The Dictionary of Art

25

Pittoni

TO

Raphael

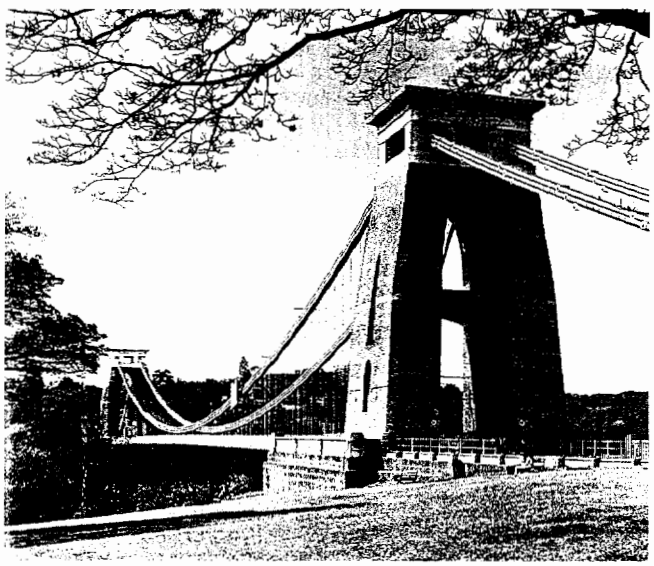
GROVE

consists of two principal spans of wrought-iron parabolic arches tied by pairs of supension chains, with the railway deck hung from vertical struts (*see* BRIDGE, fig. 1).

The Bristol contacts that led to Brunel's railway career also resulted in his involvement in shipbuilding. At Bristol two ships were built to his design, the timber-hulled paddle steamer *Great Western* (1837) and the iron-hulled screw-propulsion *Great Britain* (1843). But it was at Millwall in London that his most famous ship was built, the colossal 210 m-long *Great Eastern* (1854–9). The construction of this monster, intended for the Indian and Australian trade, was of a scale and novelty that overstretched even Brunel's capacities, and partly accounted for his early death at the age of 53.

In the midst of all these projects Brunel played a part in some of the major public events of his time. As a member of the building committee for the Great Exhibition of 1851, he conceived of housing the event beneath a huge sheet-metal dome, but his design was howled down in favour of the submission by Paxton and Fox Henderson. In 1855 he devised a prefabricated hospital of 1000 beds, erected at Renkioi in Turkey for the casualties of the Crimean War. Though none of its features was particularly original (the roof structure was a variant of his timber viaduct designs), the speed with which he worked brought public acclaim.

The author and social reformer Samuel Smiles (1812–1904) described Brunel as 'the very Napoleon of engineers, thinking more of glory than of profit, and of victory than of dividends'. Brunel was jealous of his fame and his authority, but he inspired great loyalty from his assistants and backers. 'I cannot act under any supervision, or form part of any system which recognizes any other adviser than myself, or any other source of information than mine, on any question connected with the construction or mode of carrying out practically this great project on which I have staked my character', he wrote about the *Great Eastern* during one of the crises in its construction (Rolt, p. 311). Part of his fame has derived from the position he created for himself as a single-handed manager, a role that subsequent generations of engineers have found hard to repeat.



Isambard Kingdom Brunel: Clifton Suspension Bridge, Bristol, completed 1864

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ROBERT THORNE

Brunelleschi, Filippo (*b* Florence, 1377; *d* Florence, 16 April 1446). Italian architect and sculptor. He is traditionally regarded as the father of Renaissance architecture who, in the words of Vasari, 'was sent by Heaven to invest architecture with new forms, after it had wandered astray for many centuries'. The 'new forms' were those of Classical antiquity, which Brunelleschi applied to such building types as churches and orphanages for which there were no ancient precedents. In these schemes he was the first to make use of the Classical orders since antiquity (*see* ORDERS, ARCHITECTURAL, §I, 2(iii)(a)); at the same time he employed a proportional system of his own invention, in which all units were related to a simple module, the mathematical characteristics of which informed the entire structure. Brunelleschi worked almost exclusively in Florence, and many features link his architecture with the Romanesque—if not the Gothic—heritage of that city. Nevertheless, he was beyond question responsible for initiating the rediscovery of ancient Roman architecture. He understood its inherent principles and he employed them in an original manner for the building tasks of his own day.

