



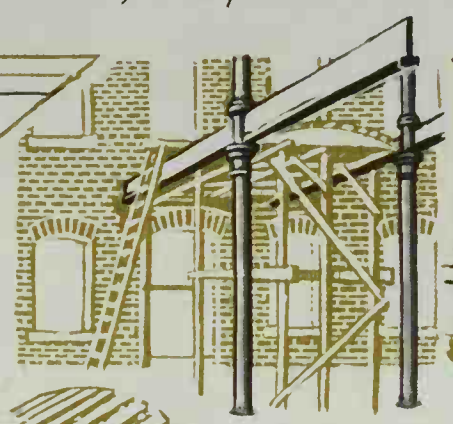
A The Quadrant, Regent Street 1818 Cast-iron columns



B Carlton House Terrace, 1827 Cast-iron Doric columns



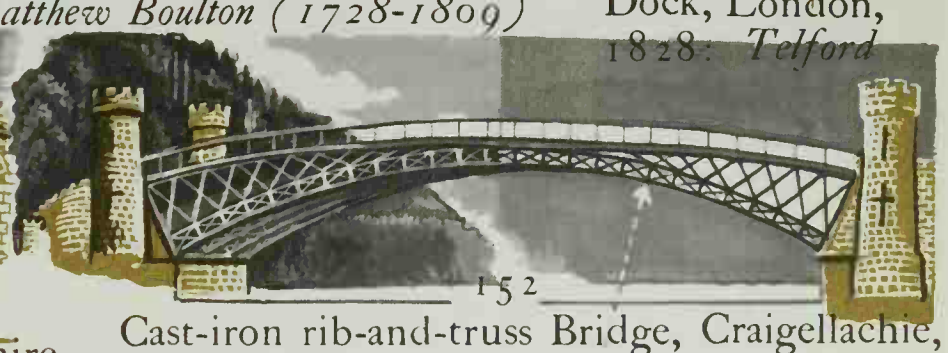
Cotton mill, Manchester, 1801. Cast-iron columns & beams
James Watt (1736-1819) & Matthew Boulton (1728-1809)



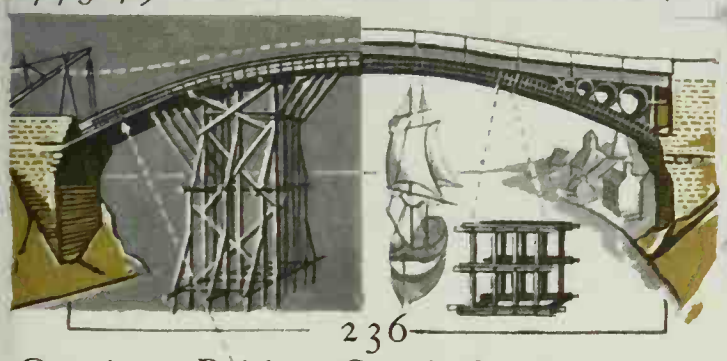
St Katherine's Dock, London, 1828: *Telford*

iron columns

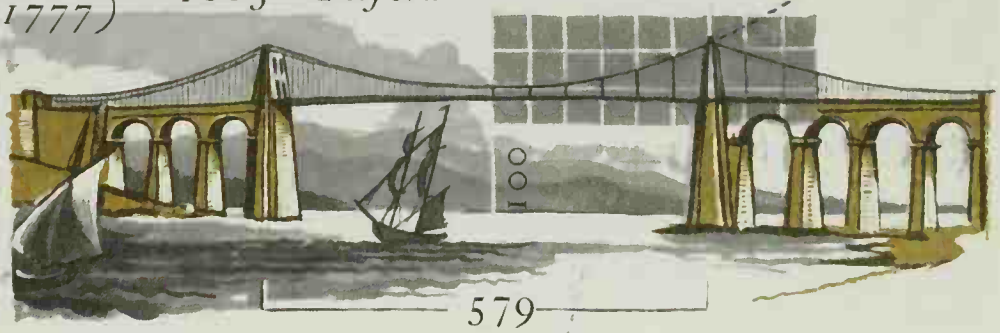
First iron bridge: Coalbrookdale, Shropshire, 1775-79 *Thomas Farnoth Pritchard (d.1777)*



Cast-iron rib-and-truss Bridge, Craigellachie, 1815 *Telford*



Cast-iron Bridge, Sunderland, 1793-96



Suspension Bridge, Menai Straits, 1819-26
William Telford (1751-1834)

19TH & 20TH CENTURIES

A.D. 1000 1500 1700 1800 1850 1900

Columbus 1492

Magellan 1497-9

Russia

U.S.A.

Spanish 1763 Portuguese English Trade and Colonies

100

Roman Renaissance
Greek Gothic Baroque

photography 1839

glider

steam engine 1769

printing *c.*1450

petrol engine 1873

*c.*1750 INDUSTRIAL REVOLUTION

Newton (1642-1727)

Copernicus (1473-1543)

earth sun

1543

law of gravitation 1687

Gauss (1777-1855)

Faraday (1791-1867)

first dynamo 1834

Clerk Maxwell (1831-1879)

electro-magnetism 1864

constant speed of light 18,600 miles per second 1887

Marie Curie (1867-1934)

radio-activity, radium

a
b c
abc > 180°
curved space

The Roman Empire

The Medieval Universe

1792 - 1865

Capitol, Washington

Houses of Parliament, London 1840-65

Eifel Tower, Paris, 1889

579

Menai suspension bridge, 1819-21

Crystal Palace, London, 1851

Parthenon, Athens

Pantheon, Rome

Beauvais Cathedral

St Peter's, Rome

St Paul's, London

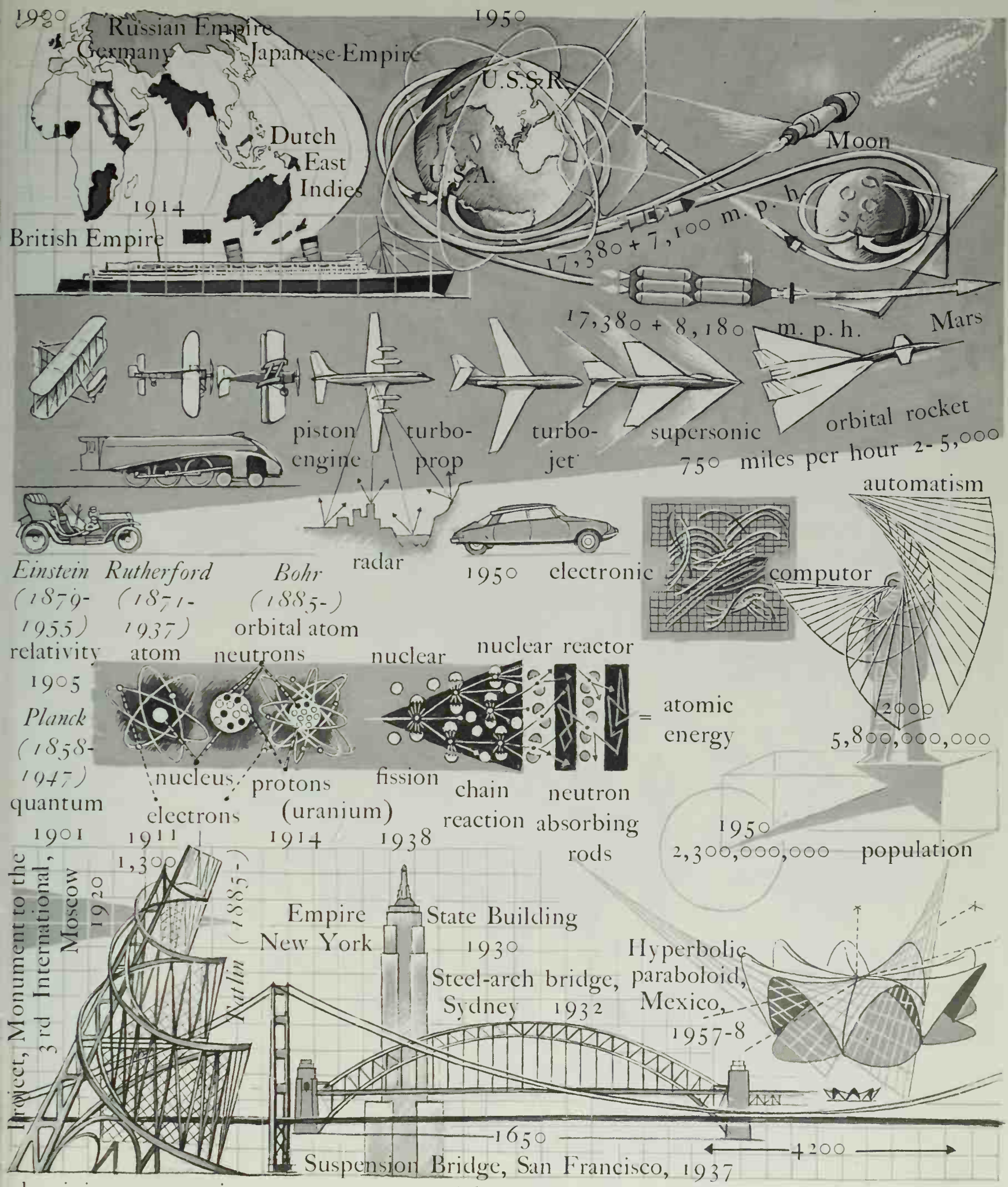
buildings in black to the same scale

100 500

timber stone brick cast iron wrought iron steel (mass-produced)

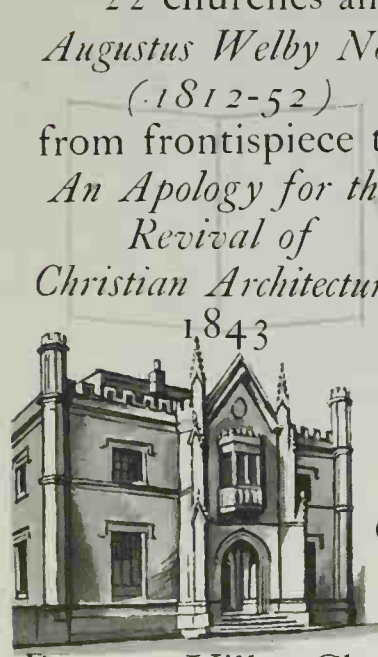
Portland cement reinforced concrete

INTRODUCTION



19TH & 20TH CENTURIES

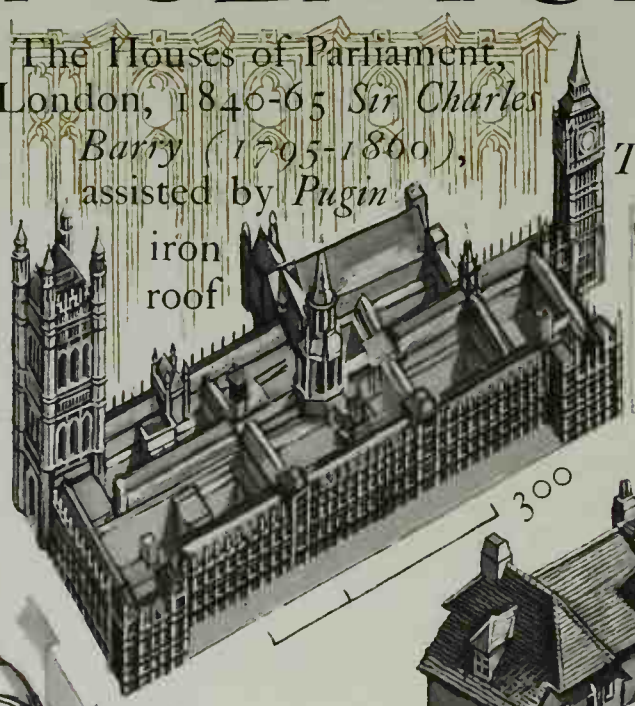
22 churches and chapels built by *Augustus Welby Northmore Pugin (1812-52)* from frontispiece to *An Apology for the Revival of Christian Architecture*, 1843



Gothic

Regency Villas, Cheltenham, *c.*1825

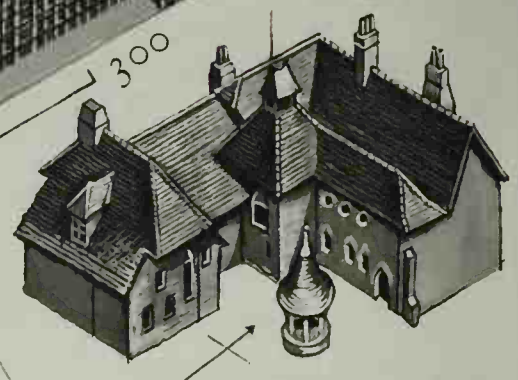
Classic



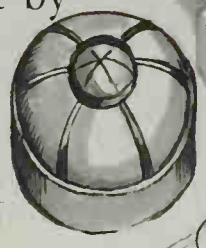
The Houses of Parliament, London, 1840-65 *Sir Charles Barry (1795-1860)*, assisted by *Pugin*

iron roof

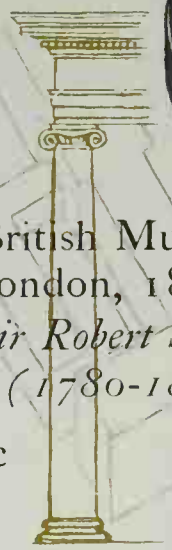
John Ruskin (1819-1900), *The Seven Lamps of Architecture*, 1849 *The Stones of Venice*, 1851



The Red House, Kent, 1859 *Philip Webb (1831-1915)* for *William Morris (1834-96)*



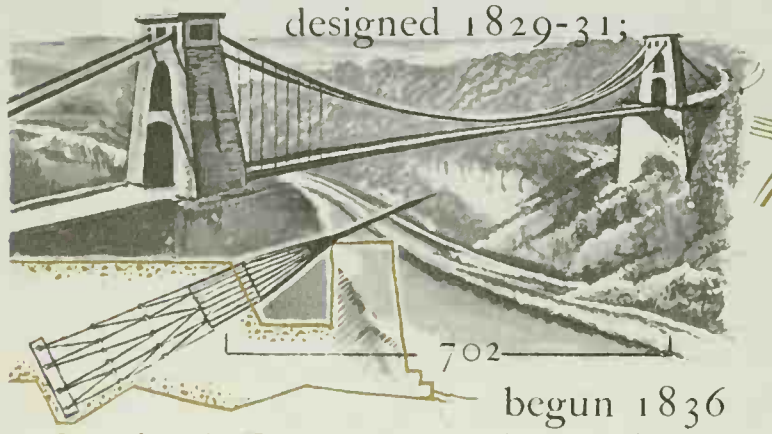
cast-iron dome *Sidney Smirke (1799-1877)*



British Museum, London, 1824-47 *Sir Robert Smirke (1780-1817)*

The Crystal Palace, Sydenham, London, 1852-54 *Paxton*; water towers, *Brunel* (Moved from Hyde Park, p.163)

St Pancras Station, London, 1865-73. Engineers, *W.H.Barlow (1812-1902)* & *M.Ordish (1824-88)* Hotel, 1865-75 *Sir George Gilbert Scott (1810-77)*

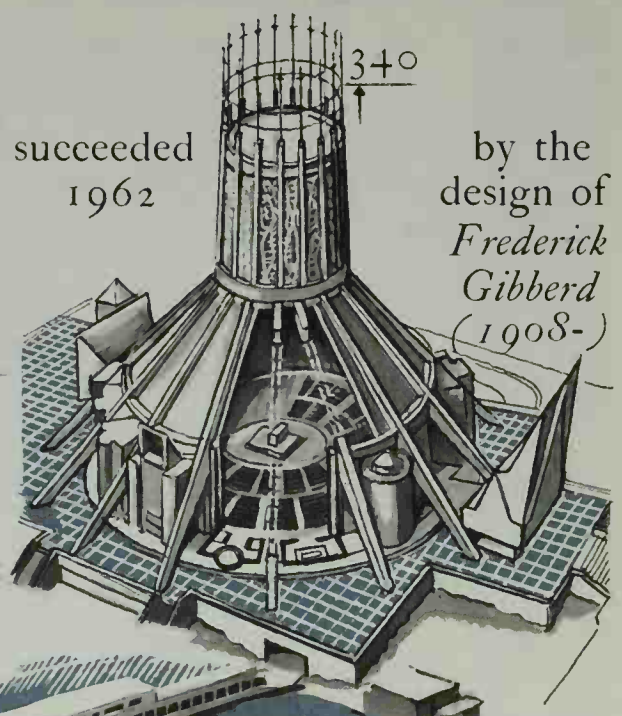


Clifton Suspension Bridge, Bristol, designed 1829-31; begun 1836 *Isambard Kingdom Brunel (1806-59)*

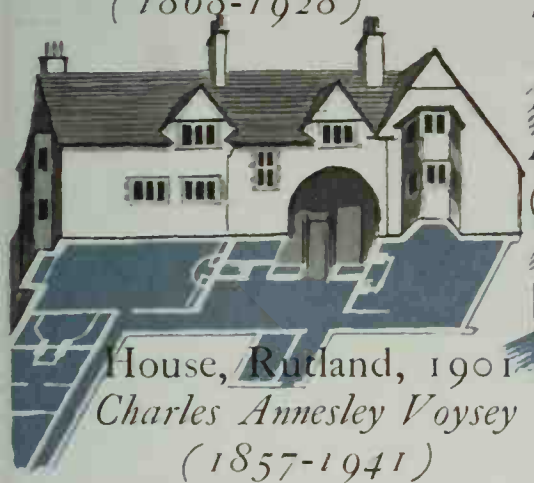
ENGLAND

School of Art, Glasgow, 1896 Art Nouveau
Charles Rennie Mackintosh (1868-1928)

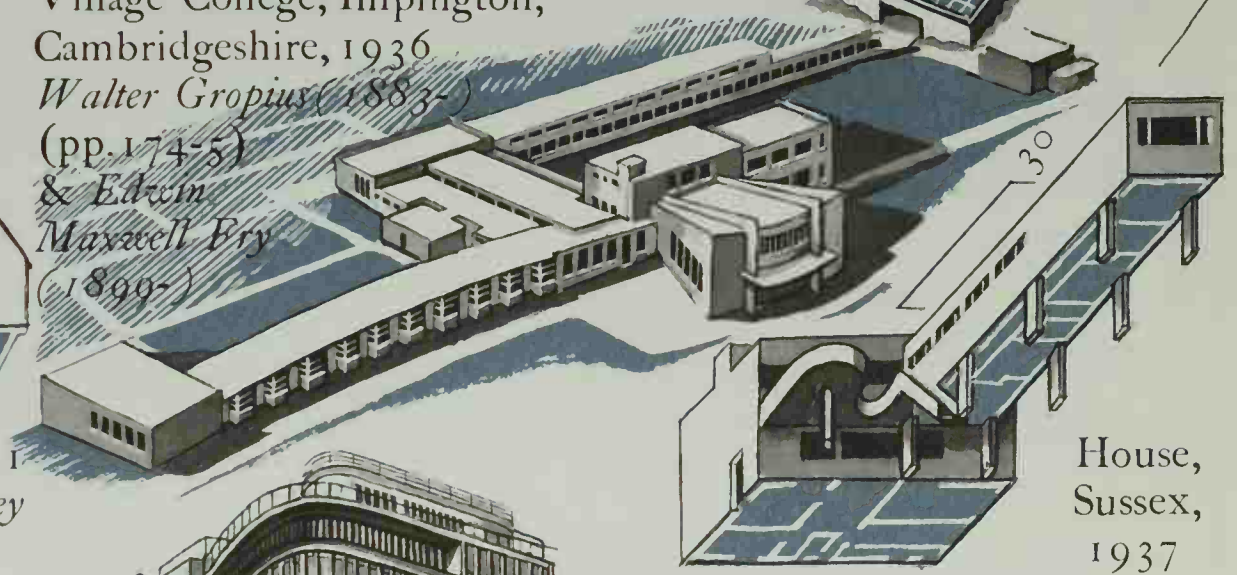
Projected Roman Catholic Cathedral, Liverpool, 1929-41
Sir Edwin Lutyens (1869-1944)



succeeded 1962 by the design of *Frederick Gibberd (1908-)*

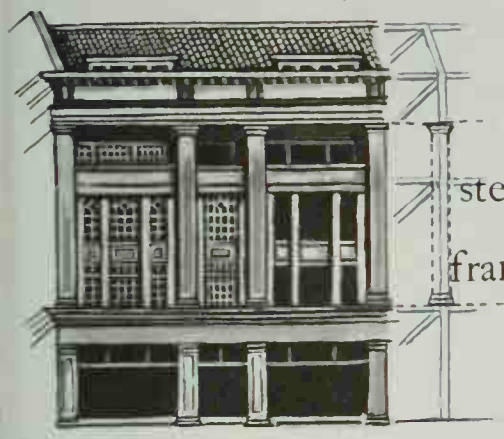


House, Rutland, 1901
Charles Annesley Voysey (1857-1941)



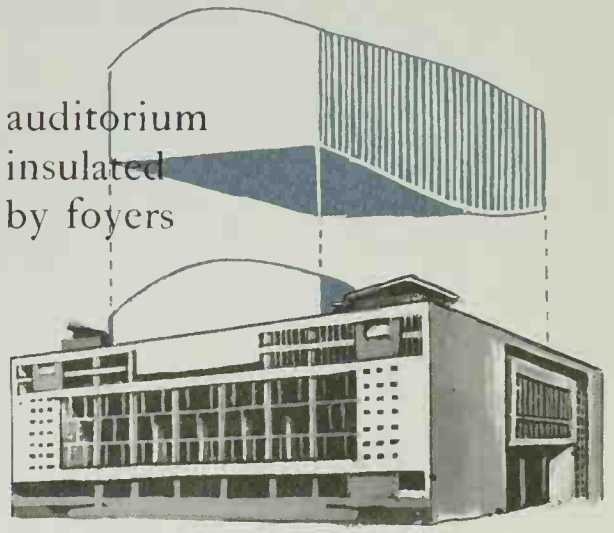
Village College, Impington, Cambridgeshire, 1936
Walter Gropius (1883-) (pp. 174-5) *& Edwin Maxwell Fry (1899-)*

House, Sussex, 1937
F. R. S. Yorke (1906-62) & Marcel Breuer (1902-): born Hungary, U.S.A. 1937

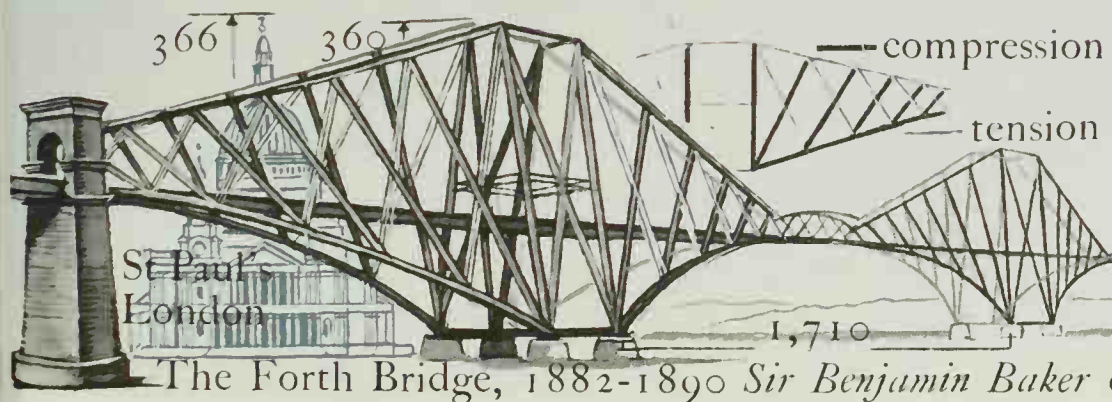


Heal & Son Store, London, 1910-14 *Smith & Brewer*

Peter Jones Store, London, 1936-39 *William Crabtree*



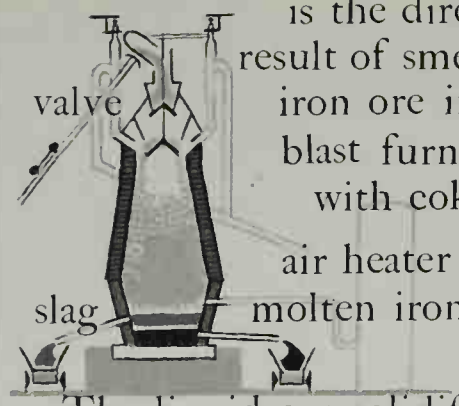
Royal Festival Hall, London, 1951 *Robert Hogg Matthew (1906-)*



The Forth Bridge, 1882-1890 *Sir Benjamin Baker & Sir John Fowler*

19TH & 20TH CENTURIES

CAST IRON



is the direct result of smelting iron ore in a blast furnace with coke.

The liquid ore solidifies on cooling & can be given the desired shape by being poured into moulds. The process was first carried out *c.*1710 by *Benjamin Darby (1677-1717)*. Cast iron is brittle & reacts to bending stress. Used primarily for vertical columns

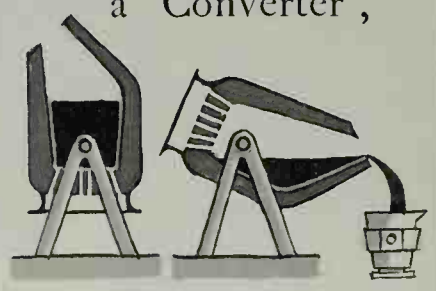
WROUGHT IRON

is obtained by oxidizing white-hot cast iron. It is puddled (purified) from an excess of carbon & impurities in a 'reverberatory' furnace, introduced by Henry Cort *c.*1760s.

Ductile and malleable, wrought-iron can be pulled out into wire or rolled into beams

STEEL

is made from cast-iron, the carbon being burnt out by a blast of air through the molten metal in a 'Converter',

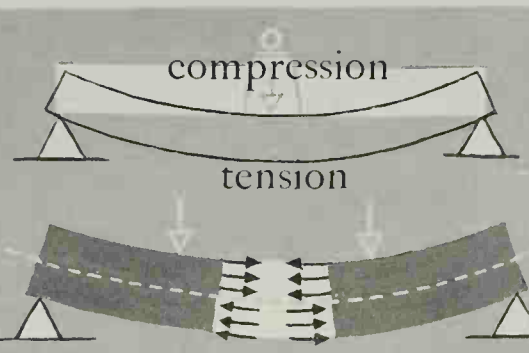


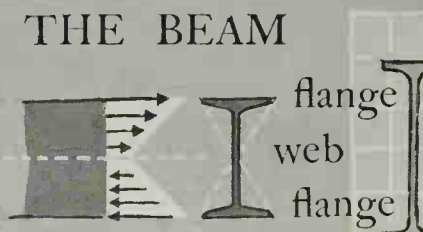
invented by Sir Henry Bessemer in 1856. Steel has equal strength in compression and tension

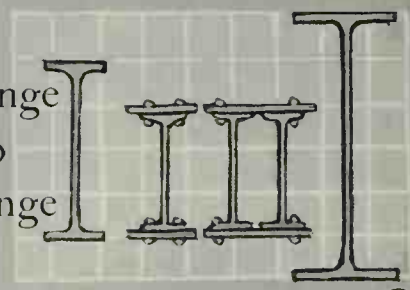
Cast-iron column, Victoria Station, London, 1861

c.1845 Sir William Fairbairn

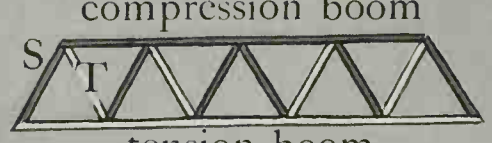
THE BEAM



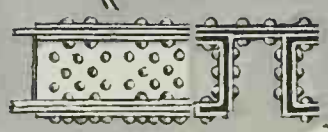


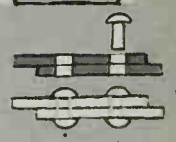


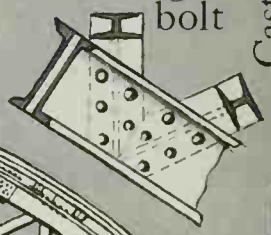
& TRUSS



S. / compression or strut
T. \ tension or tie

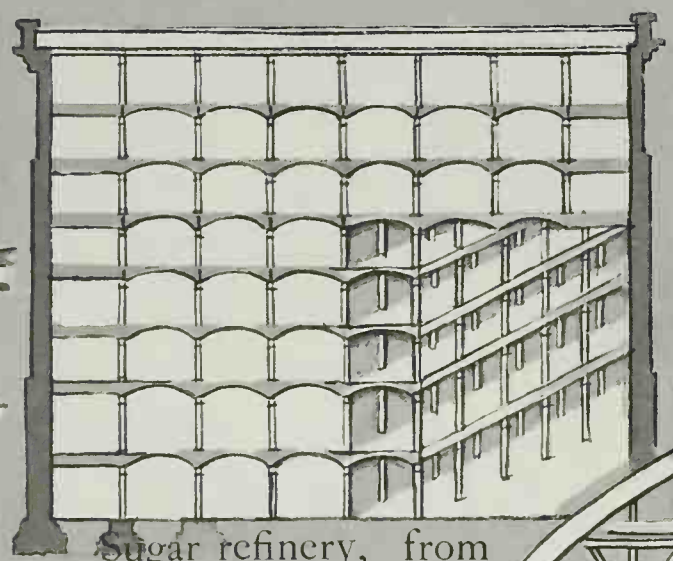




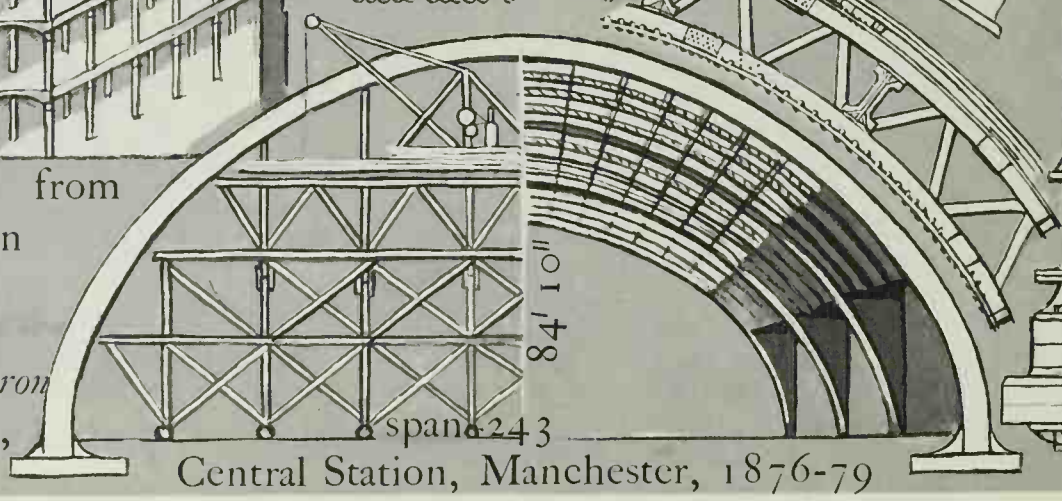


Cast-iron column, Woodside Station, Birkenhead, *c.*1876

Cast-iron column and wrought-iron beams,



Sugar refinery, from Sir William Fairbairn (1789-1874), *The Application of Cast-iron & Wrought-iron to Building Purposes*, London, 1845



Central Station, Manchester, 1876-79

CAST IRON, WROUGHT IRON, STEEL

Design for wrought-iron column: *Viollet-le-Duc* (1814-79), from *Lectures on Architecture*, Paris, 1863-72

The Crystal Palace, Hyde Park, London, 1851
Sir Joseph Paxton (1803-1865)

984

1848

408

Constructed in 17 weeks in cast-iron with pre-fabricated standardized parts and based on multiples of 24 feet standard glass size 49″ by 10″

Art Nouveau: cast-iron structure, Brussels, 1893
Victor Horta (1861-1947)

The Fair Building, Chicago, U.S.A., 1891
William Le Baron Jenny (1832-1907)

The Eiffel Tower, Paris, 1887-89. Constructed of wrought-iron
Gustave Eiffel (1832-1923)

steel beams to which cross beams are rivetted to form a rigid framework

150

span 375

hinge base

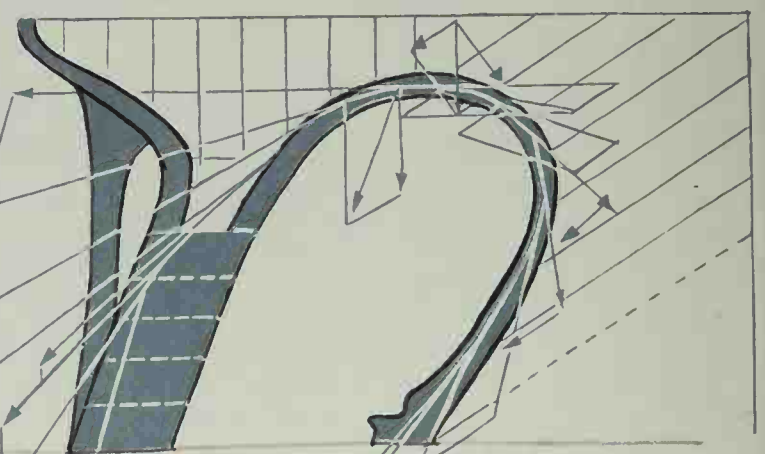
Galerie des Machines, International Exhibition, Paris, 1889: three-hinged steel arch *Dutert*, engineer *Cottamin*

19TH & 20TH CENTURIES

Japanese print, *Hokusai (1760-1849)*

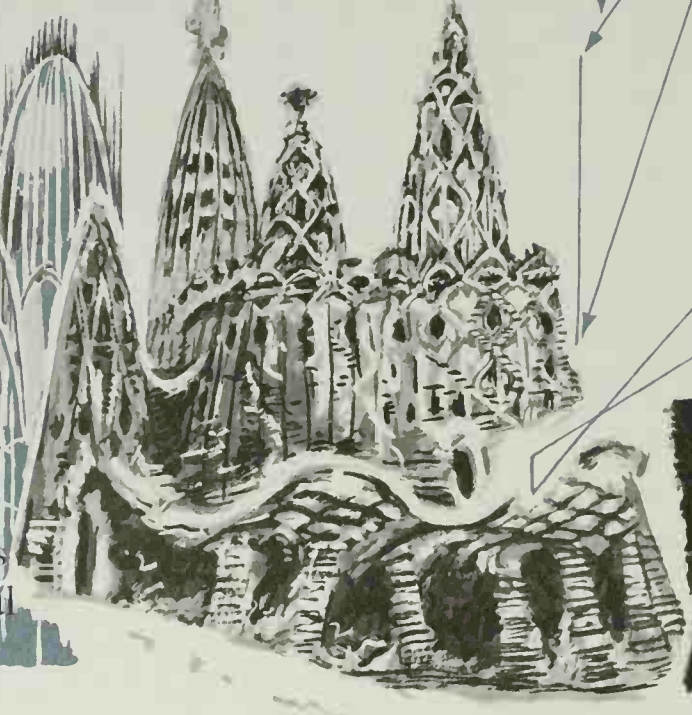
Casa Battló ('House of the bones'), Barcelona, 1903-07 *Gaudí*

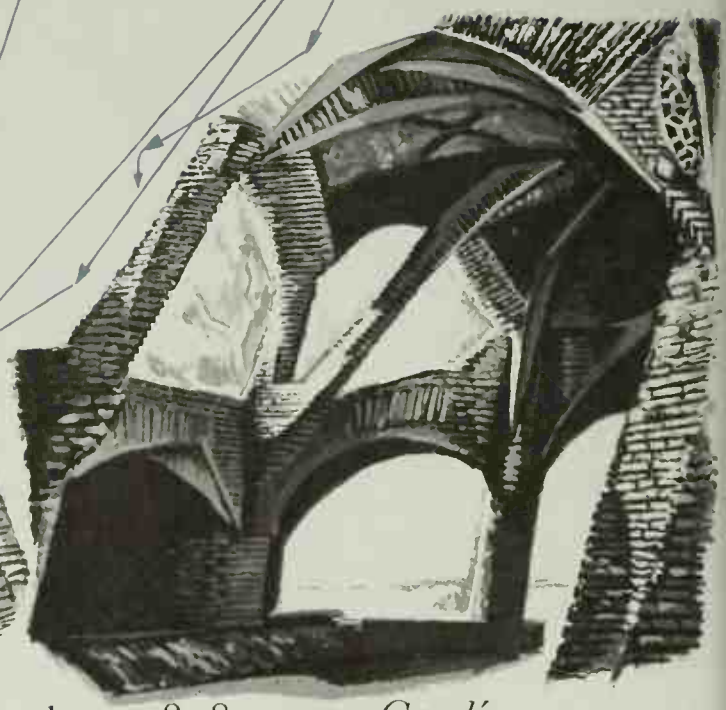
Parc Güell, Barcelona, 1900-14 *Gaudí*



tilted helicoid columns

Wire model of ribs with weights hung proportional to the loads to be carried





Project for Güell Colony chapel, nr Barcelona 1898-1914 *Gaudí*

Antoni Gaudí (1852-1926): born Reus, near Tarragona; worked & died in Barcelona. 'Gaudí

SPAIN, MODERNISMO, GAUDÍ

Cathedral, Cologne

100

24' 7" 24' 7" 49' 2"

Casa Milá ('The Quarry'), Barcelona, 1905-10 *Gaudí*

Sagrada Familia, Barcelona, 1883. Unfinished at Gaudí's death, 1926; work continues

A

A. transept, 1913-26

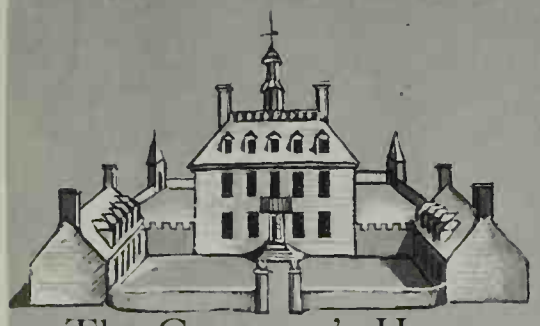
200

finials coloured with glazed tiles and glass mosaics

is the constructor of 1900, the professional builder in stone, iron and brick' *Le Corbusier*

19TH & 20TH CENTURIES

Colonial or Georgian period: influence of *Wren, Gibbs, Chambers & the Palladians*



The Governor's House, Virginia, 1705 (rebuilt 1932)

Westover, Virginia, *c.*1730

Redwood Library, Newport, Rhode Island, 1750 *Peter Harrison (1716-75)*: born England; U.S.A. 1740

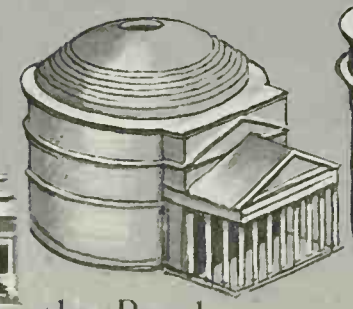
First design

Monticello, Charlottesville 1770-1809
Thomas Jefferson (1743-1820); studied Roman buildings in Europe 1784-89

The Revolution 1775-1783

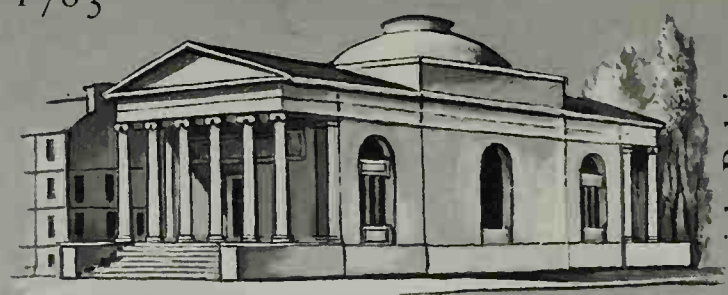
St Michael, Charleston, South Carolina, 1761

Temple, Nîmes

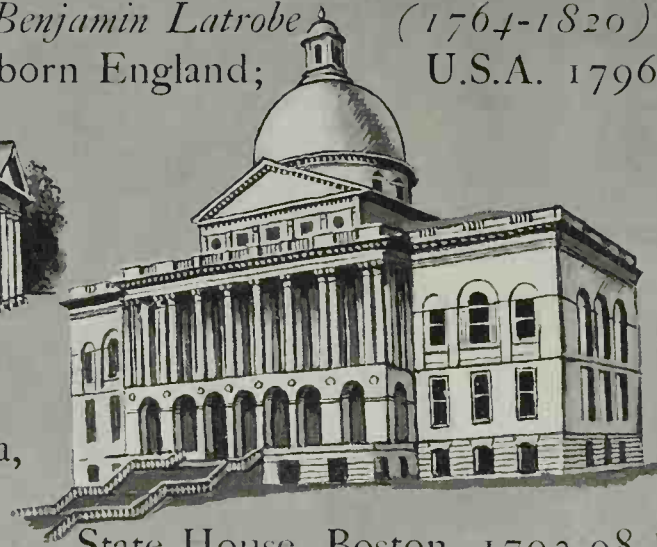


the Pantheon, Rome

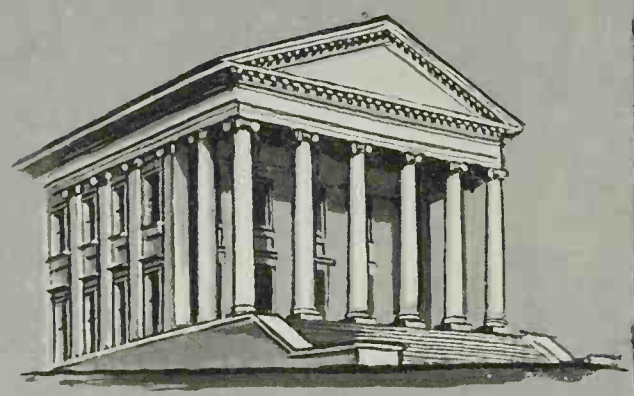
Federal Period



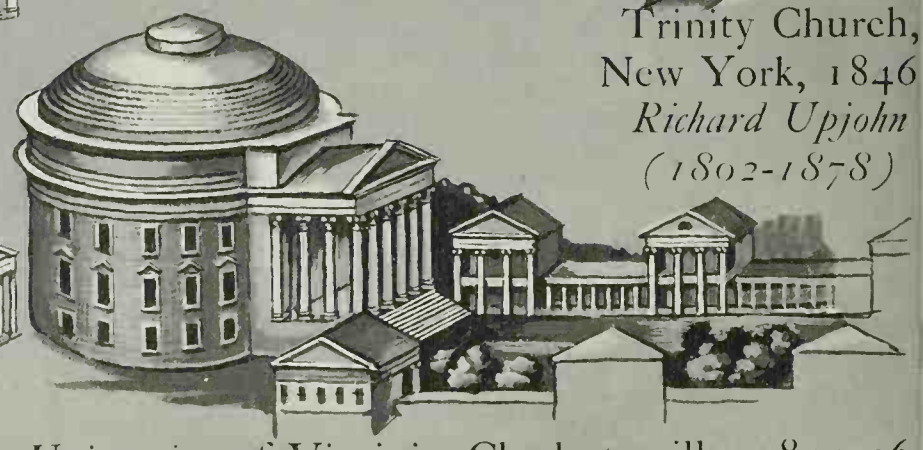
The Bank of Philadelphia, 1798-99
Benjamin Latrobe (1764-1820): born England; U.S.A. 1796



State House, Boston, 1793-98
Charles Bulfinch (1763-1844)

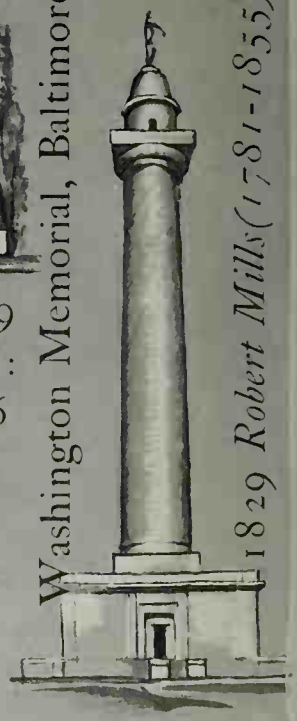


State House, Richmond, Virginia, 1785-96 *Jefferson*



University of Virginia, Charlottesville, 1822-26

Greek & Gothic



Washington Memorial, Baltimore, 1829 *Robert Mills (1781-1855)*

Trinity Church, New York, 1846 *Richard Upjohn (1802-1878)*

U. S. A.

revivals

Civil War 1861-1865

The Chicago School 1883- (pp.168-9)

Romanesque, Salamanca

Crane Library, Quincy, Massachusetts, 1883

Trinity Church, Boston, 1872-77
Henry Hobson Richardson (1838-1886): studied in Paris

Exchange, Philadelphia 1832-4 *William Strickland (1788-1845)*, pupil of Latrobe

Transportation Building, Chicago Exposition, 1893 *Louis H. Sullivan (1856-1924)*: Paris 1874 *Frank Lloyd Wright* worked with Sullivan 1888-93

The Capitol, Washington: central block, 1792-1828, *William Thornton (1759-1828)* & others. Wings & dome (cast-iron), 1851-65 *Thomas Ustick Walter (1804-1887)*

James Bogardus (1800-1874)
Cast Iron Buildings, their Construction and Advantage
New York, 1858

300
coliseum in cast-iron: suspended roof
1200

Project, New York World's Fair, 1853

1048

Brooklyn Bridge, 1869-1883 *John Roebling (1806-69)* & *W. A. Roebling (1837-1926)*

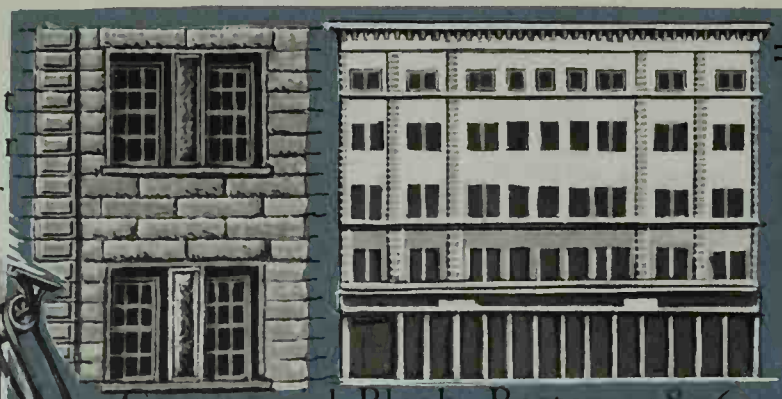
19 TH & 20 TH CENTURIES

The first passenger elevator

patented by Elisha Graves Otis,

shown at the Crystal Palace Exposition, New York, 1853

First used in a store 1857



Commercial Block, Boston, 1856.
Granite from Quincy, near Boston

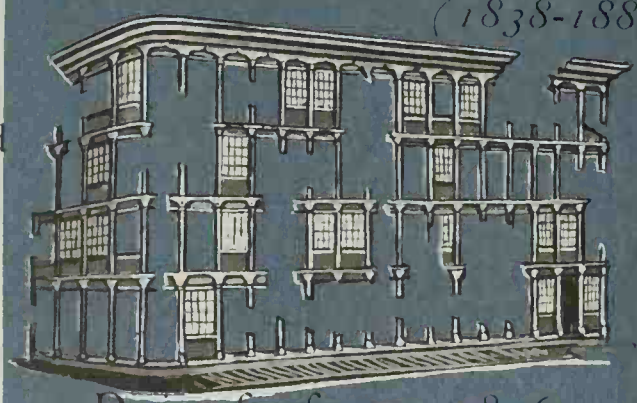
masonry walls

The Chicago School,

masonry walls

Auditorium Building, Chicago, 1887-89
Louis H. Sullivan (1856-1924)
& Dankmar Adler 1881-1894

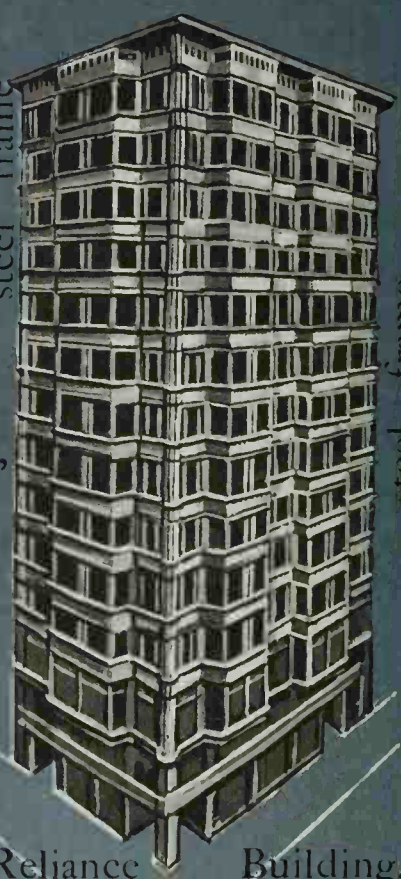
Marshall Field Wholesale Store, Chicago, 1885 *H. H. Richardson (1838-1886)*



Design for factory, 1856, showing resistance of cast iron
James Bogardus (1800-1874)

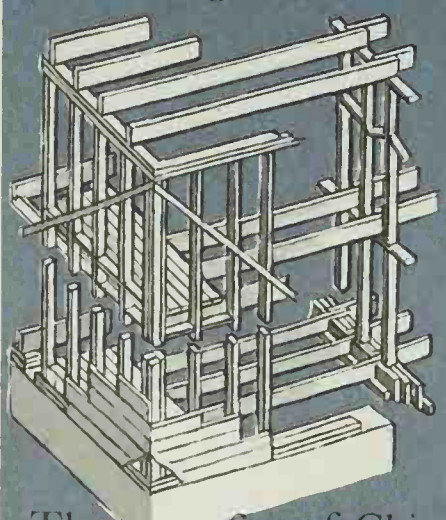
Leiter Building, Chicago, 1889-90
William Le Baron Jenny (1832-1907)

steel frame



steel frame

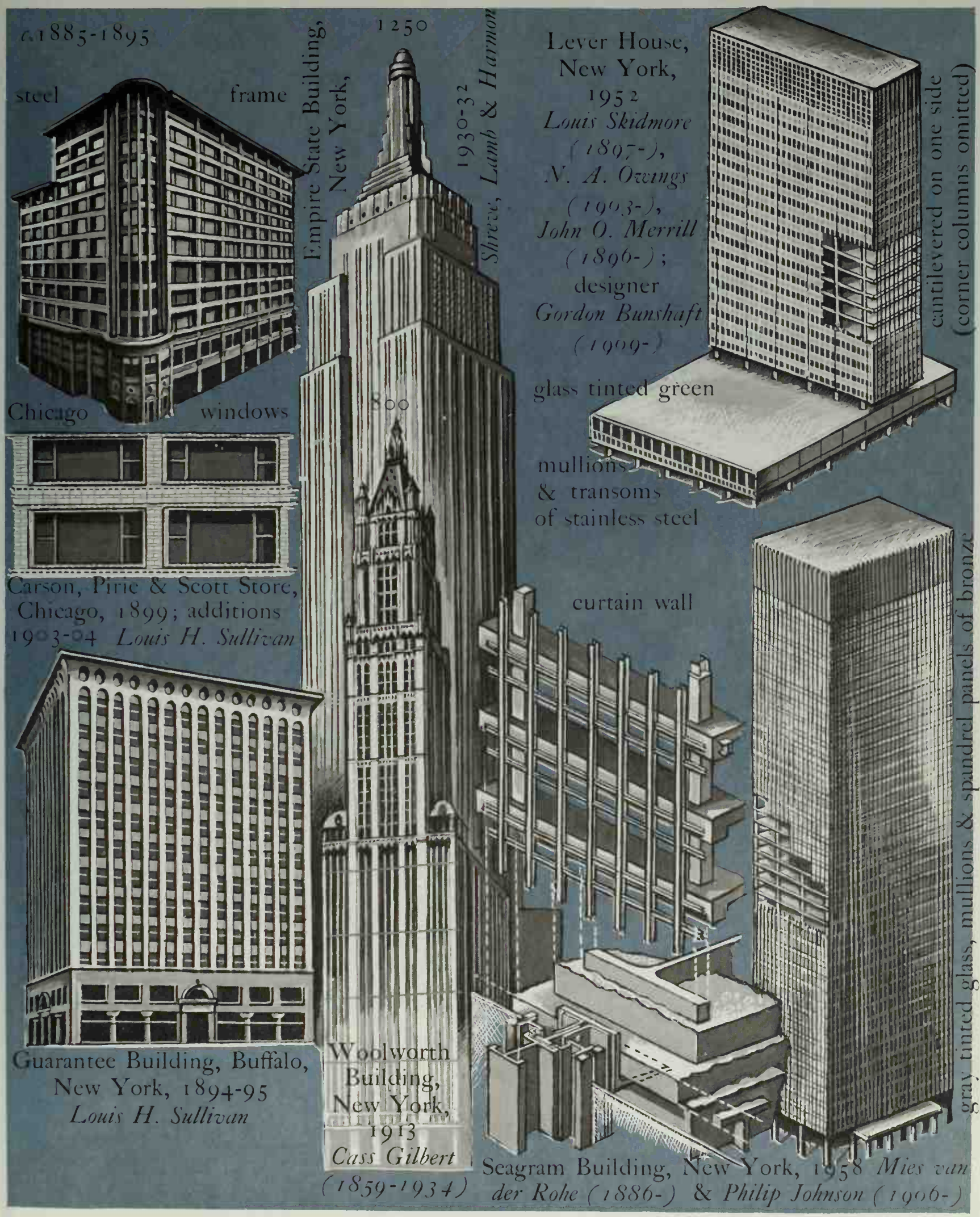
Reliance Building, Chicago, 1890-95
Daniel Hudson Burnham (1846-1912)
& John Wellborn Root (c.1850-1891)



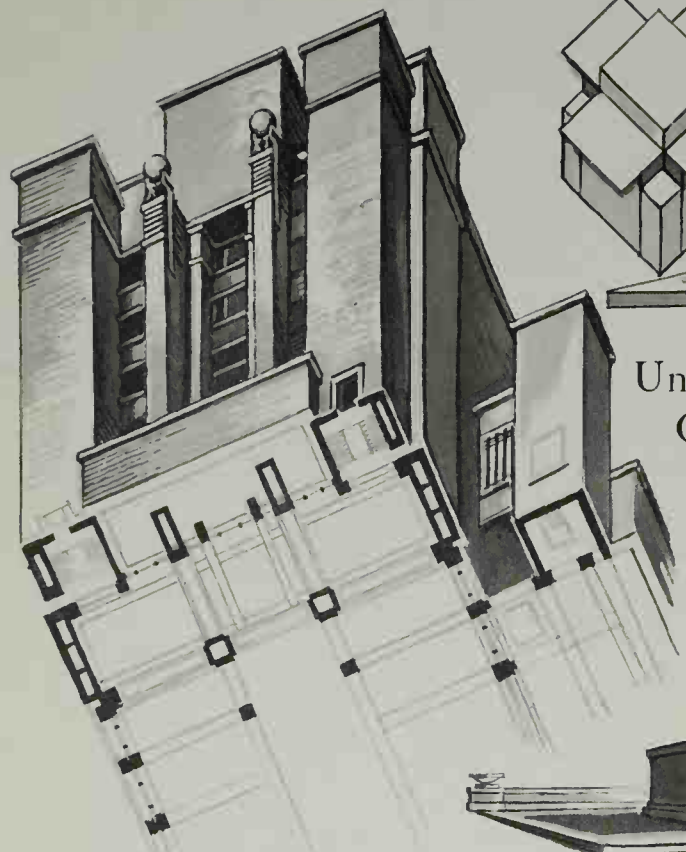
'Balloon-frame' construction, created by a rapid increase of building, *c.*1830s: standardized timber 2" by 4" with 16" spacing, held together by mass-produced nails

The great fire of Chicago, 1871, created the need for large commercial buildings

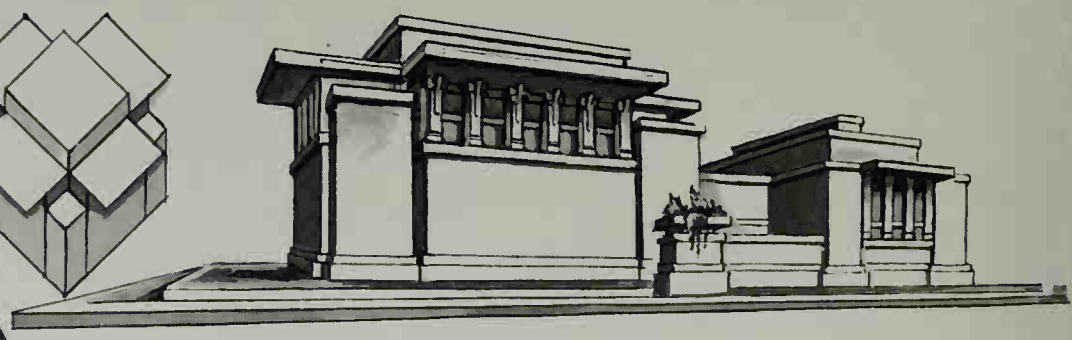
U. S. A. - THE SKYSCRAPER

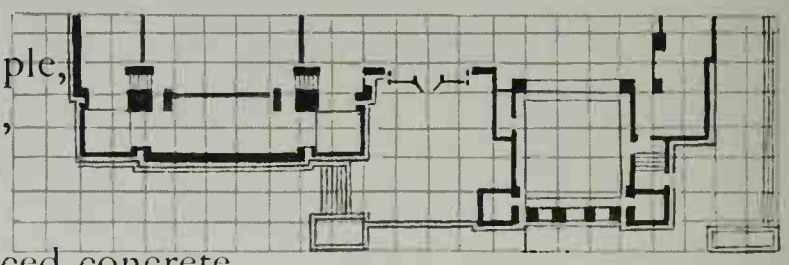


19TH & 20TH CENTURIES

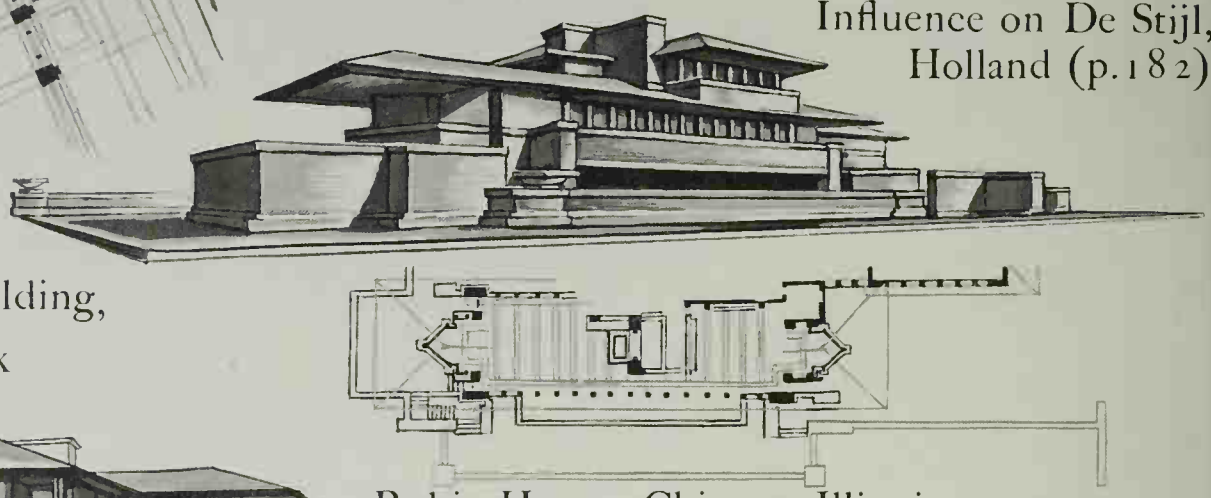


Larkin Administration Building,
Buffalo, 1904. Brick

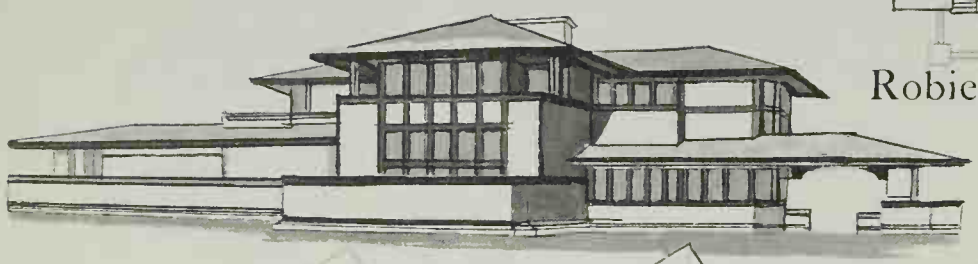




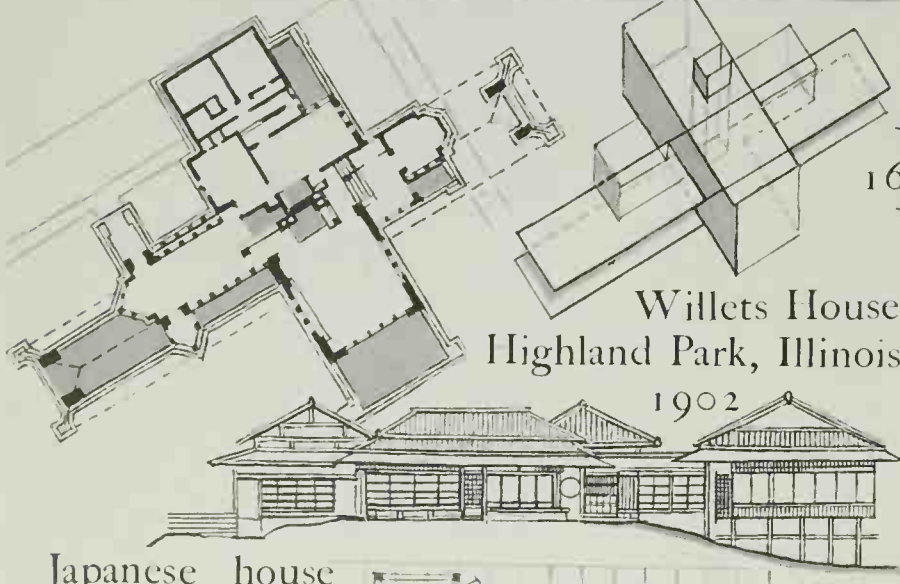
Unity Temple,
Oak Park,
Illinois,
1906.
Reinforced concrete



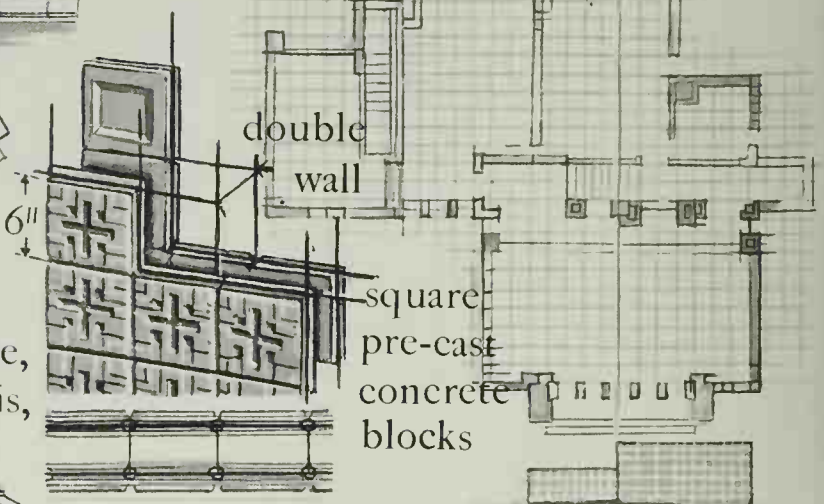
Influence on De Stijl,
Holland (p.182)



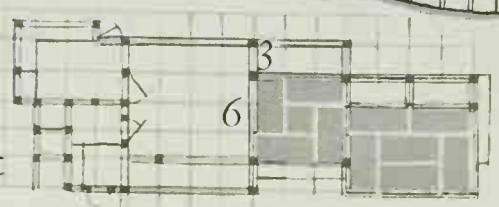
Robie House, Chicago, Illinois, 1909

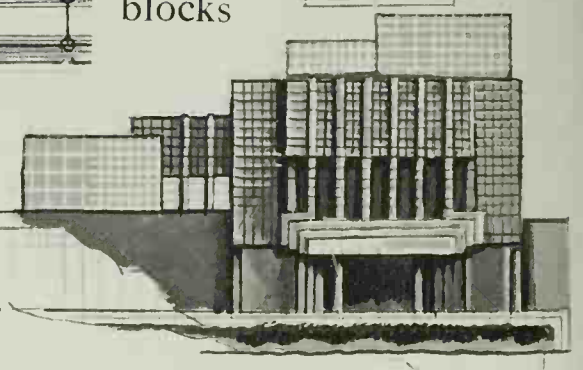


Willets House,
Highland Park, Illinois,
1902



Japanese house
based on the
standardized shape
of mats 6 by 3 feet

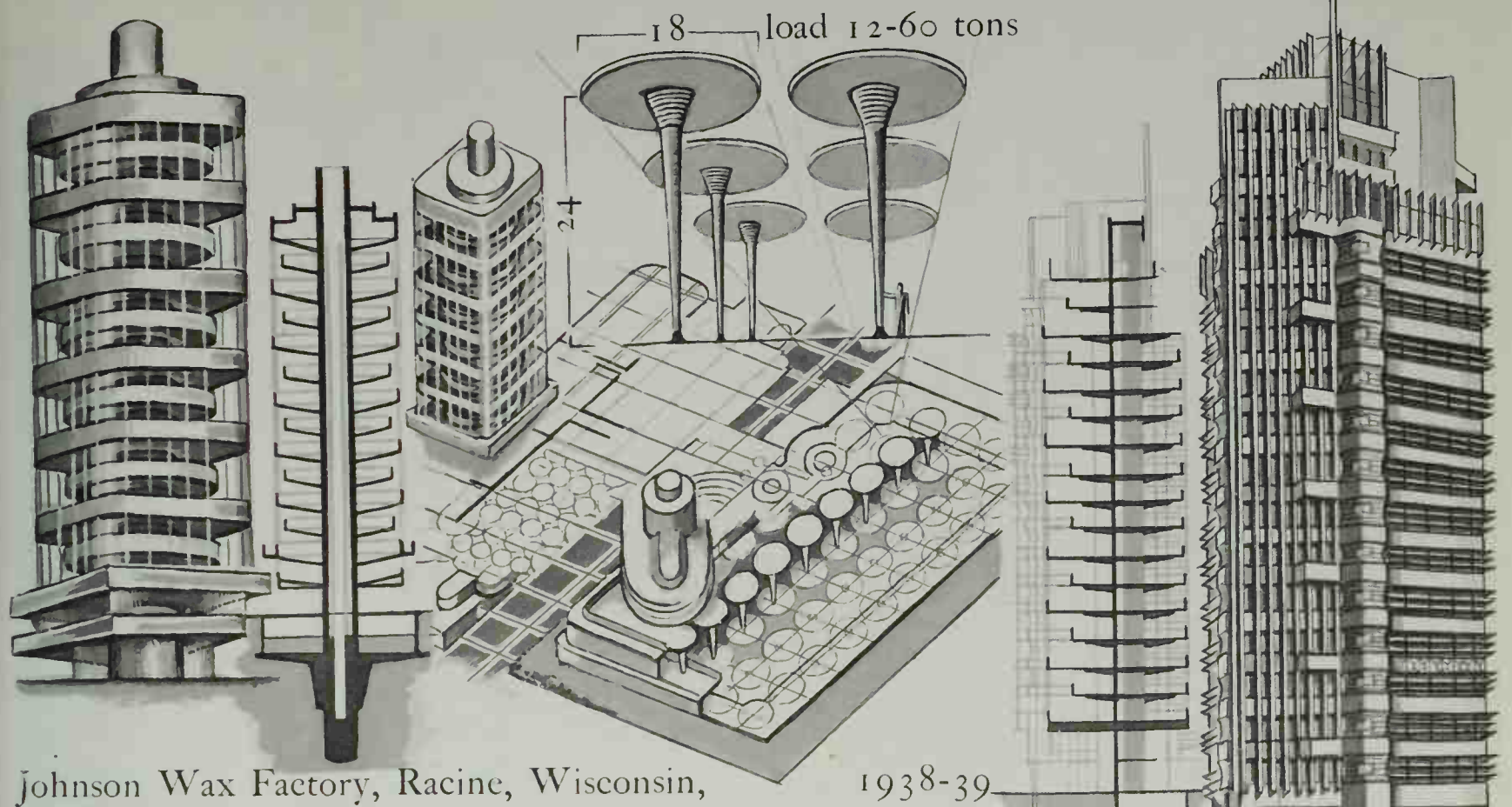




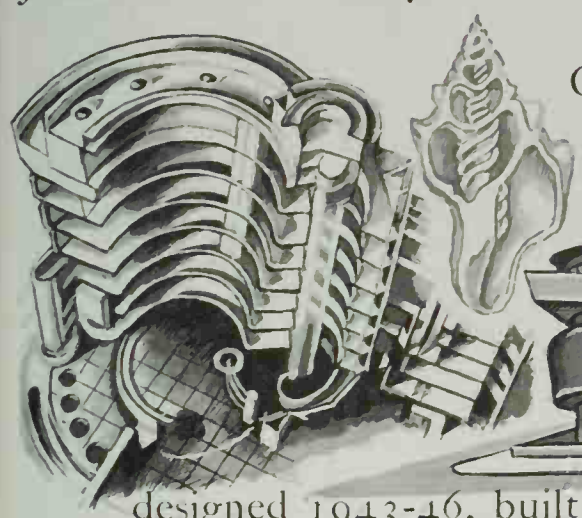
Millard
House,
Pasadena,
California,
1923

Frank Lloyd Wright (1867-1959), born Wisconsin, worked with Louis Sullivan 1888-93.

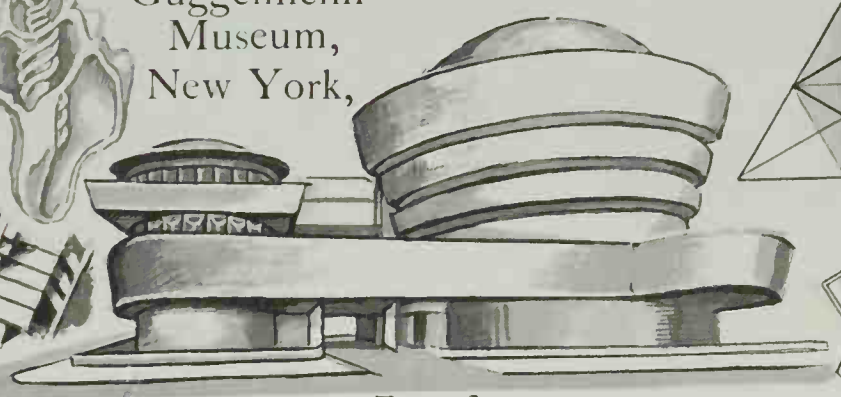
U. S. A., FRANK LLOYD WRIGHT



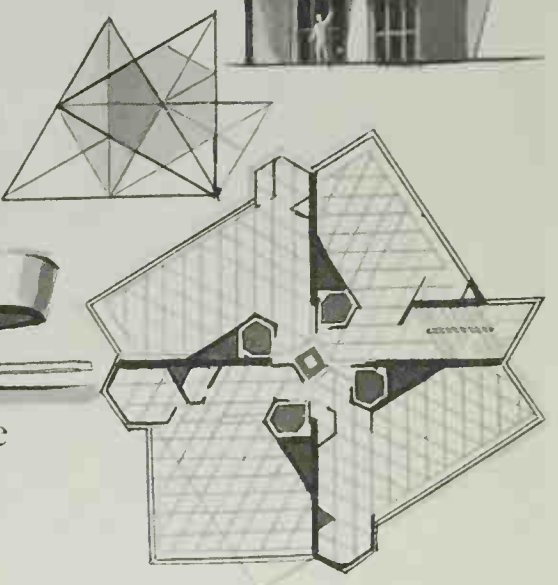
Johnson Wax Factory, Racine, Wisconsin, 1938-39



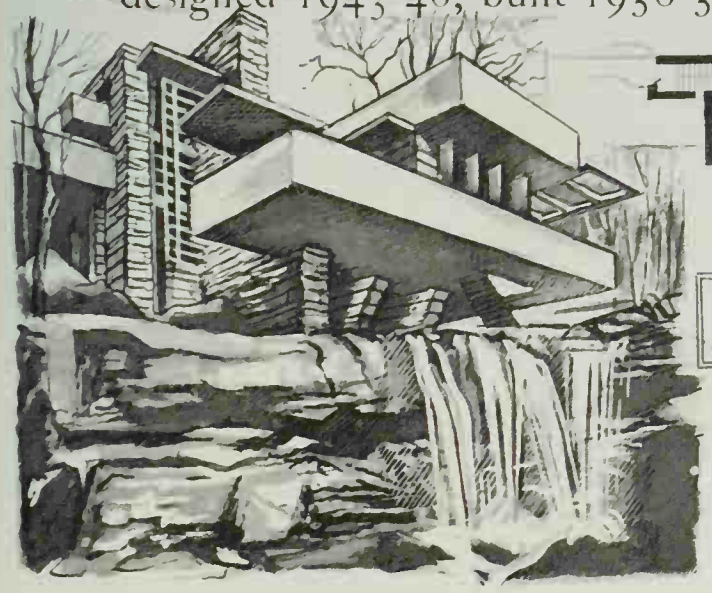
Guggenheim Museum, New York,

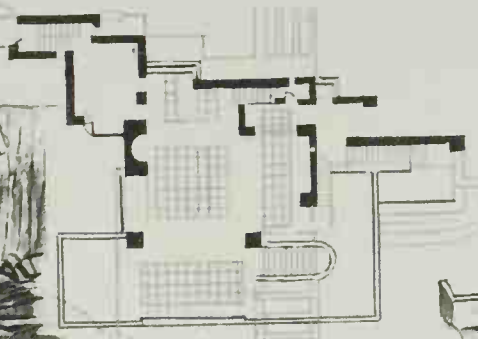


designed 1943-46, built 1956-59. Reinforced concrete



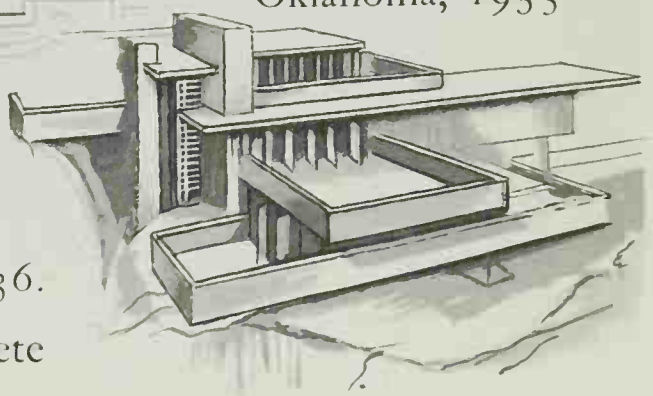
Price Tower, Bartlesville, Oklahoma, 1953





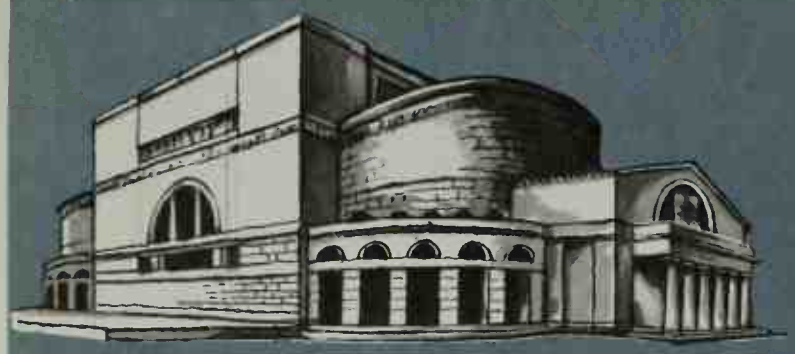
Falling Water, Bear Run, Pennsylvania, 1936.

Reinforced concrete

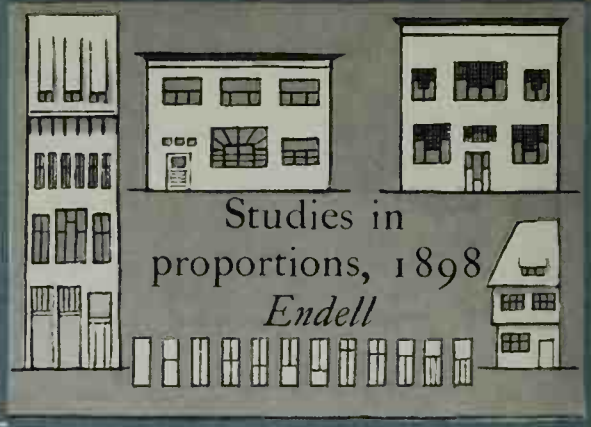


He innovated designs for an 'organic' architecture, kaleidoscopic in its variety

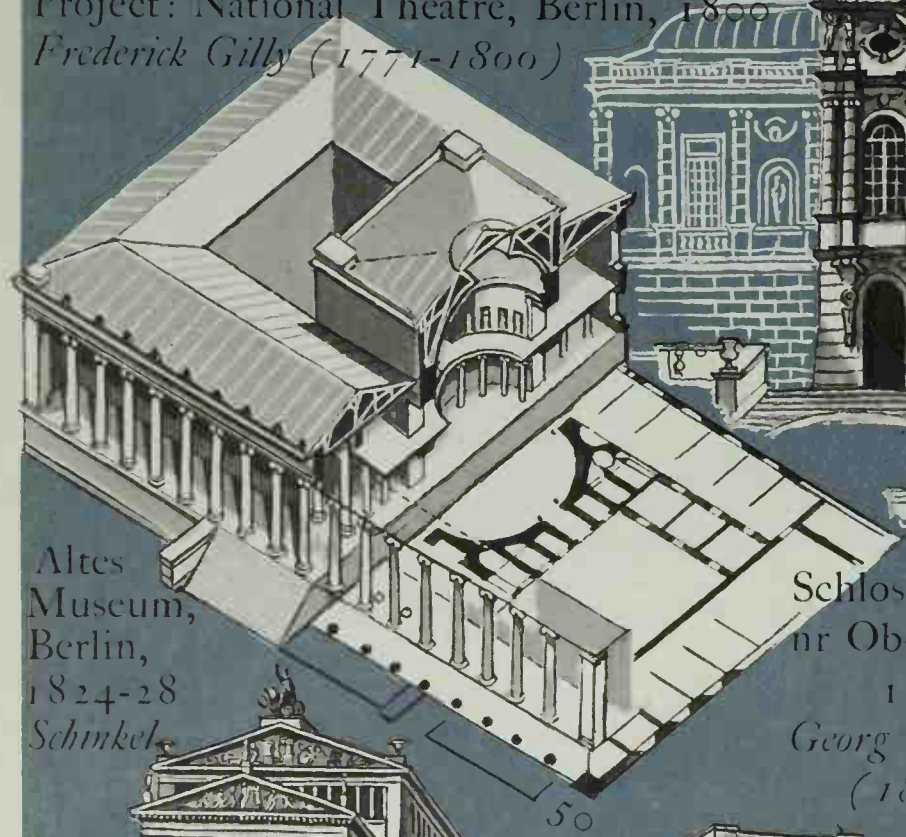
19TH & 20TH CENTURIES



Project: National Theatre, Berlin, 1800
Frederick Gilly (1771-1800)



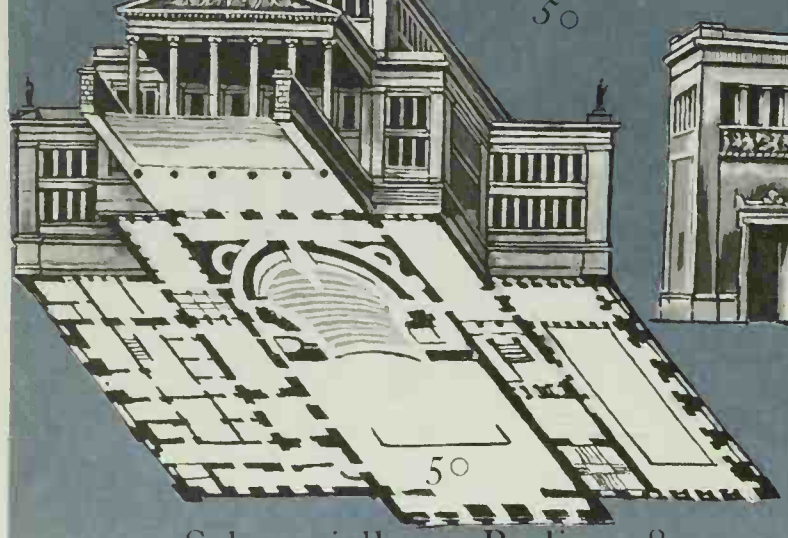
Studies in proportions, 1898
Endell



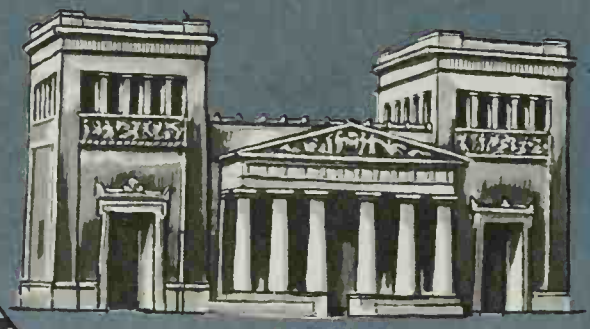
Altes Museum, Berlin, 1824-28
Schinkel

Schloss Linderhof, nr Oberammergau, 1870-86
Georg von Dollman (1830-95)

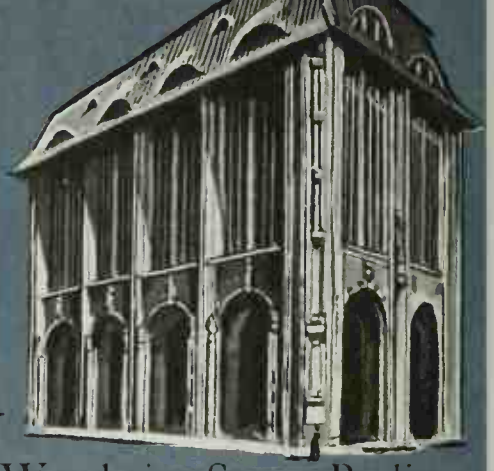
Elvira Photographic Studio,
August Endell (1871-1925)



Schauspielhaus, Berlin, 1819-21
Karl Friedrich Von Schinkel (1781-1841)



The Propylaeon, Munich, 1846-63
Leo von Klenze (1784-1864)



Wertheim Store, Berlin, 1896 *A. Messel (1853-1900)*

J.-N.-L. Durand (1760-1834)
Précis des Leçons d'Architecture données à l'Ecole Polytechnique Paris, 1802-05

} rational designs for Greek, Roman, Early Christian & Romanesque architecture

Classical-Romantic moods generated by
Winklemann (1717-1768)
Lessing (1729-1781)
Goethe (1749-1832)
Heine (1797-1856)

Art Nouveau, 1890-1910
Germany: *Jugendstil*
France: *style nouille* (noodle style) or *style Guimard*
Italy: *stile Liberty* (after the London shop) or *stile floreale*
Spain: *modernismo*

GERMANY

steel hinge A

concrete A

A.E.G. Turbine Factory, Berlin, 1909 *Peter Behrens (1868-1940)*: director of School of Art, Dusseldorf, 1903-07. In 1907, the year the Deutscher Werkbund was founded as a centre for artists, architects & industrialists, Behrens was appointed designer to the A.E.G. (German General Electric Company). *Gropius* worked under Behrens 1907-10, *Mies van der Rohe* 1908-11, & *Le Corbusier* 1910-11

3-hinged steel frame

8o

load

steel frame

loading and deflection

Foundry, Kattowitz, 1910

rein-forced concrete

bending moments

2-hinged frame

3-hinged frames

span 240'

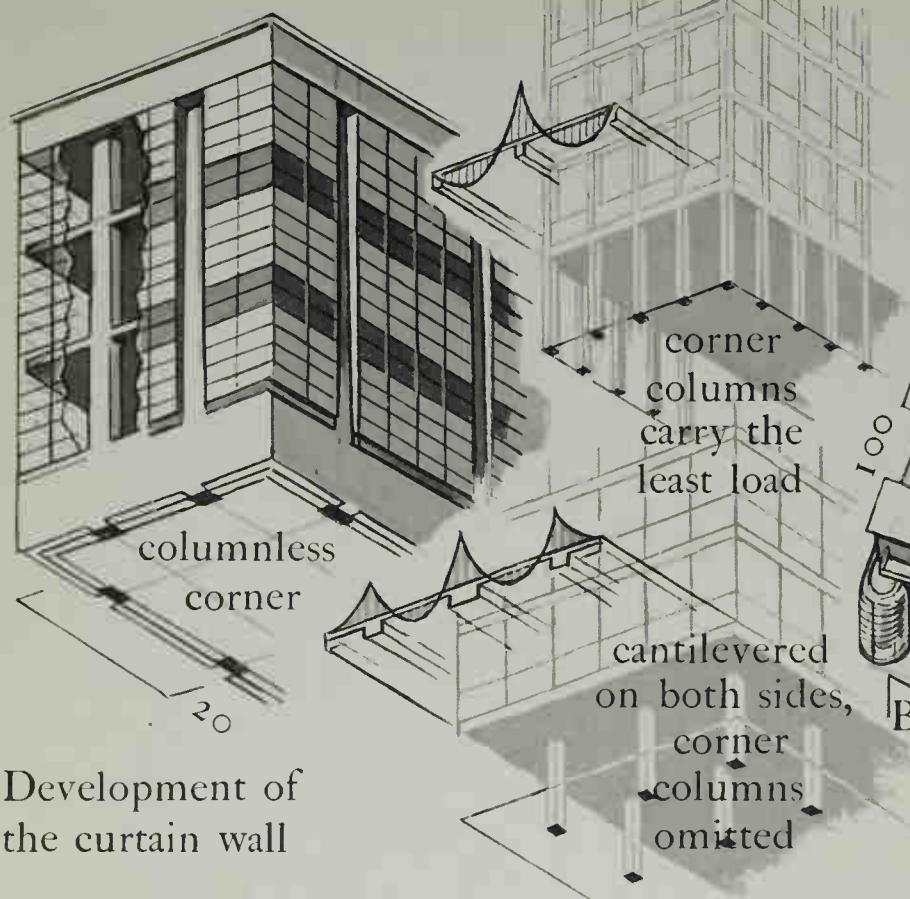
Jahrhunderthalle, Breslau, 1910-12 reinforced concrete *Max Berg (1870-)*

brick faced with concrete.

School of Art, Weimar, 1906 *Henry van de Velde (1863-1957)*: born Antwerp, organised the Weimar School of Art, 1906-14 (which re-opened 1919 under *Gropius* as the Bauhaus)

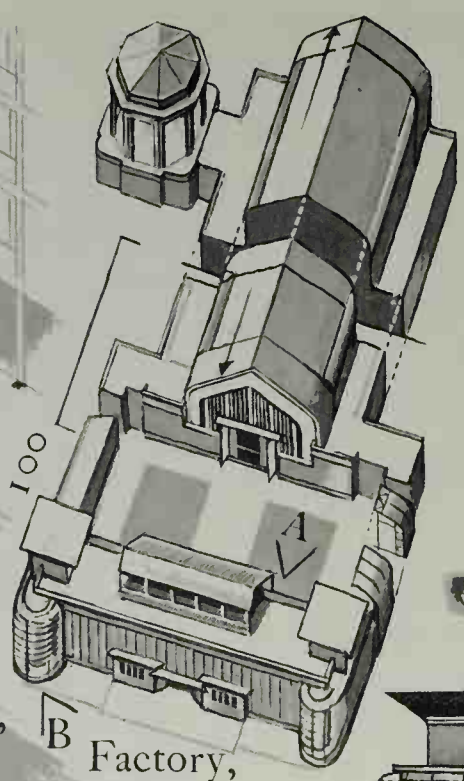
Einstein Tower, Potsdam, 1920-21. *Eric Mendelsohn (1887-1953)*: England and Palestine 1933-41; U.S.A. from 1941

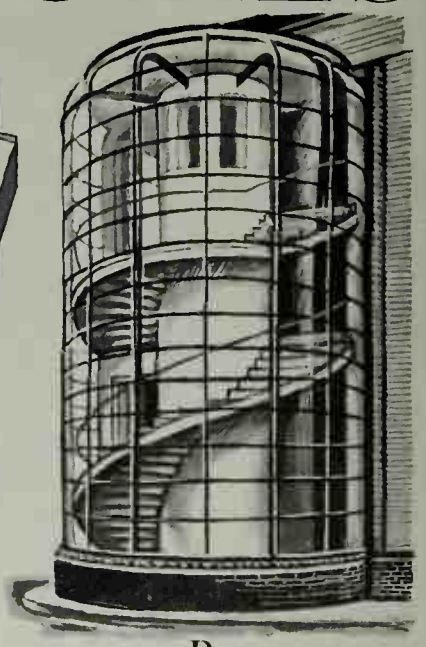
19TH & 20TH CENTURIES



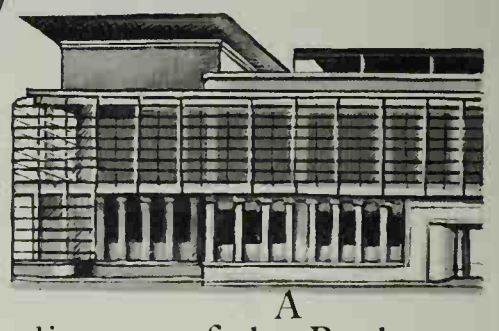
Development of the curtain wall

Fagus Factory, Alfeld-an-der-Leine, 1911





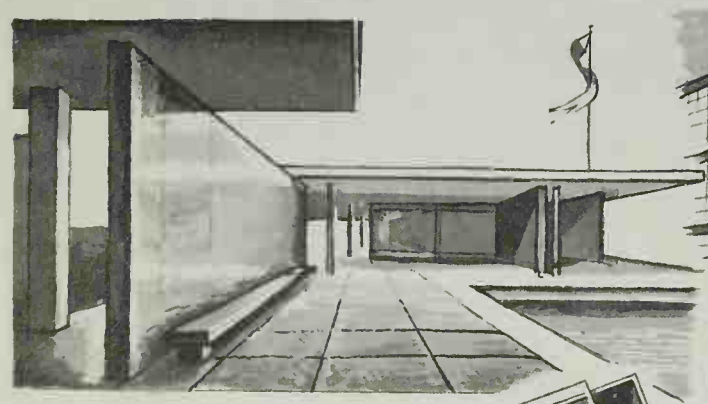
B



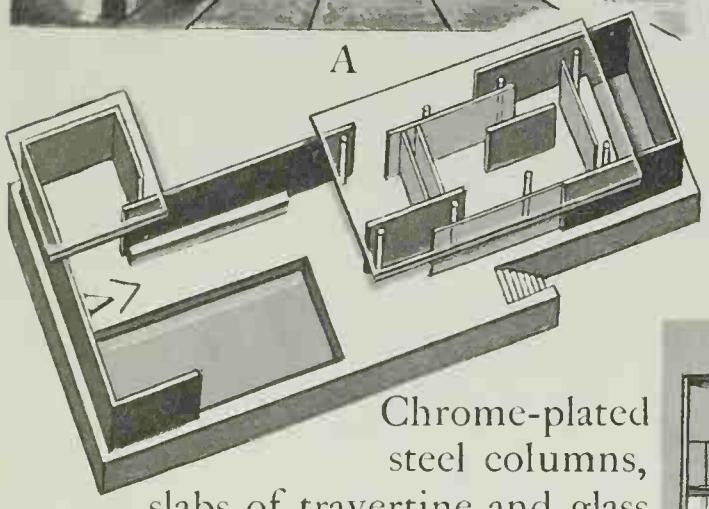
A

Factory, Deutscher Werkbund Exhibition, Cologne, 1914

Walter Gropius (1883-): assistant to Behrens, 1907-11 (p.173); director of the Bauhaus,

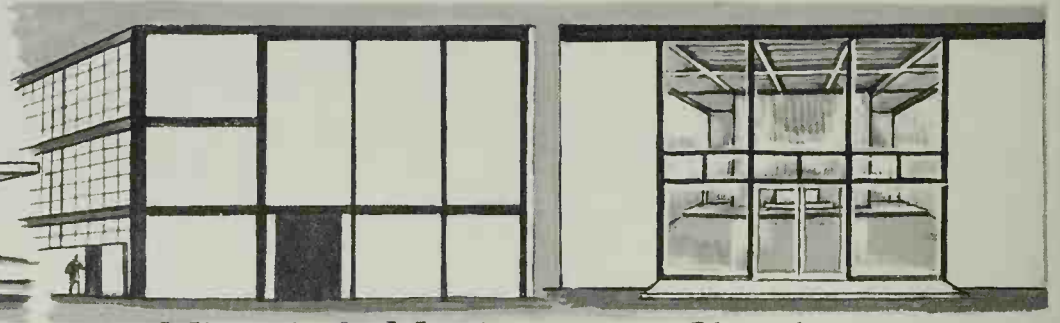


A



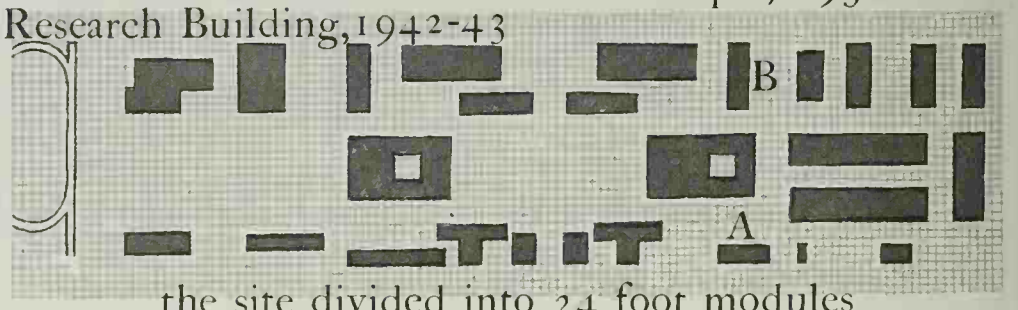
Chrome-plated steel columns, slabs of travertine and glass

German Pavilion, International Exhibition, Barcelona, 1929

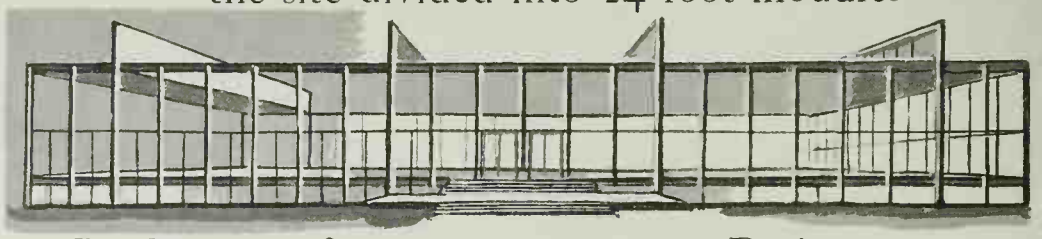


A. Minerals & Metals Research Building, 1942-43

Chapel, 1952



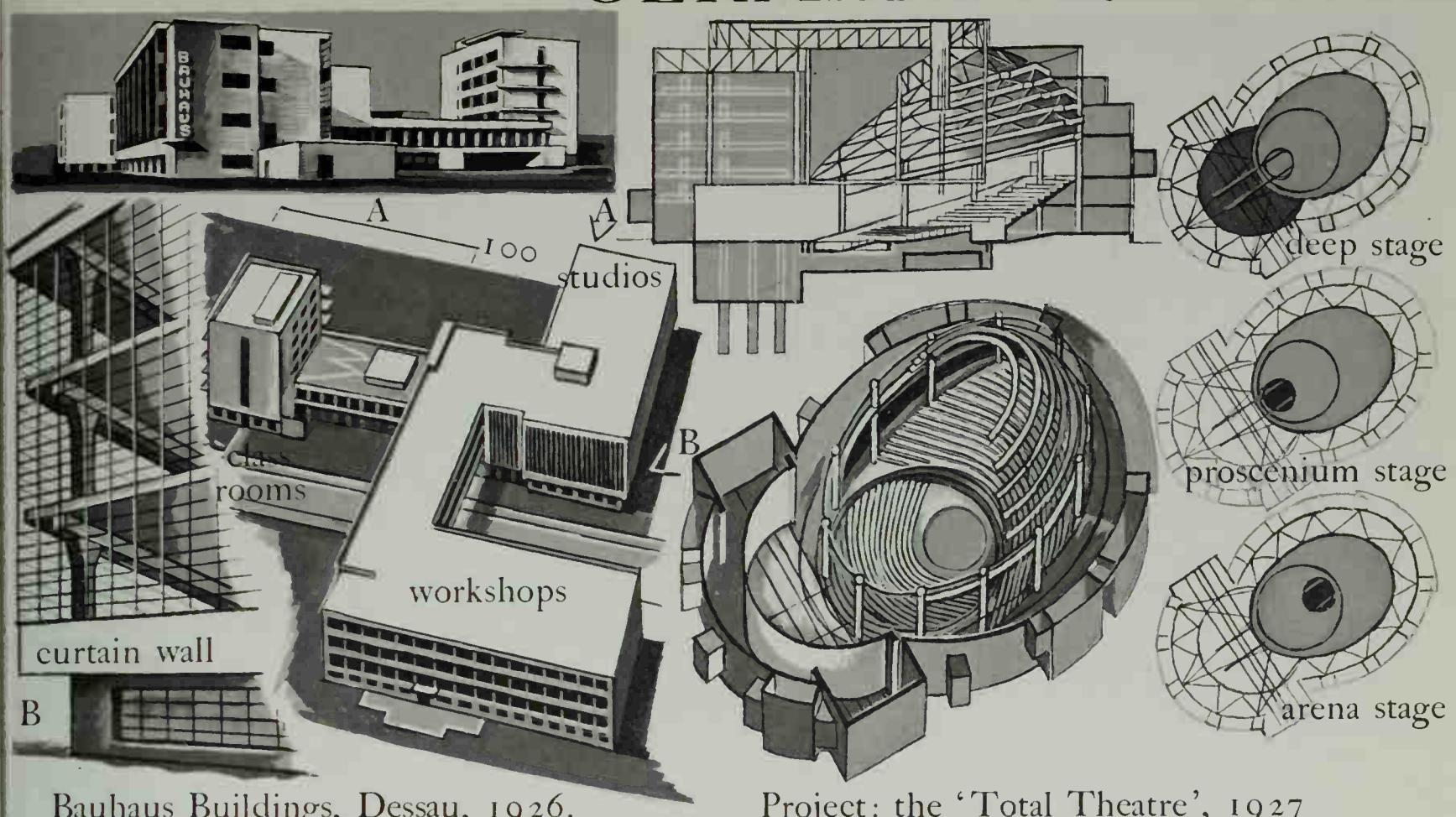
the site divided into 24 foot modules



B. School of Architecture and Design, 1952
Illinois Institute of Technology, Chicago, 1940

Ludwig Mies van der Rohe (1886-): born Aachen, Germany; worked with Behrens 1908-11;

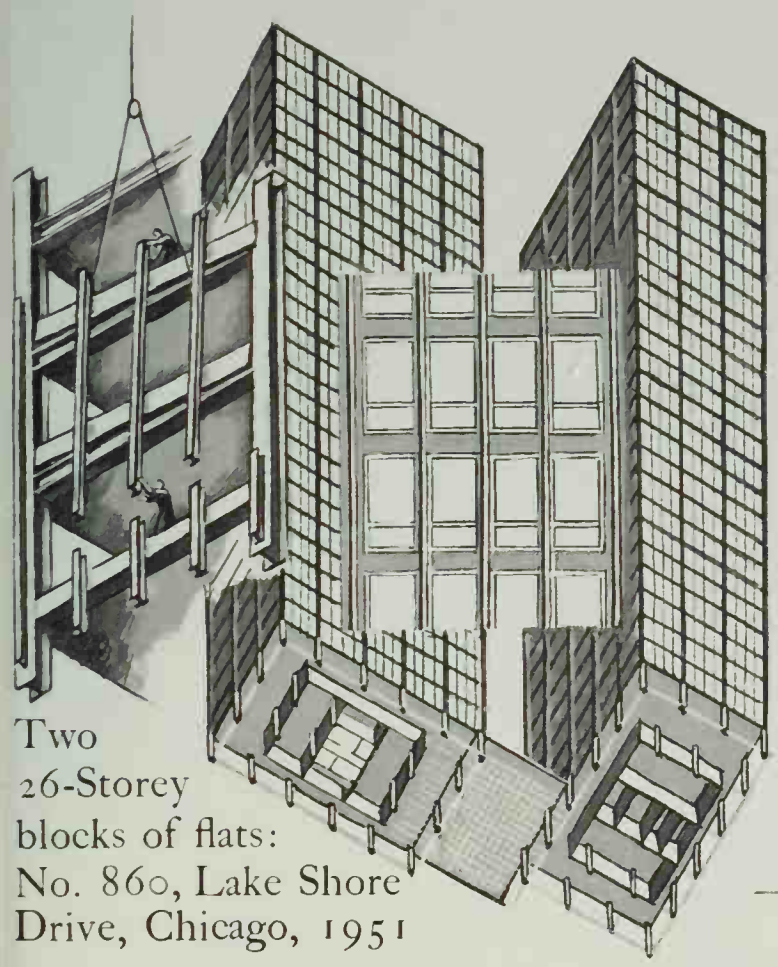
GERMANY & U. S. A.



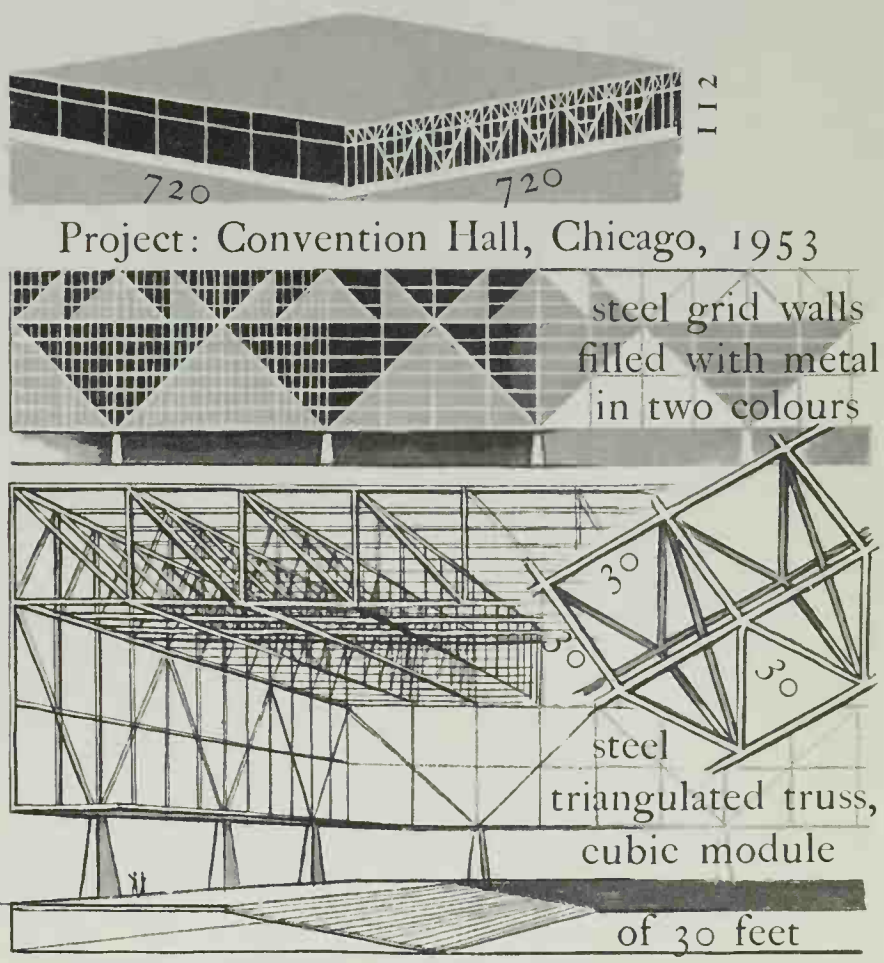
Bauhaus Buildings, Dessau, 1926.

Project: the 'Total Theatre', 1927

Weimar 1919-25, at Dessau 1925-8; worked in England 1934-37 (p.161), U.S.A. 1937



Two 26-Storey blocks of flats: No. 860, Lake Shore Drive, Chicago, 1951



Project: Convention Hall, Chicago, 1953

director of the Bauhaus, Dessau, 1930-33; to U.S.A., 1937. His dictum: 'less is more'

19TH & 20TH CENTURIES

Project for a cenotaph for Newton, 1784
Etienne-Louis Boullée (1728-1799)

Metro entrance, Paris 1900
Hector Guimard (1867-1942)

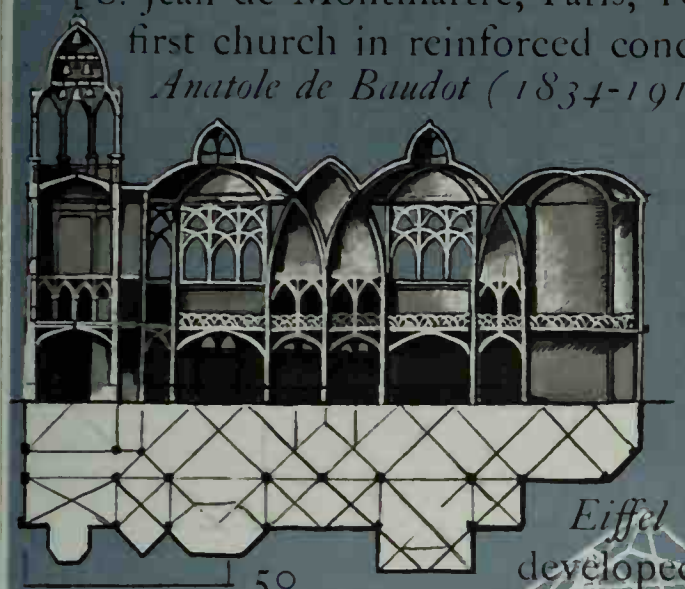
Opéra, Paris, 1861-74
Charles Garnier (1825-1898)

Church of the Madeleine, Paris, 1806-42,
Pierre-Alexandre Vignon (1763-1823)

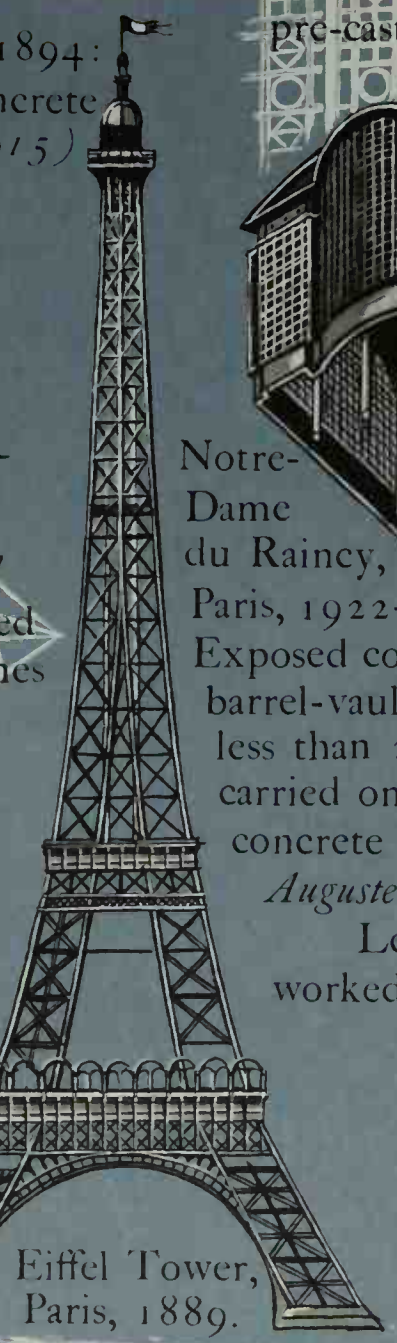
Bibliotheque Nationale, Paris, 1851-58. Cast iron
Henri Labrouste (1801-1875)

FRANCE

S. Jean de Montmartre, Paris, 1894:
first church in reinforced concrete
Anatole de Baudot (1834-1915)



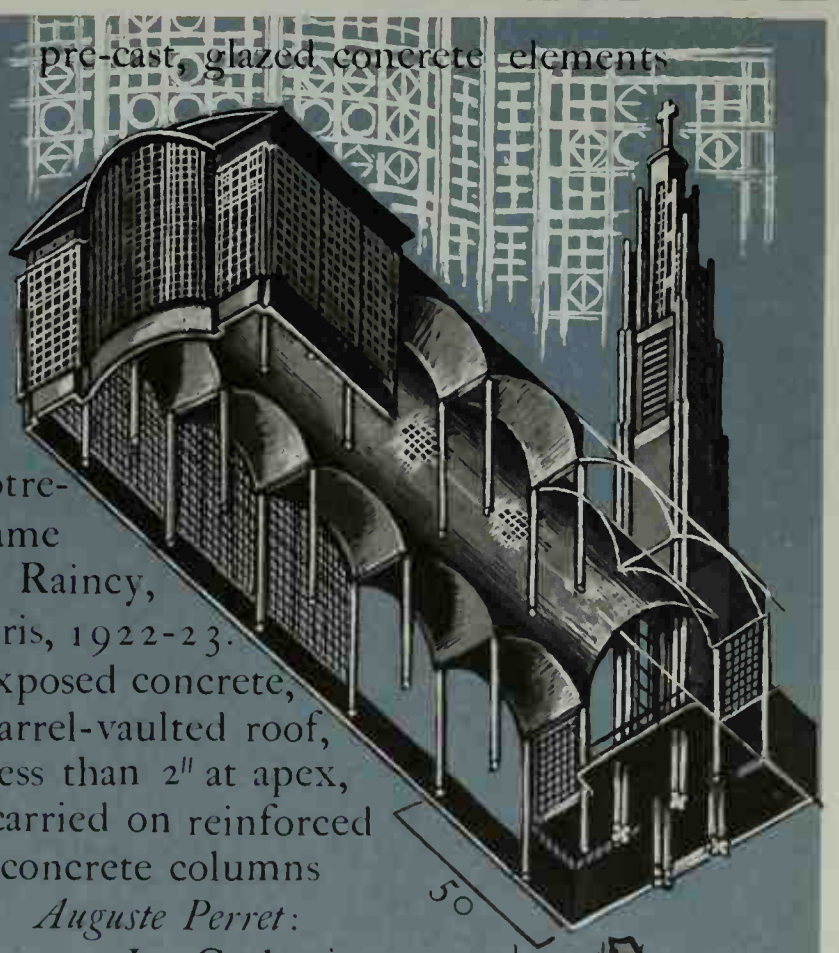
Eiffel
developed
space frames
& aero-
dynamics

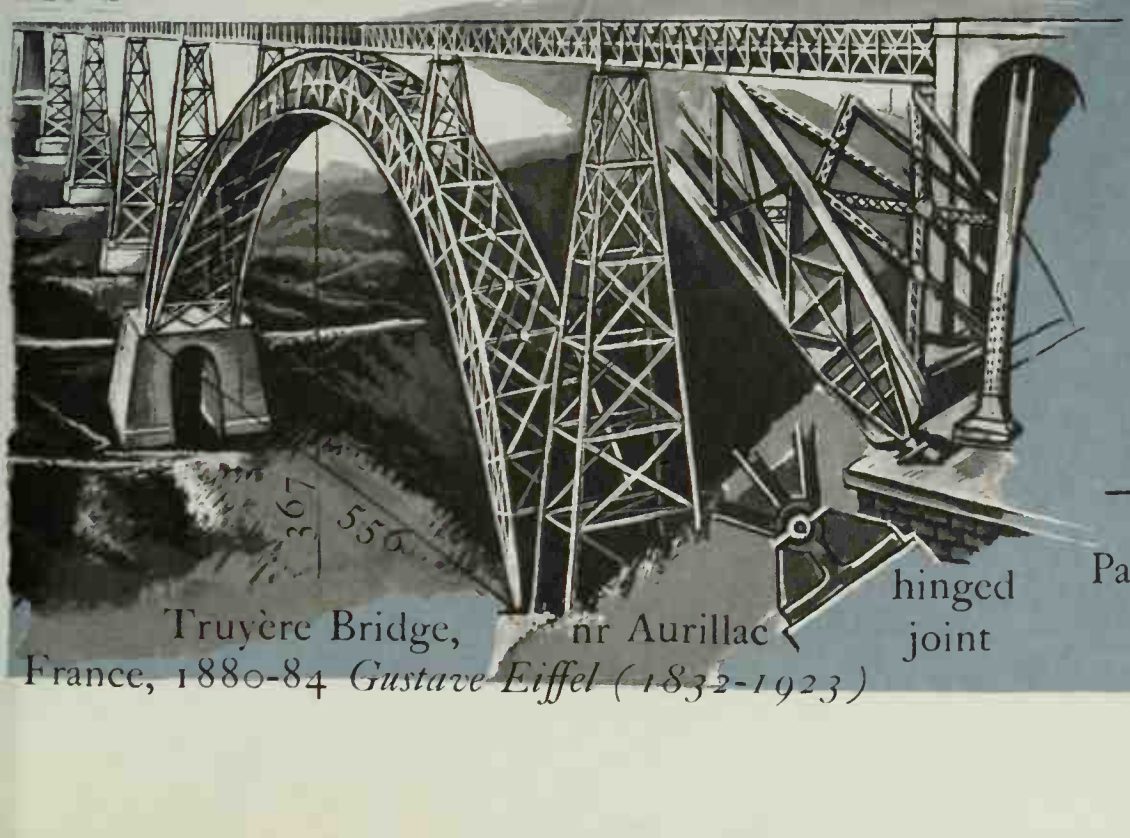


Eiffel Tower,
Paris, 1889.
Wrought iron *Eiffel*

pre-cast, glazed concrete elements

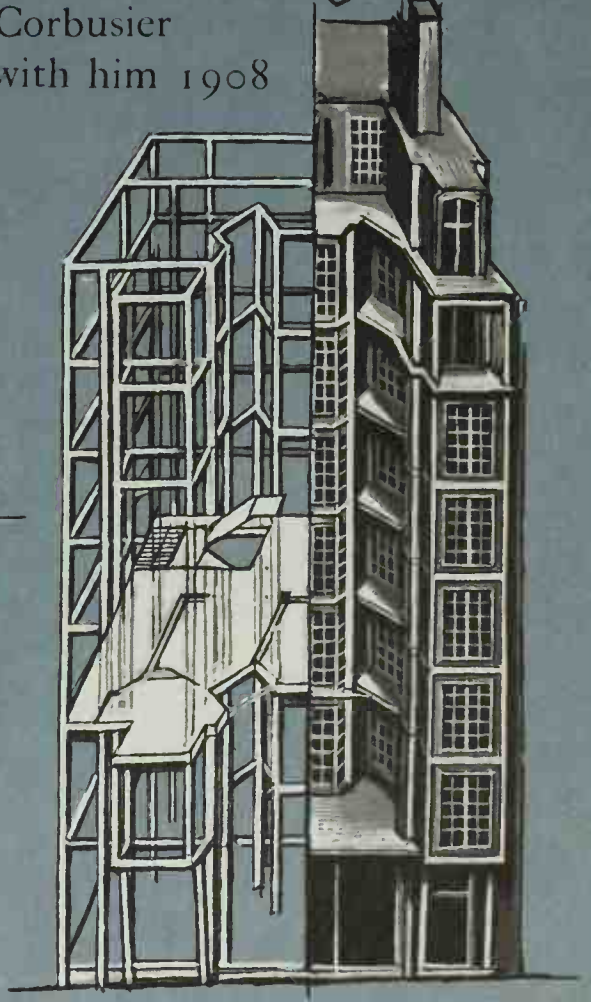
Notre-
Dame
du Raincy,
Paris, 1922-23.
Exposed concrete,
barrel-vaulted roof,
less than 2" at apex,
carried on reinforced
concrete columns
Auguste Perret:
Le Corbusier
worked with him 1908





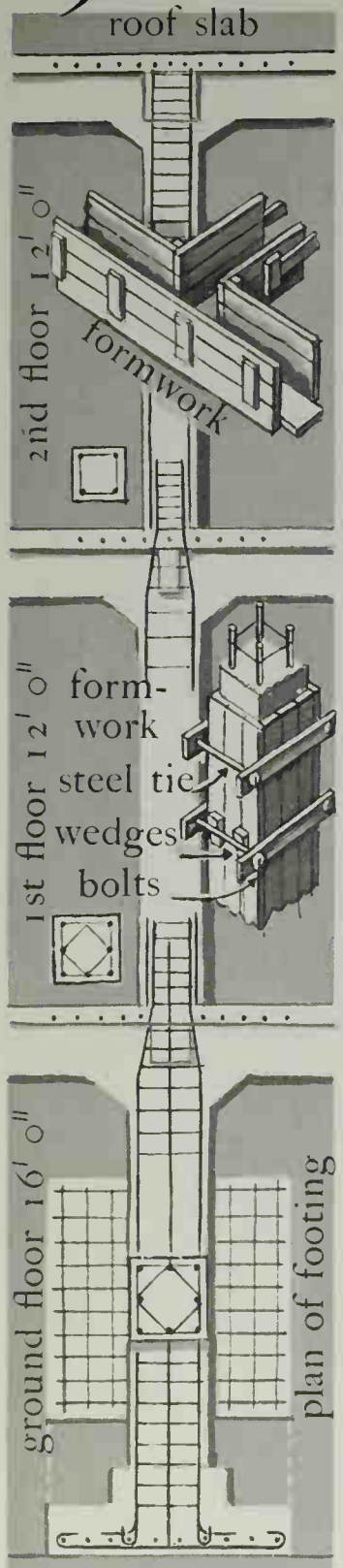
Truyère Bridge, nr Aurillac
France, 1880-84 *Gustave Eiffel (1832-1923)*

hinged
joint



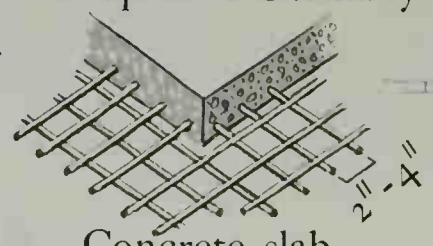
Flats, Rue Franklin,
Paris, 1903. Exposed reinforced
concrete framework
Auguste Perret (1874-1954)

19TH & 20TH CENTURIES

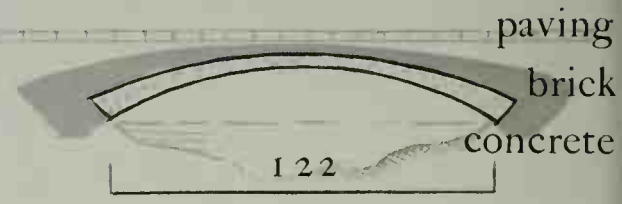


REINFORCED CONCRETE is a development of concrete — which had fallen into disuse from Roman times (pp.54-5) & was rediscovered *c.*1774 by the English engineer *John Smeaton* — and of iron.
In 1824 Portland cement was invented by *John Aspdin of* Leeds.
In 1867 *Joseph Monnier*, a French gardener, patented plant-tubs made of concrete, stiffened by wire netting; the patent was bought in 1885 and developed in Germany by *Wayss* and *Koenen*

Reservoir

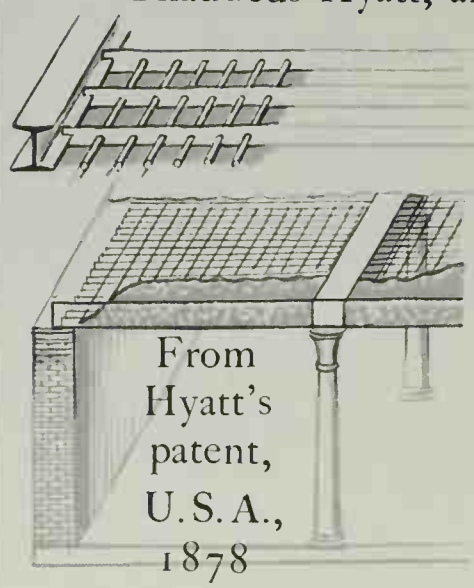


Concrete slab with steel reinforcing rods, $1\frac{1}{8}$" - $1\frac{1}{4}$" in diameter

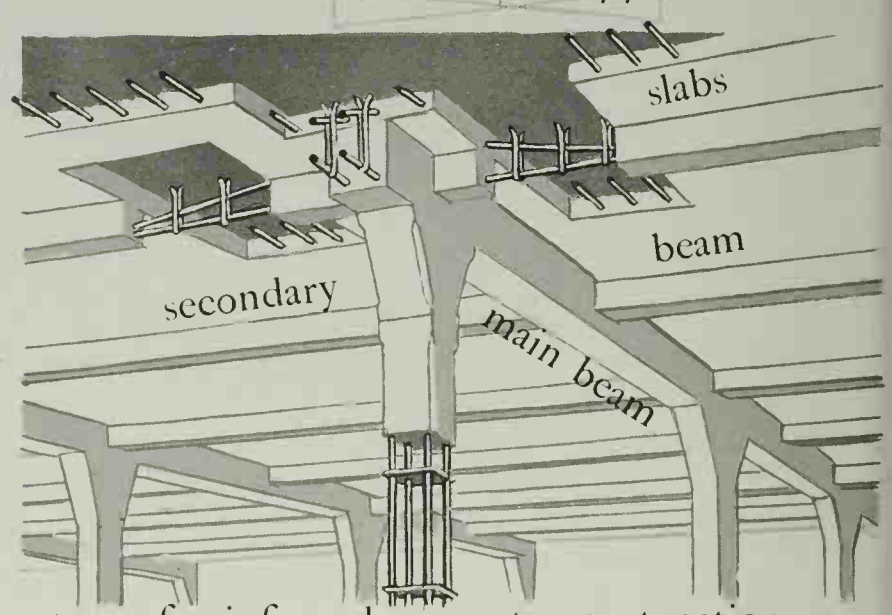


Bridge, Wildegg, Switzerland, 1890

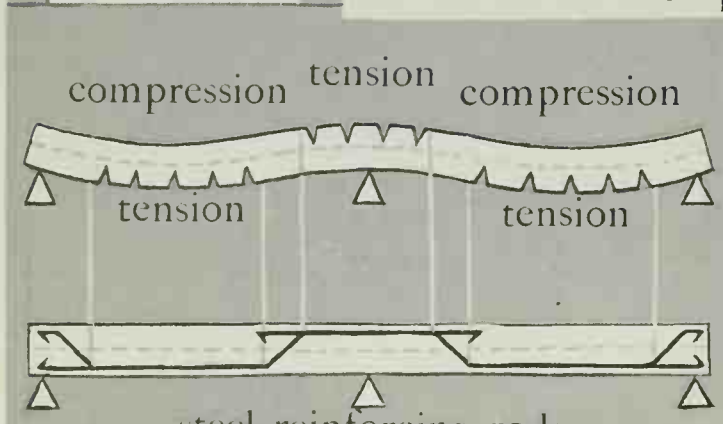
Thaddeus Hyatt, an American inventor, published *An Account of Some Experiments with Portland Cement Concrete, Combined with Iron as a Building Material*, London, 1877



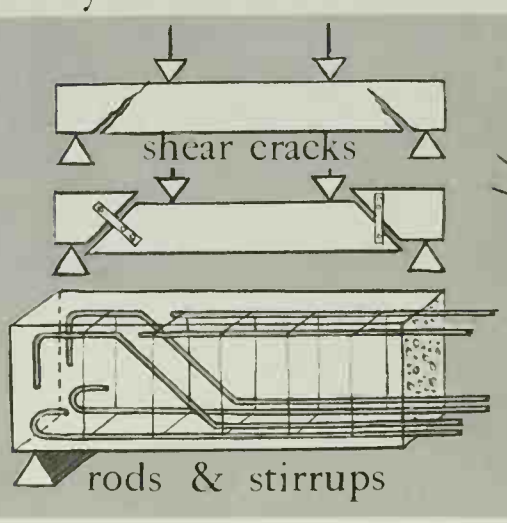
From Hyatt's patent, U.S.A., 1878



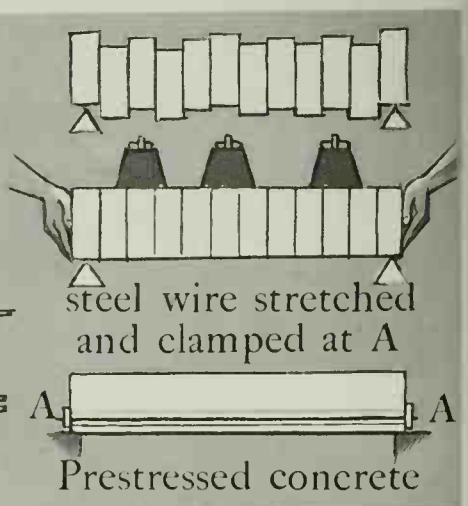
In 1892 the French engineer *Francois Hennibique (1842-1921)* devised a complete system of reinforced concrete construction



steel reinforcing rods inserted to take tension

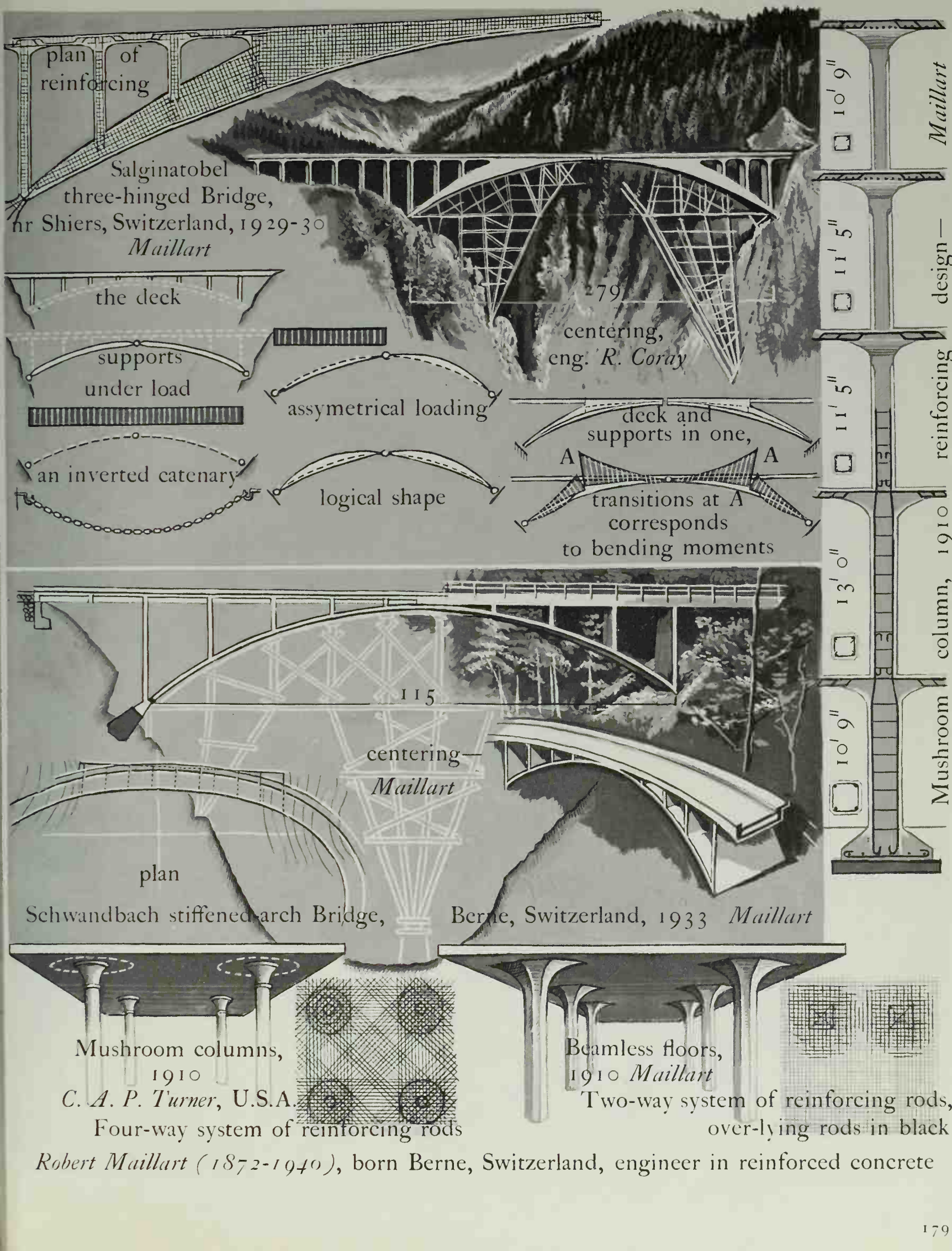


rods & stirrups



Prestressed concrete

REINFORCED CONCRETE



Mushroom columns, 1910
C. A. P. Turner, U.S.A.
Four-way system of reinforcing rods

Beamless floors, 1910 *Maillart*
Two-way system of reinforcing rods, over-lying rods in black

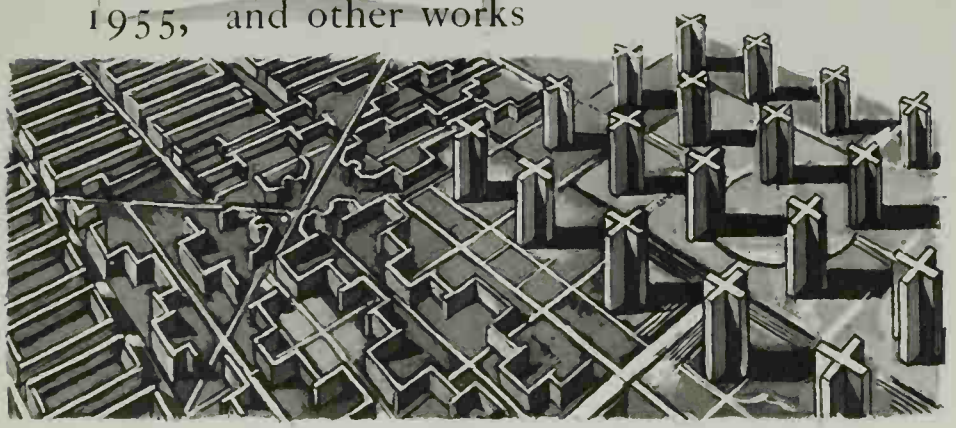
Robert Maillart (1872-1940), born Berne, Switzerland, engineer in reinforced concrete

19 TH & 20 TH CENTURIES

Le Corbusier (Charles-Edouard Jeanneret) (*1887-1965*), painter, architect, writer and theorist, born Chaux-de-Fonds, Switzerland. Learnt the use of reinforced concrete from *Perret* in Paris, 1908, worked under *Behrens*, with *Gropius* and *Mies vander Rohe*, in Berlin, 1910.

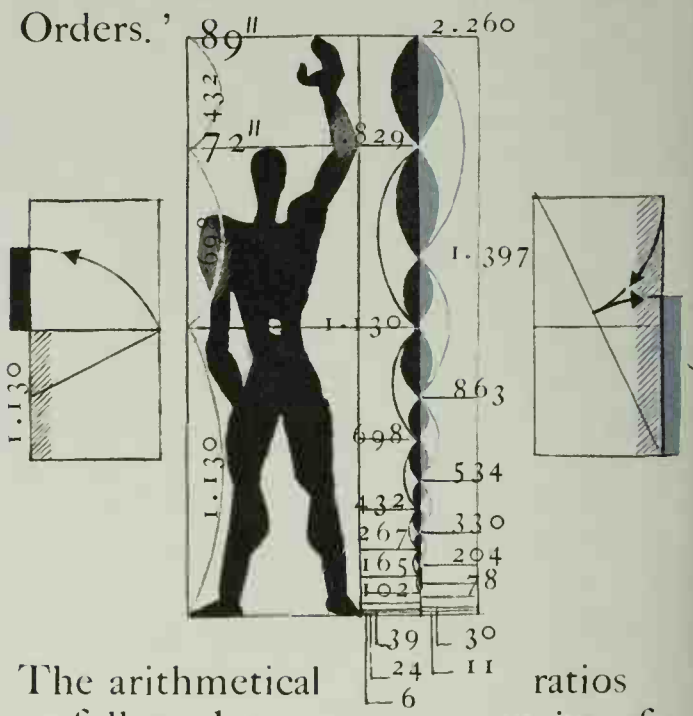
Vers une Architecture, Paris, 1923
Urbanisme, 1925
La Ville Radieuse, 1935
The Modulor, 1949
La Poeme de l'Angle Droit, 1955, and other works

As a 'cubist' painter, in 1918, with *Ozenfant*, he founded 'Purism' and a review, *L'Esprit Nouveau*



Contemporary city of three million inhabitants
From *Vers une Architecture*, Paris, 1923

'The Modulor a harmonious measure to the Human Scale.... & the Cosmic Orders.'

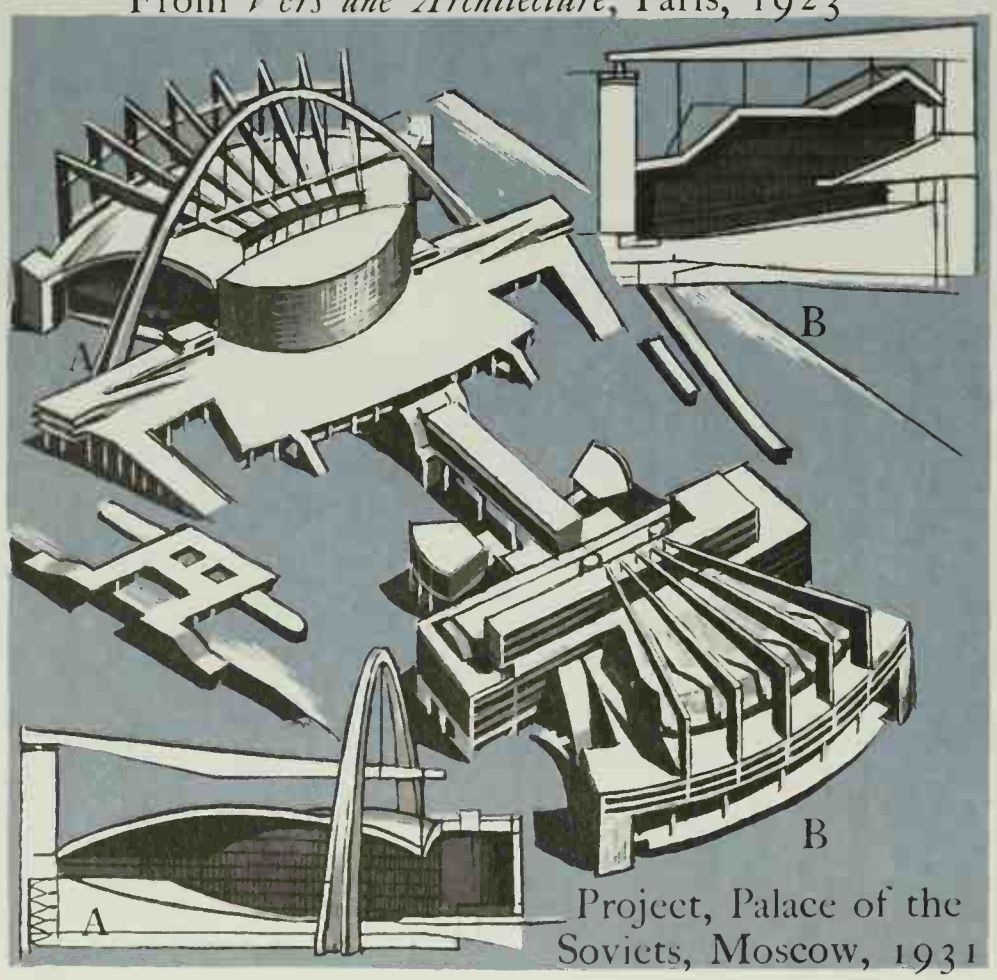


The arithmetical ratios follow the series of Fibonnaci of Pisa (b.1175):

$1,(1+1)2,(2+1)3,(3+2)5,(5+3)8\ldots$

$\frac{1}{1}+0,\frac{2}{1}=2\cdot0,\frac{3}{2}=1\cdot5,\frac{5}{3}=1\cdot66,\frac{8}{5}=1\cdot6\ldots$

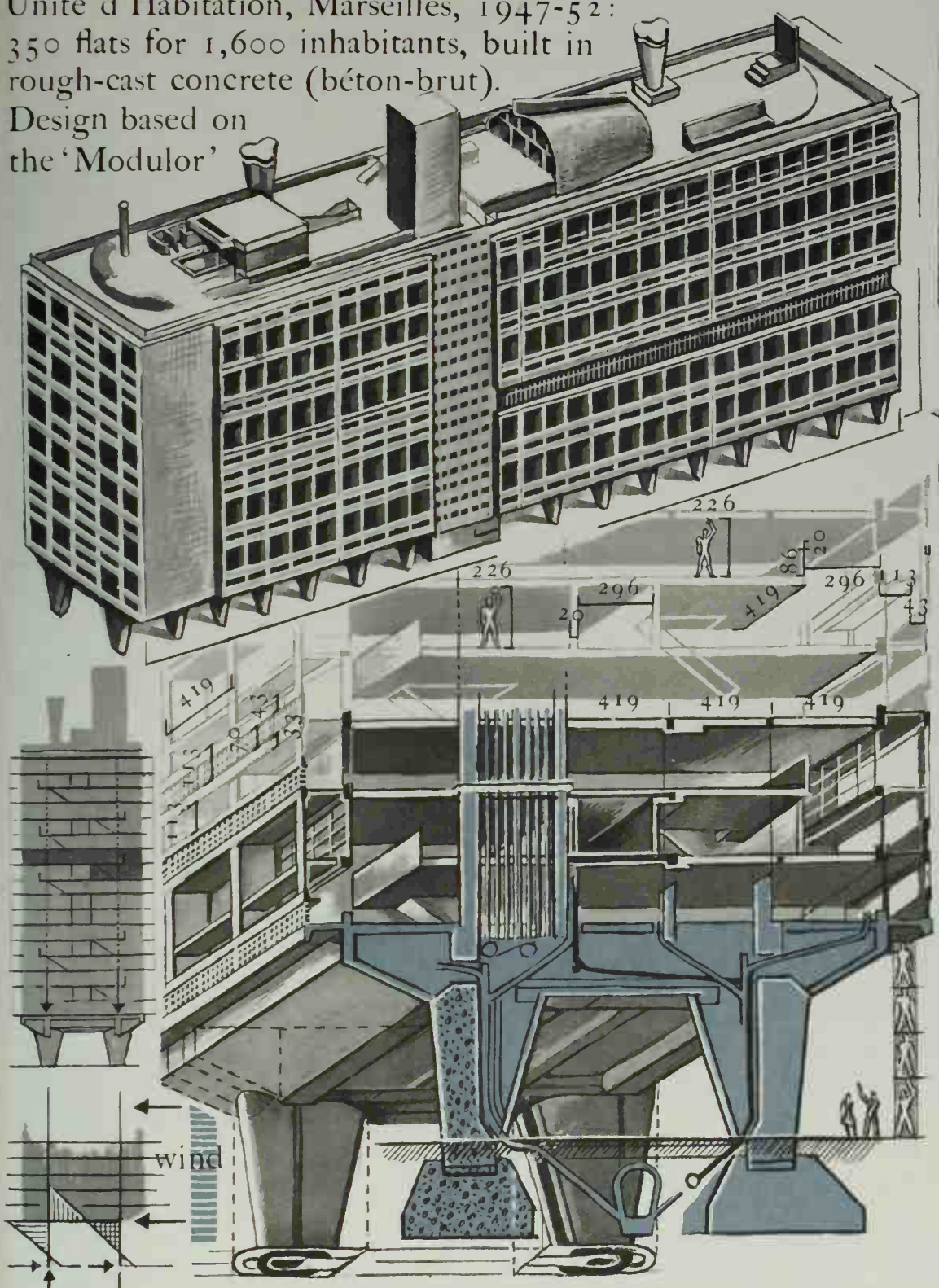
that is they approach nearer and nearer to the Golden Section, 1·618034

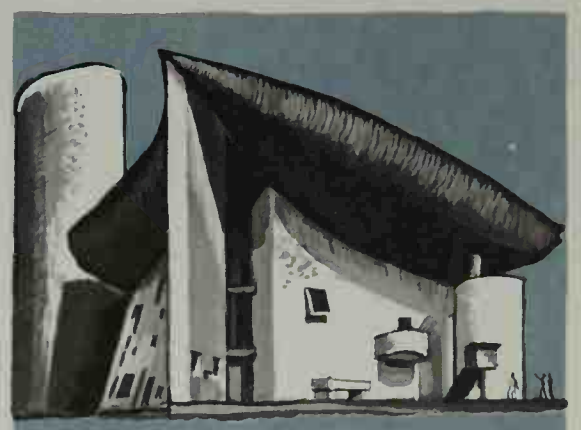


Project, Palace of the Soviets, Moscow, 1931

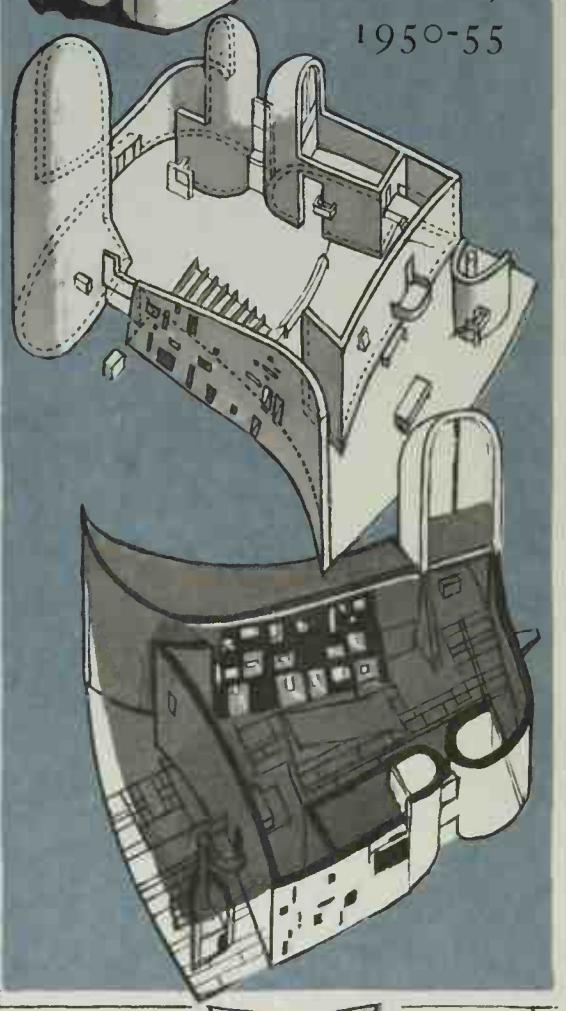
LE CORBUSIER

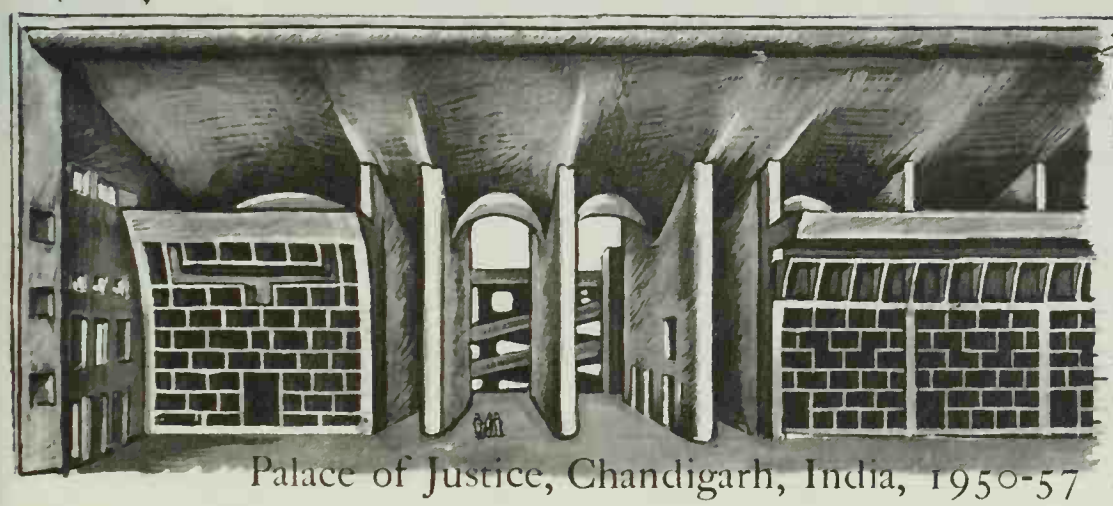
Unité d'Habitation, Marseilles, 1947-52: 350 flats for 1,600 inhabitants, built in rough-cast concrete (béton-brut). Design based on the 'Modulor'

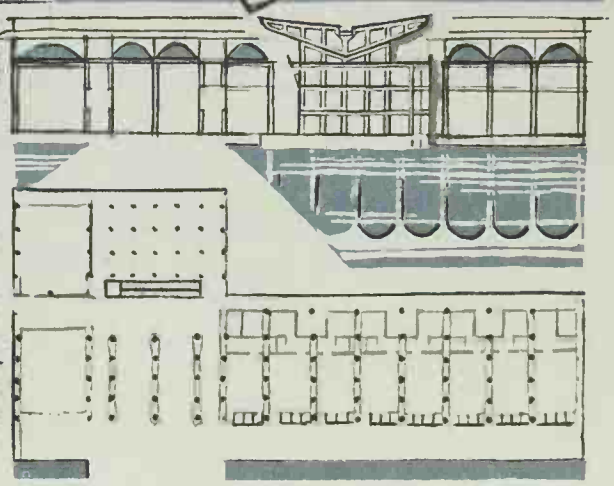




Notre Dame du Haut, Ronchamp, France, 1950-55





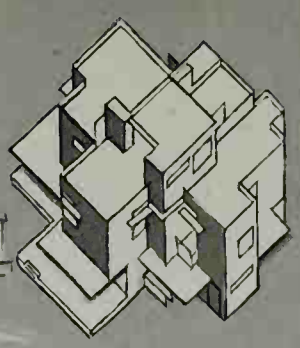


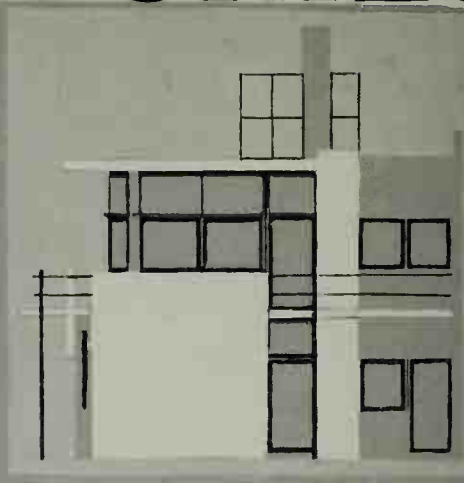
Palace of Justice, Chandigarh, India, 1950-57

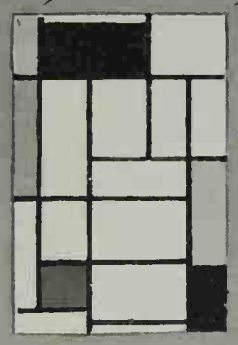
19 TH & 20 TH CENTURIES

Two books on the buildings of *Frank Lloyd Wright* were published in Berlin, in 1910 and 1911

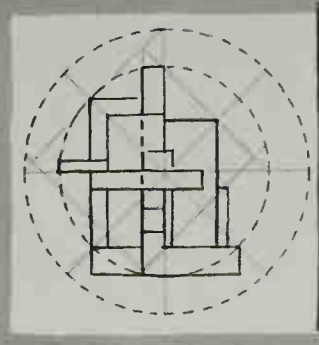
House, Heide, Utrecht, 1916
Robert van l'Hoff



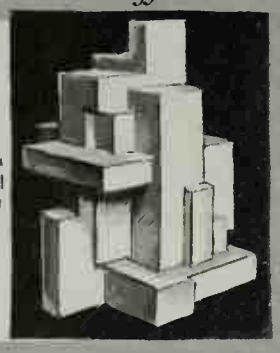




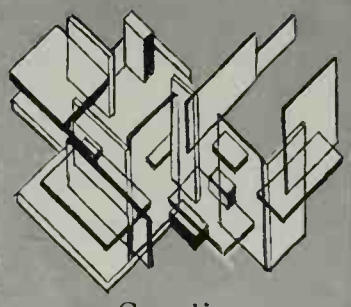
Composition, 1921
Piet Mondrian



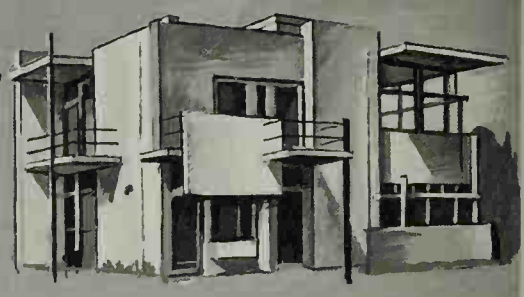
Modular diagram
Georges Vantongerloo



Composition, 1919

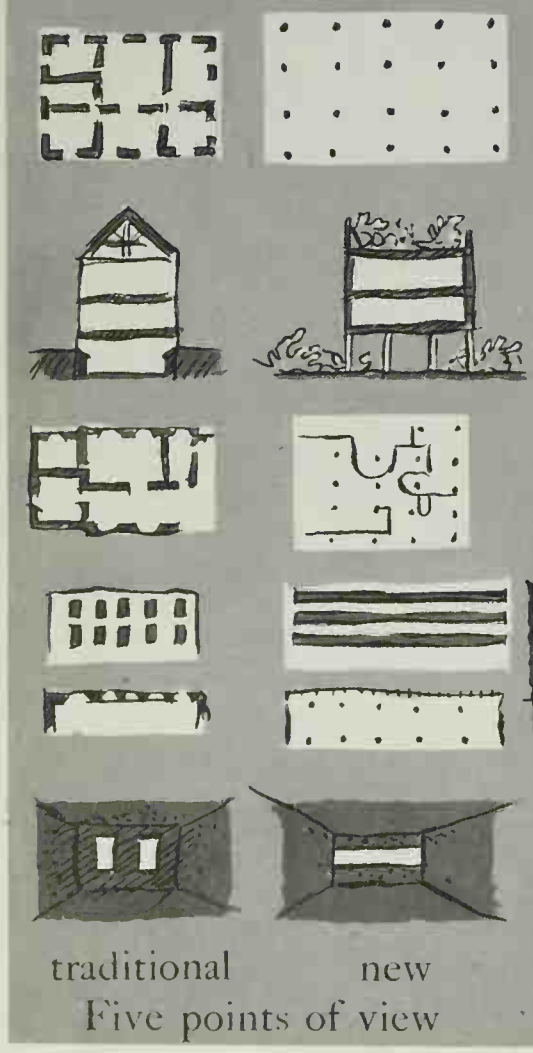


Studies for a house, 1923
Theo van Doesburg & Corvan Esteren

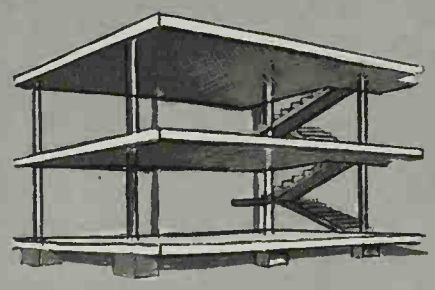


House, Utrecht, 1924
Gerrit Thomas Rietveld

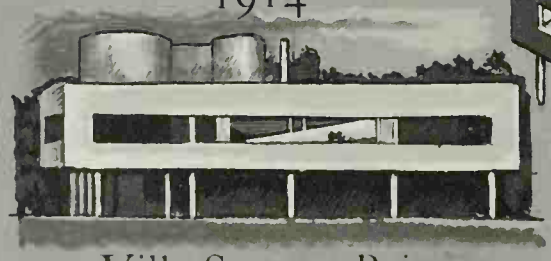
'De Stijl', Holland, 1917-*c.*1931: founded by a group of artists and architects whose aim was to simplify forms to rectangles and cubes, colours to red, yellow & blue, and to create a balance between static & dynamic movements.



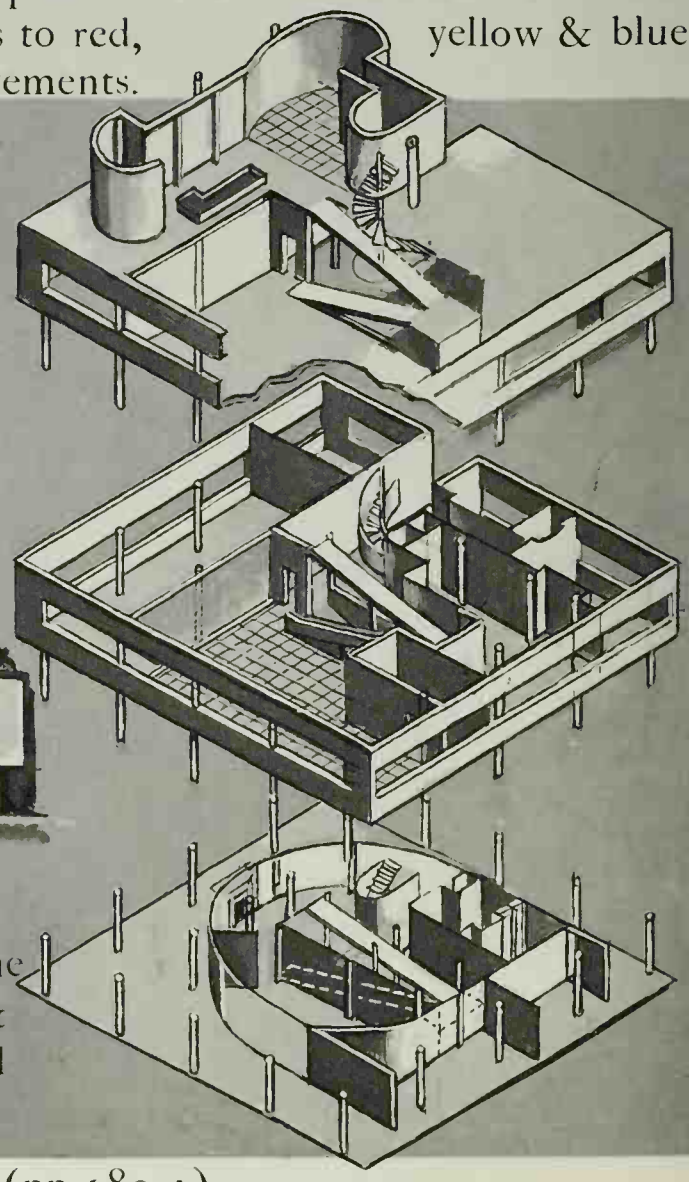
traditional new
Five points of view



Dom - Ino construction in reinforced concrete 1914

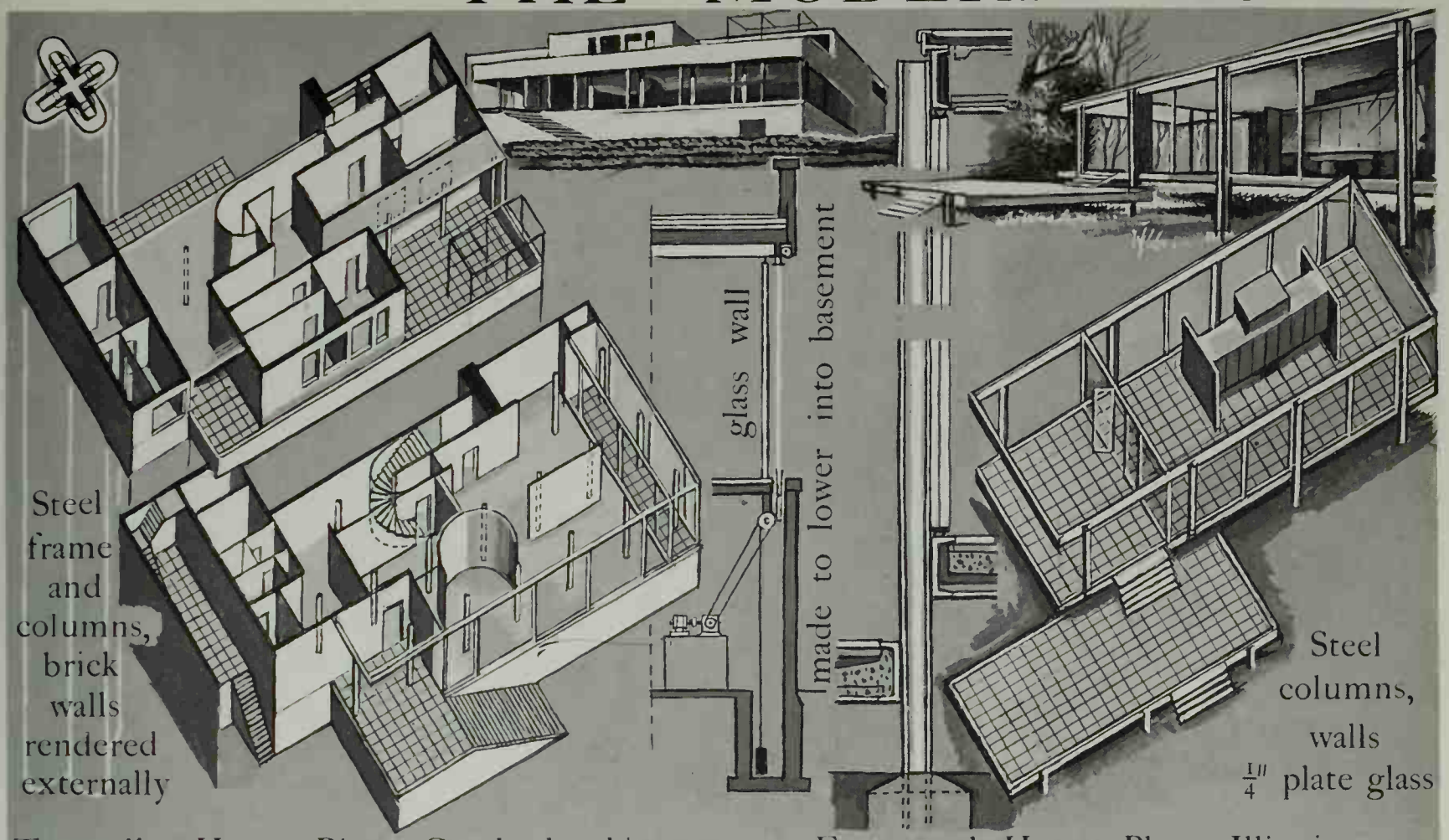


Villa Savoye, Poissy, nr. Paris, 1929-31. Reinforeed concrete frame and piers, walls, brick & breeze blocks, floors and roof, hollow tiles.



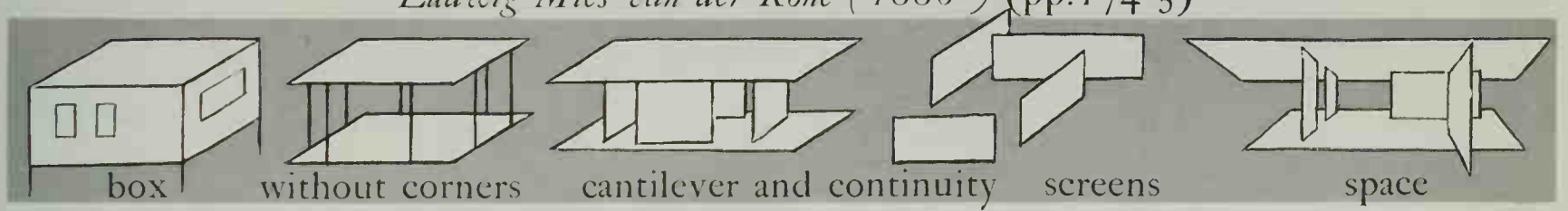
Le Corbusier (1877-1965) (pp.180-1)

THE MODERN HOUSE

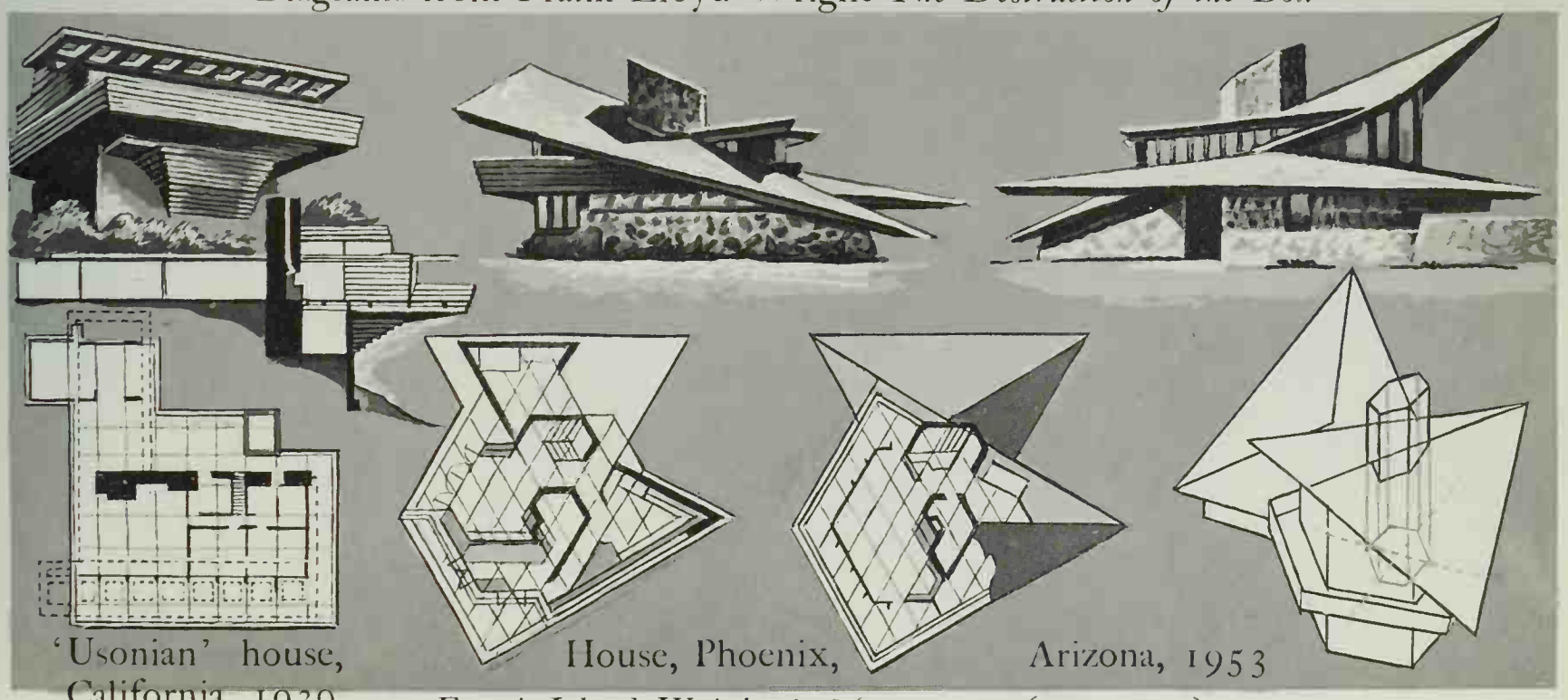


Tugendhat House, Birno, Czechoslovakia, 1930 Farnsworth House, Plano, Illinois, 1950

Ludwig Mies van der Rohe (1886-) (pp.174-5)



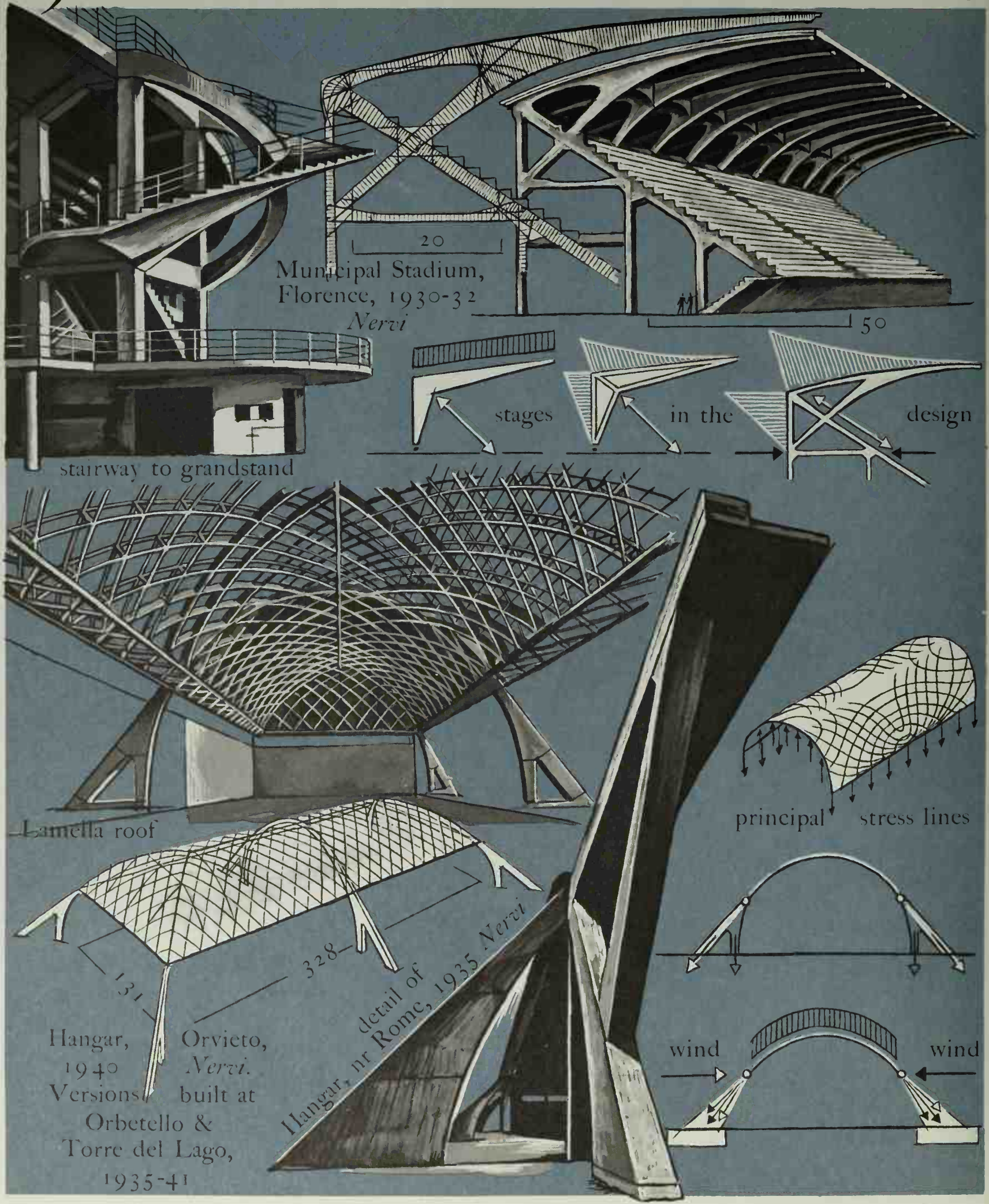
Diagrams from Frank Lloyd Wright *The Destruction of the Box*



'Usonian' house, California, 1939 House, Phoenix, Arizona, 1953

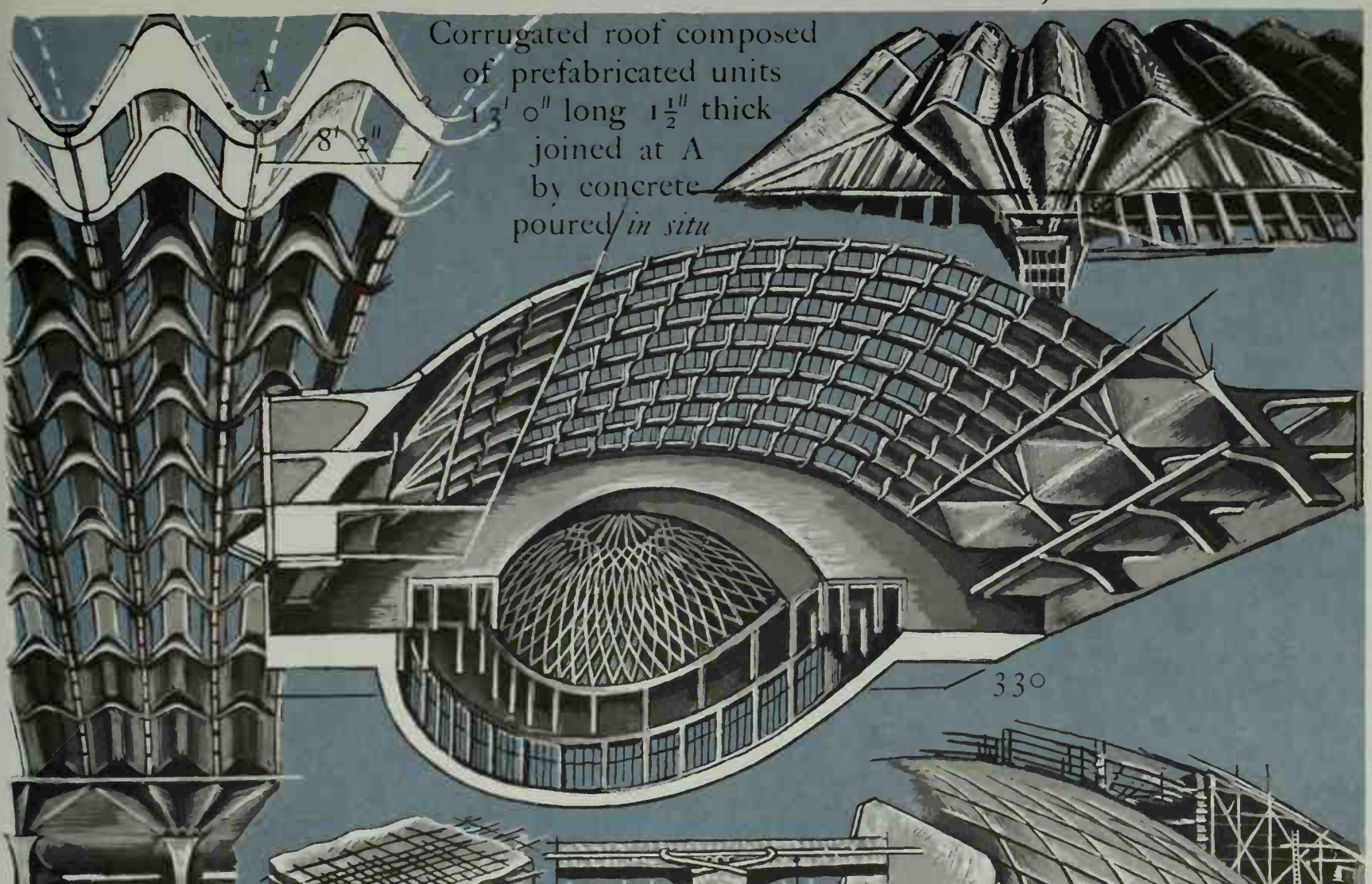
Frank Lloyd Wright (1867-1959) (pp.170-1)

19 TH & 20 TH CENTURIES



Peri Luigi Nervi (1891-), born Lombardy, engineer in reinforced concrete, follows 'both

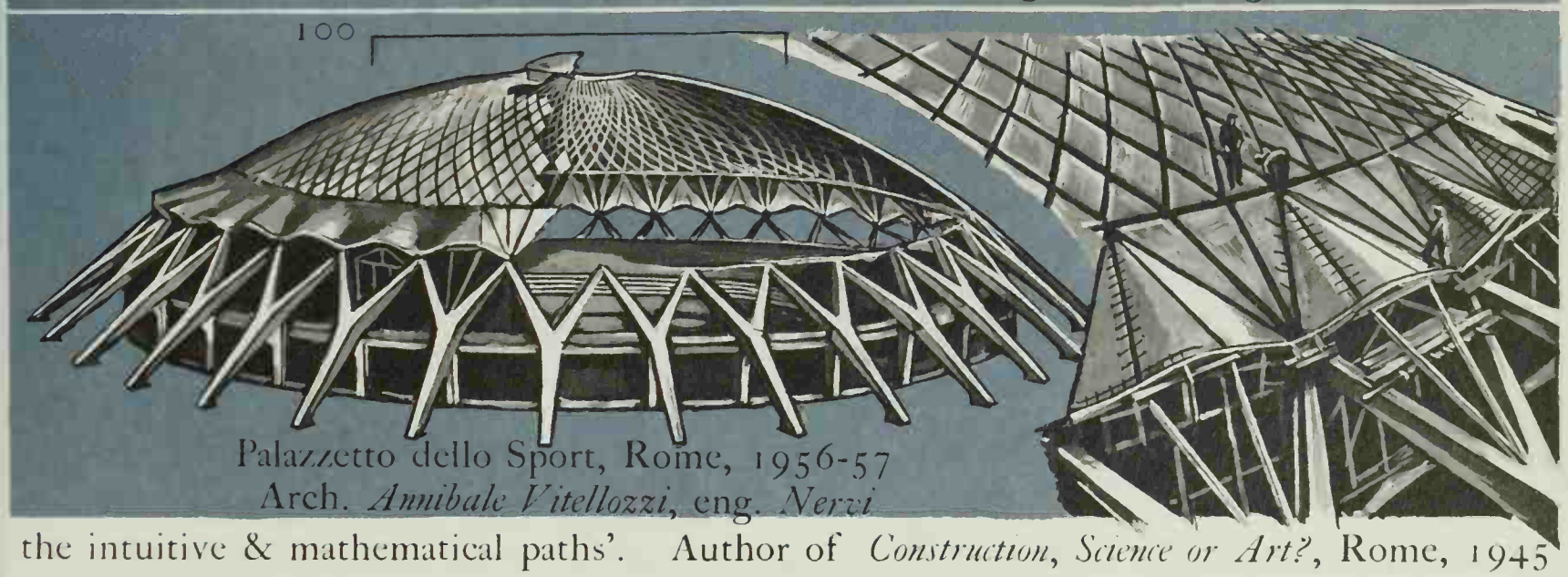
ITALY, NERVI



ferro-cemento
fine steel mesh 0.02"-
0.06" sprayed with
mortar cement

Section of joints
of prefabricated units 13' 0" by 6' 6" & ¾" thick

Exhibition Hall, Turin, 1948-50 *Nervi* developed prefabricated units of *ferro-cemento* (iron-concrete), speedily assembled on a light scaffolding

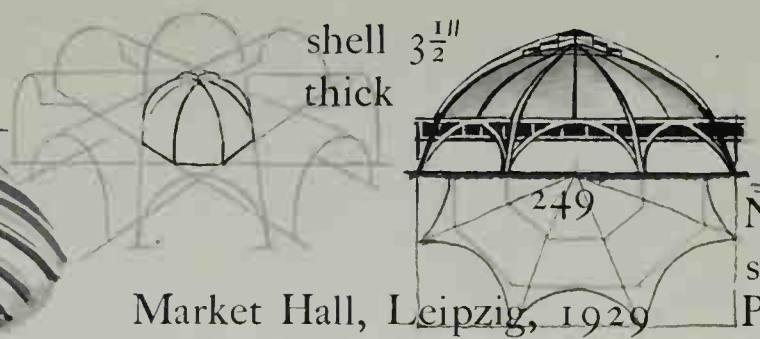


Palazzetto dello Sport, Rome, 1956-57
Arch. *Annibale Vitellozzi*, eng. *Nervi*

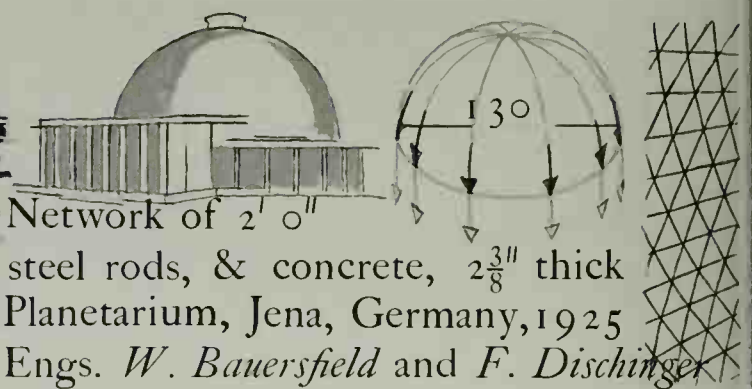
the intuitive & mathematical paths'. Author of *Construction, Science or Art?*, Rome, 1945

19TH & 20TH CENTURIES

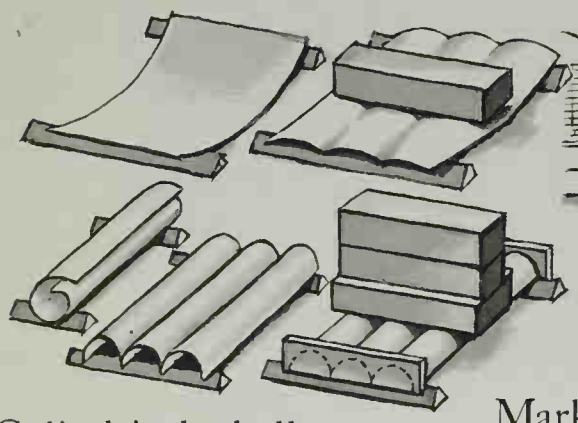
Shells



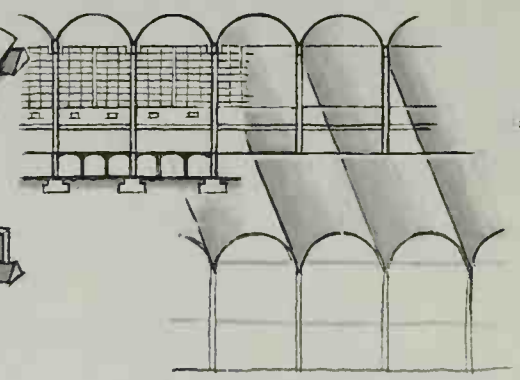
Market Hall, Leipzig, 1929
F. Dischinger and *Ritter*



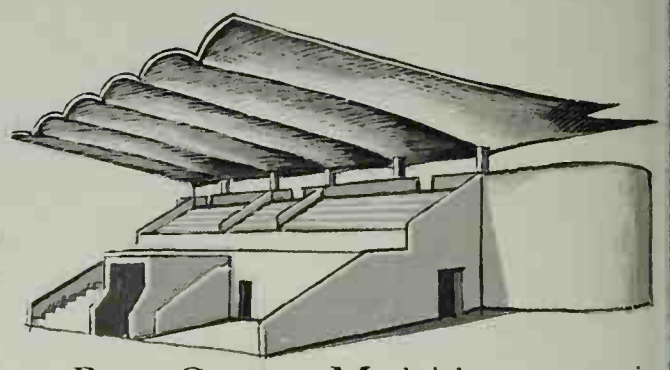
Network of 2' 0" steel rods, & concrete, $2\frac{3}{8}$" thick
Planetarium, Jena, Germany, 1925
Engs. *W. Bauersfield* and *F. Dischinger*



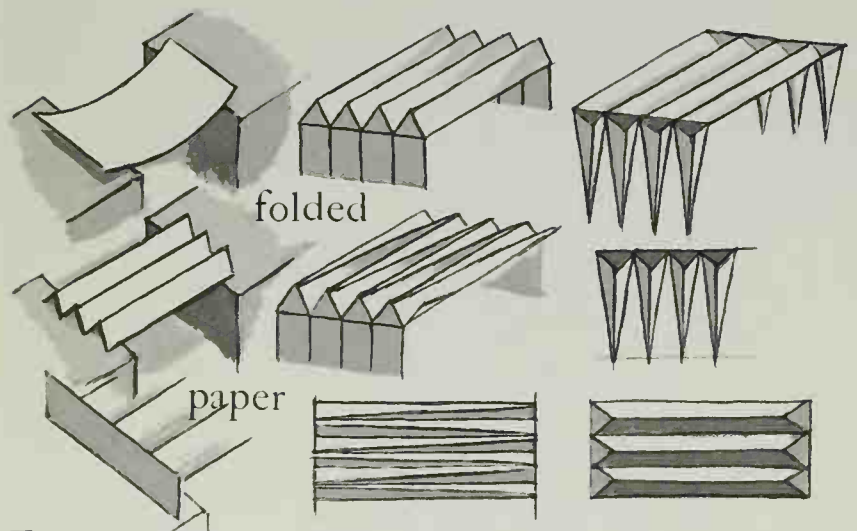
Cylindrical shells



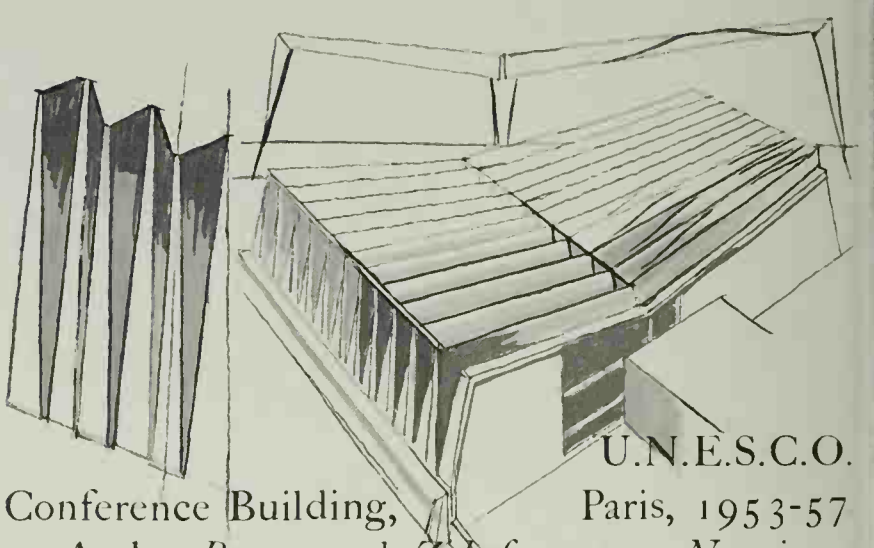
Market Hall, Frankfurt, 1927



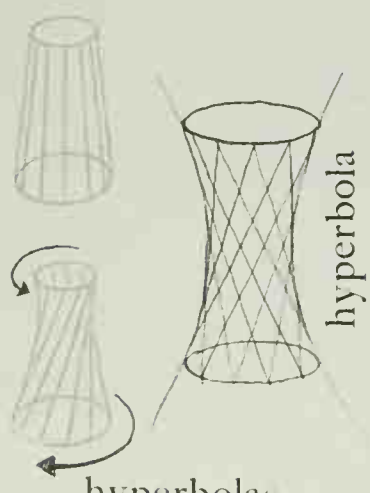
Race Course, Madrid, 1935
Eduardo Torroja (1899-1961)



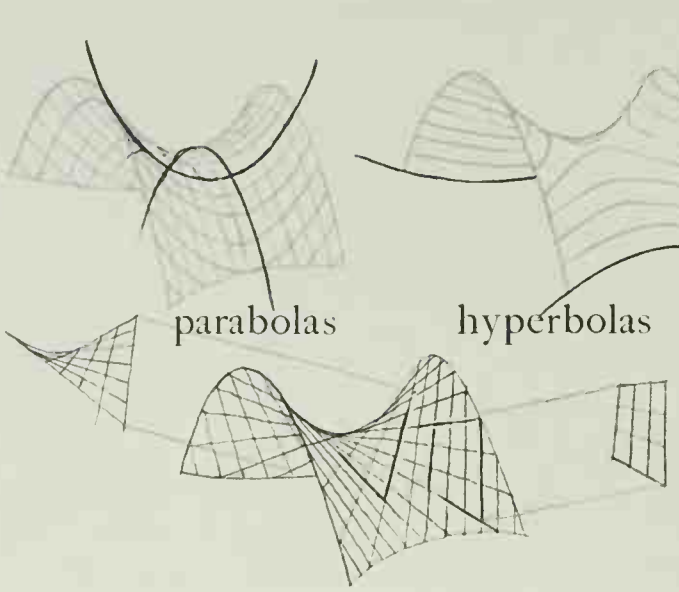
Folded plate structures

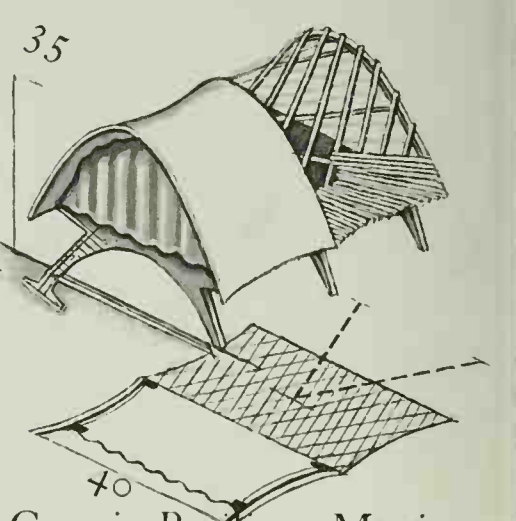


Conference Building, U.N.E.S.C.O. Paris, 1953-57
Archs. *Breuer* and *Zehrfuss*, eng. *Nervi*



hyperbolas of revolution

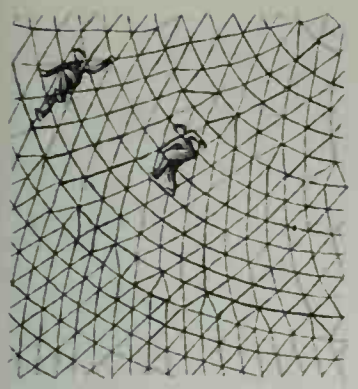


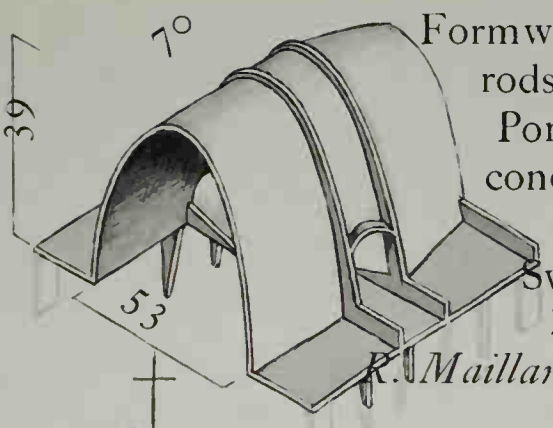


Cosmic Pavilion, Mexico University, 1951 *Candela*

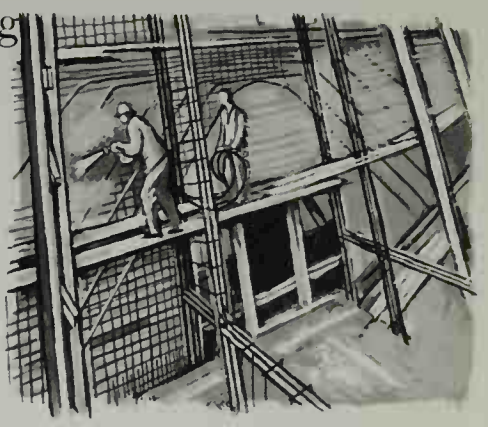
Hyperbolic paraboloids ('hypars'), doubly curved surfaces, mathematically analyzable, and

SHELL CONCRETE

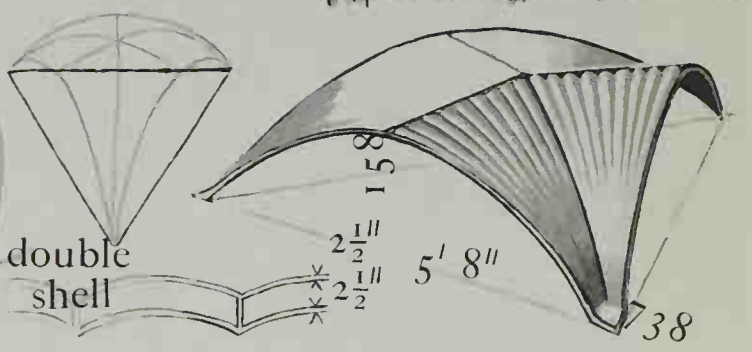




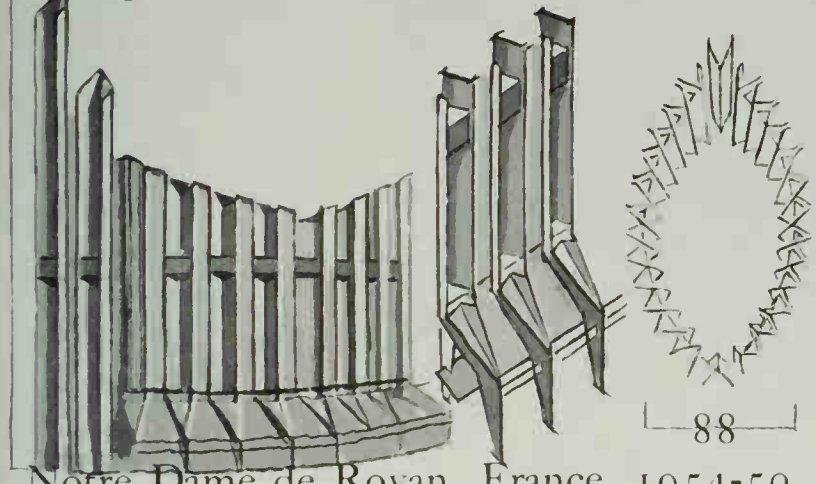
Formwork & reinforcing rods, sprayed with Portland cement concrete, $2\frac{3}{8}$" thick: Cement Hall, Swiss Exhibition, Zurich, 1938
R. Maillart (1872-1940)



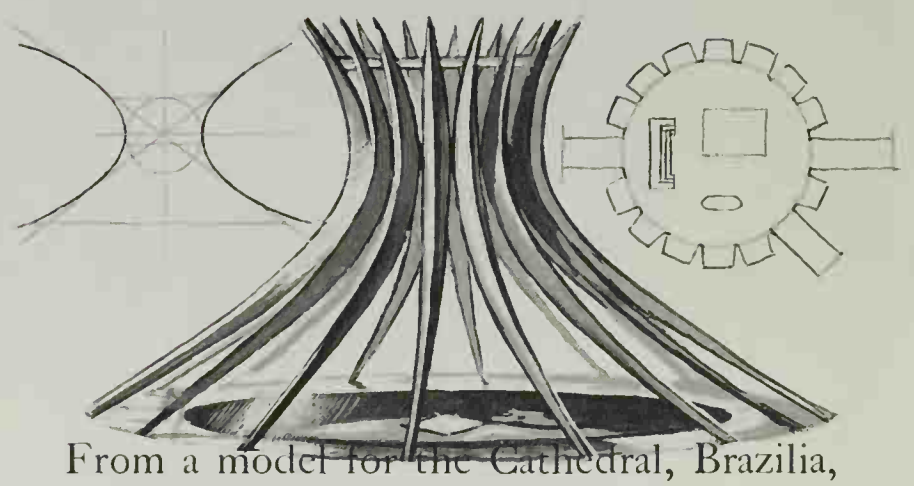
Collegiate Church, St Louis
Archs. *Helmuth, Obata* and *Kassobaum*, eng. *Nervi*



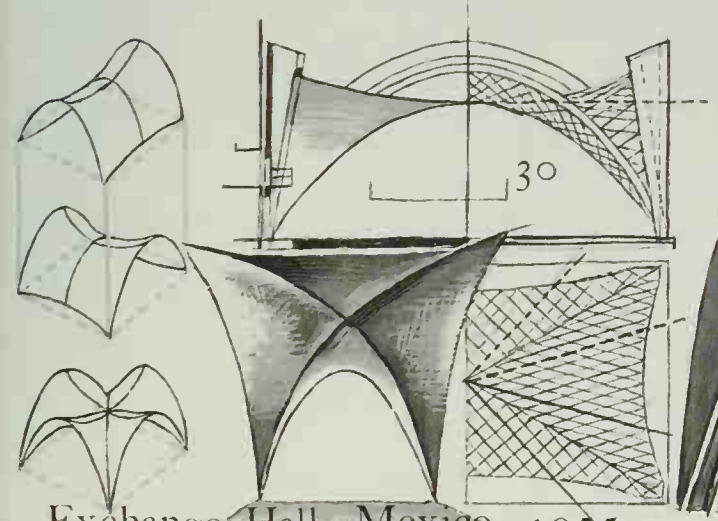
C.N.I.T. Exhibition Hall, Paris, 1958
Camelot, De Mailly and *Zehrfuss*



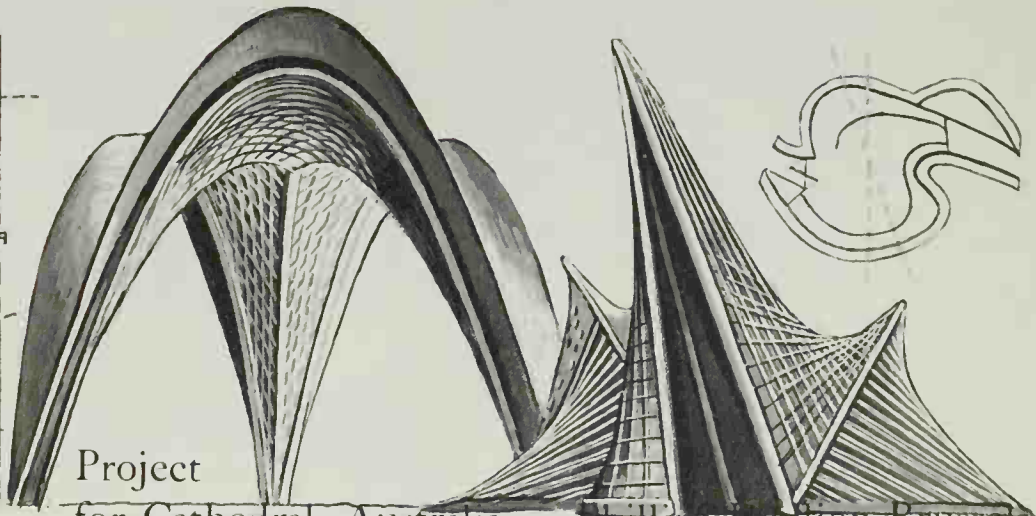
Notre Dame de Royan, France, 1954-59
Archs. *G. Gillet, B. Laffaile* and *R. Sager*



From a model for the Cathedral, Brazilia, 1960 *Oscar Niemeyer (1907-)*



Exchange Hall, Mexico, 1955
E. de la Mora & F. L. Carmona

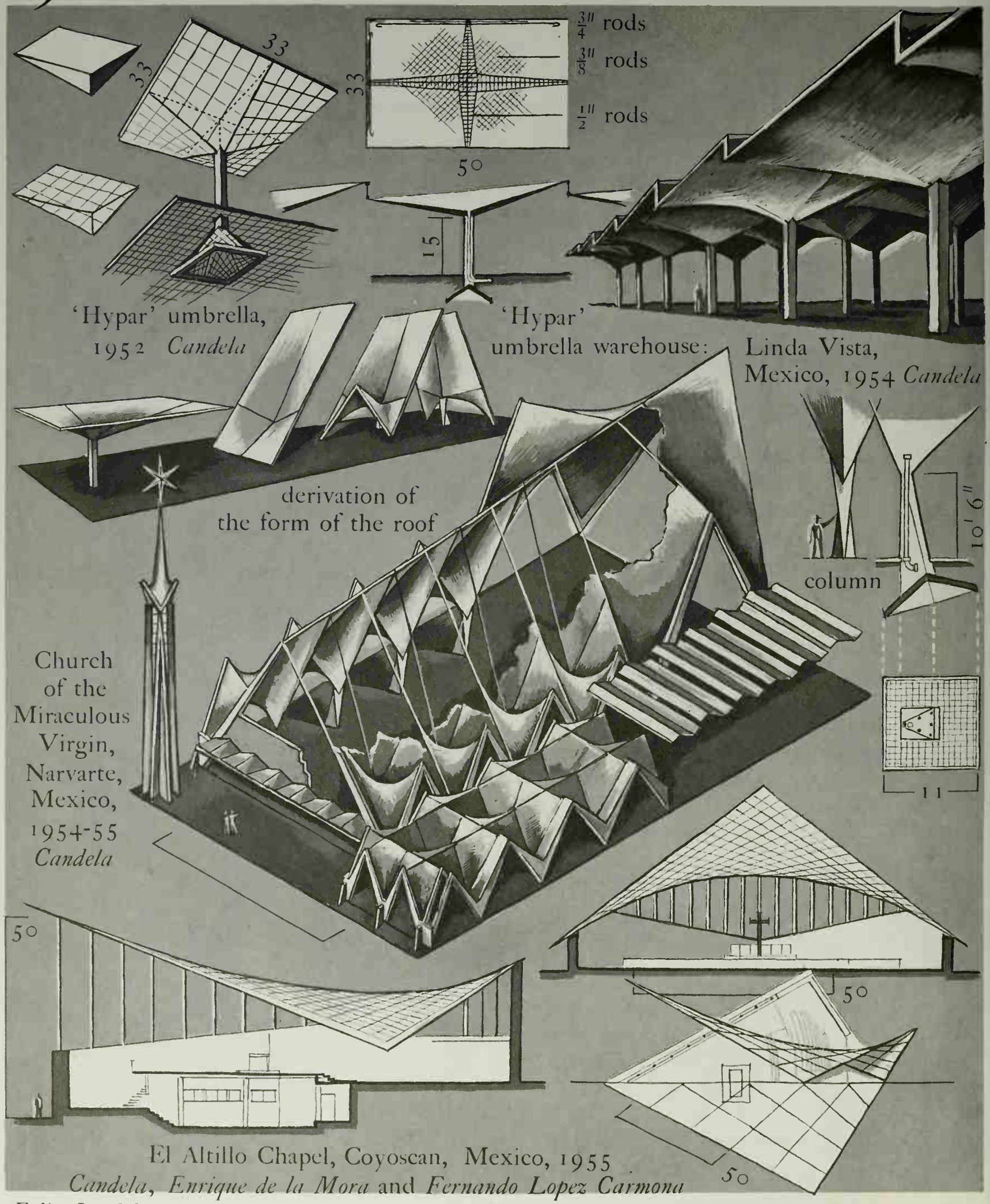


Project for Cathedral, Australia
A. Nervi and *C. Vannoni*

Phillips Pavilion, Brussels, 1958 *Le Corbusier*

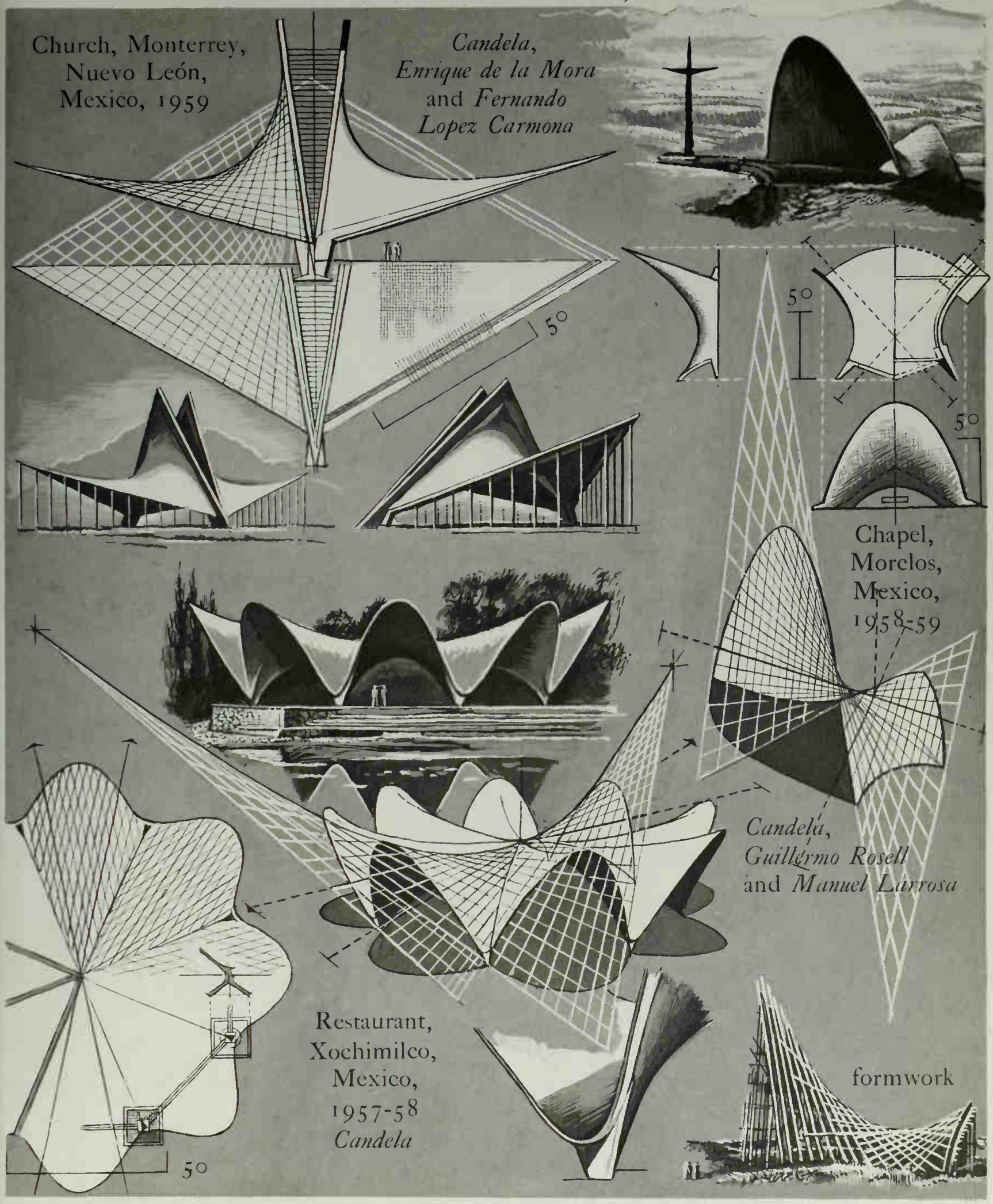
easy to build with formwork of straight planks, largely developed by *Candela* (pp. 188-9)

19 TH & 20 TH CENTURIES



Felix Candela (1910-): born and studied at Madrid, Mexico 1939 onwards. Since 1951

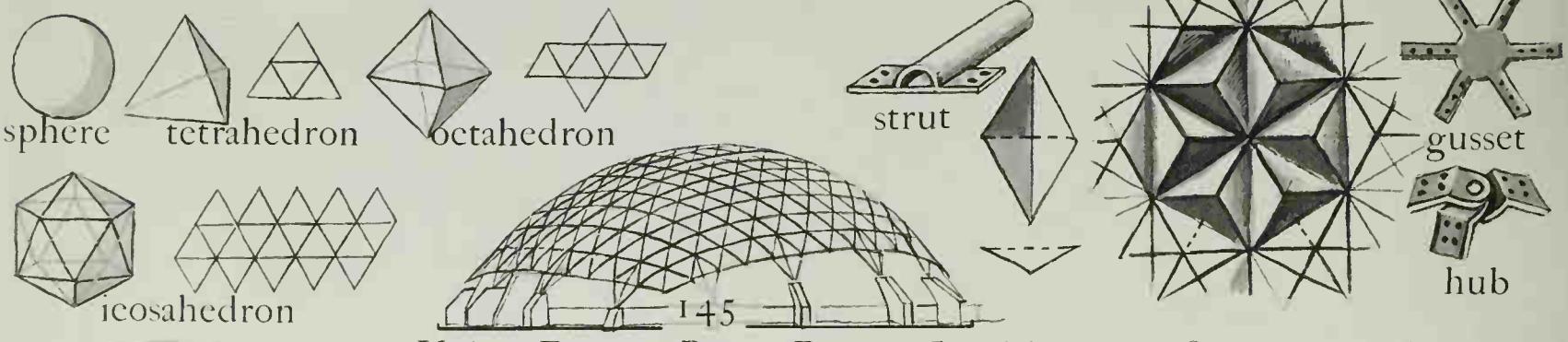
MEXICO, CANDELA



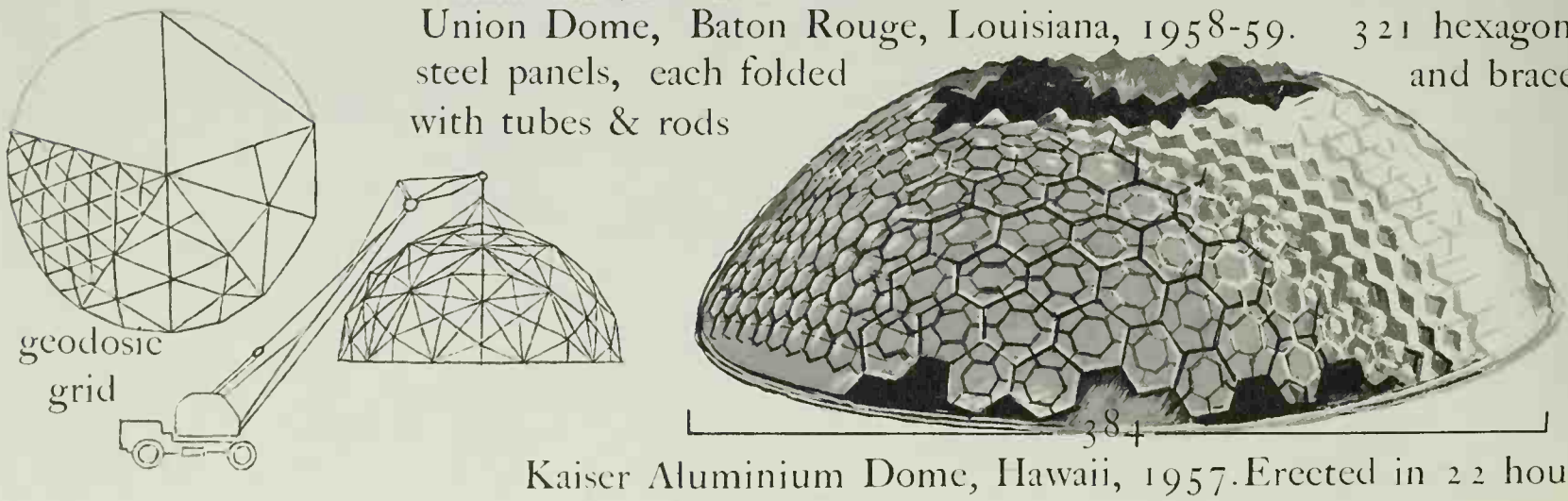
he has developed the hyperbolic paraboloid ('hypar'), often working with other architects

19TH & 20TH CENTURIES

T.W.A. Terminal, Kennedy Air Port, New York, 1956-62
Eero Saarinen (1910-61), born Finland, went to U.S.A. in 1923

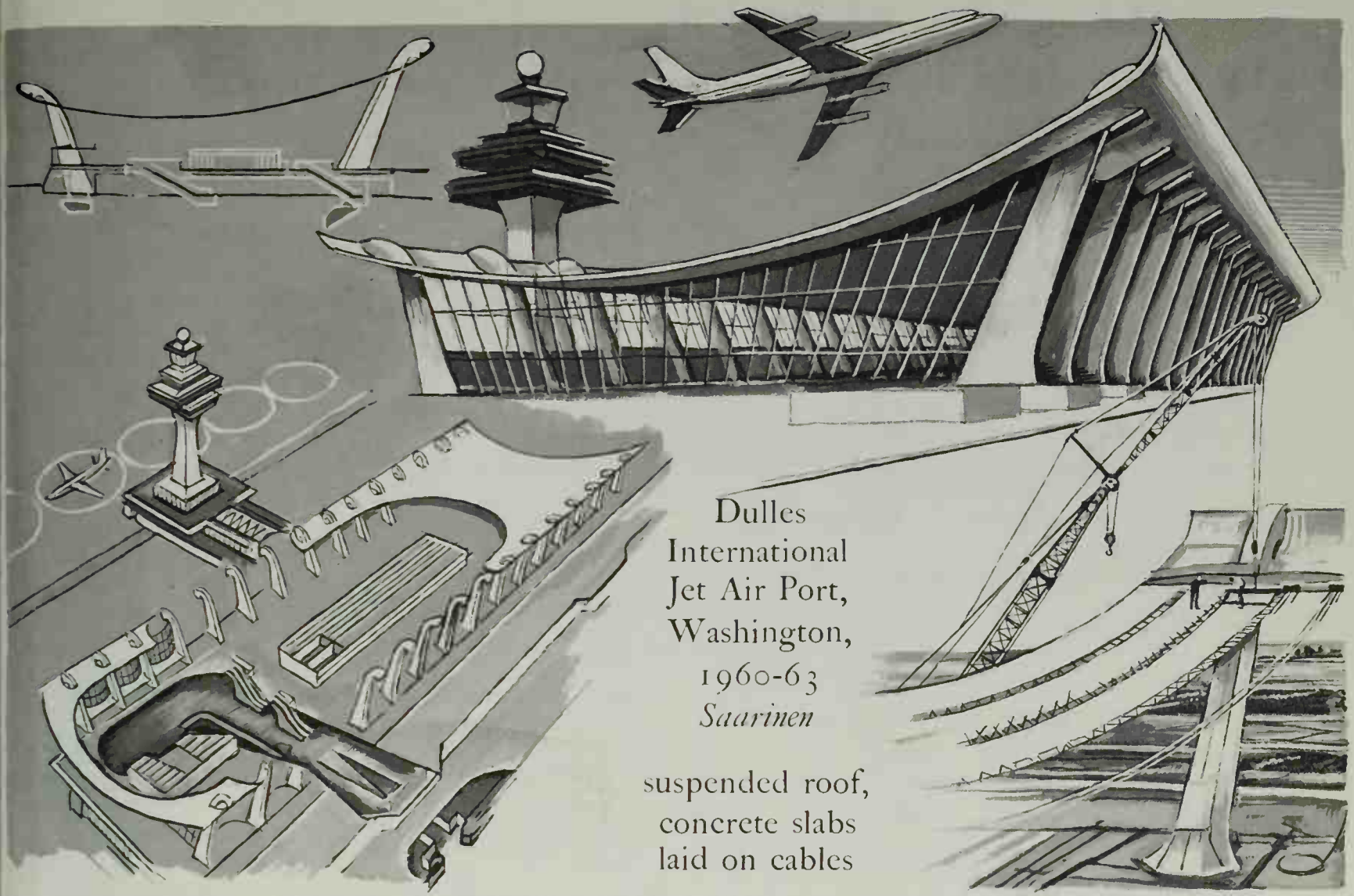


Union Dome, Baton Rouge, Louisiana, 1958-59. 321 hexagonal steel panels, each folded and braced with tubes & rods



Kaiser Aluminium Dome, Hawaii, 1957. Erected in 22 hours
Geodosic Domes from 1948 *Richard Buckminster Fuller (1895-)*, 'comprehensive designer'

U.S.A.



Dulles
International
Jet Air Port,
Washington,
1960-63
Saarinen

suspended roof,
concrete slabs
laid on cables

'Key project' for Ellis Island,
New York Harbour, 1959-61,
one of the last projects made by
Frank Lloyd Wright (1867-1959)

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Note—More extensive bibliographies can be found in the books marked below with an asterisk

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Continued from front flap

Every page of this book bears the stamp of an accomplished teacher and an equally skilled artist. Its scope and presentation make it invaluable for student and general reader alike: students will appreciate it as a comprehensive visual textbook, general readers as an exceptionally clear guide to European, British and American architecture. Complete with lists of buildings, architects, and technical terms, it will also prove an indispensable work of reference for any school or public library. But, above all, this exciting book communicates its author's vision and enthusiasm.

JOHN MANSBRIDGE, a distinguished artist and illustrator, has also had wide experience in teaching art and in lecturing on the history of architecture. Until his retirement in 1966 he was for many years Senior Lecturer in the School of Art at the Goldsmiths' College, London. His *Graphic History of Architecture* is the fruit of ten years' painstaking research and preparation.

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