I. Life and work. II. Influence and posthumous reputation.

I. Life and work.

He was the son of the notary Ser Brunellesco di Lippi, an official in the Florentine administration. Brunelleschi's schooling in the liberal arts was of the type that normally preceded training for one of the learned professions, but a gift for drawing led him instead to serve from 1398 as a journeyman in the silk-workers' guild (Por S Maria), which also controlled the craft of goldsmithing. Brunelleschi matriculated as a master goldsmith on 2 July 1404. Surviving work from this period includes silver figures of two *Prophets* (1398–1400) on the altar of S Jacopo, Pistoia Cathedral, and the gilded bronze panel depicting the *Sacrifice of Isaac* (1401; Florence, Bargello) that he submitted in the competition for the east doors of the Baptistery of Florence Cathedral; Brunelleschi's panel places Isaac at the centre of a scene of intense action, in which the main figures are depicted in profile. A wooden Crucifix (1.7×1.7 m, *c.* 1410–15; *see* CRUCIFIX, §3(ii) and fig. 5) by Brunelleschi in the Gondi Chapel of S Maria Novella, Florence, was, according to an early 16th-century account, the outcome of a private competition with Donatello; a

wooden Crucifix that has been attributed to the latter hangs in Santa Croce.

According to Brunelleschi's biographer, ANTONIO MANETTI, after Lorenzo Ghiberti had won the competition (1401) for the Baptistery doors, the runners-up, Donatello and Brunelleschi, both left for Rome to study sculpture and architecture respectively. Brunelleschi, who, by family tradition, was a peripheral member of the Florentine political establishment, subsequently took up positions in local political circles, including service on the city council and on advisory committees on the great building works that characterized the emerging oligarchic state at the time and gave new form to the city (*see* FLORENCE, §I, 3). The account of Brunelleschi's visit to Rome is still disputed, but his involvement with Florentine building works and his studies of Classical and of Tuscan Romanesque architecture—exemplified not least in the classicizing details of the Baptistery—must have provided the foundations of his personal *all'antica* language of architectural details, and to his development *c.* 1413 of perspective contruction (*see* PERSPECTIVE, §II) and proportion systems. Brunelleschi's stepson, Buggiano, carved his funeral monument (1447–8; Florence Cathedral; *see* BUGGIANO and fig.).

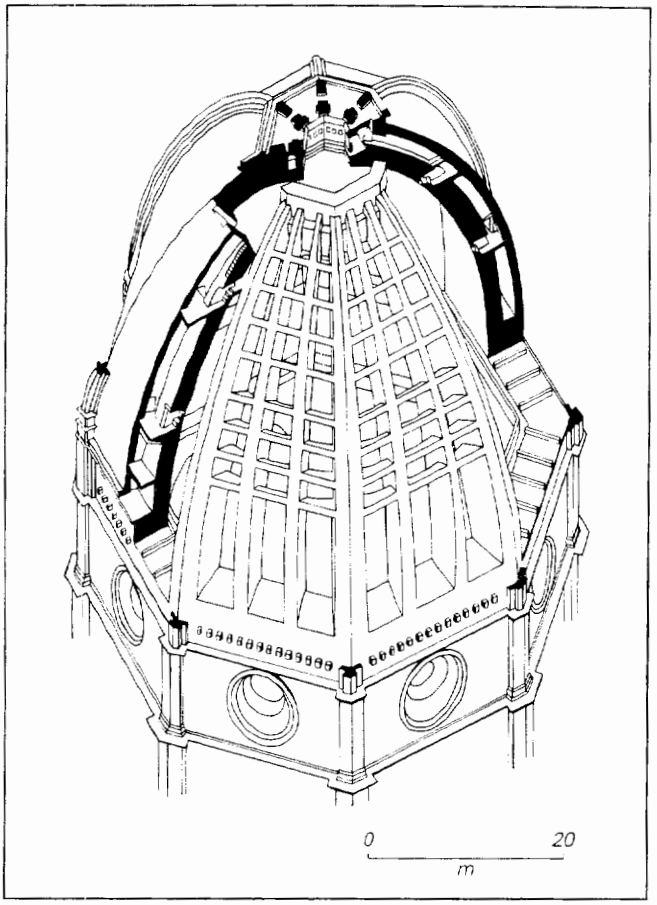
1. Architecture. 2. Lost works, projects and attributions. 3. Urban planning.

1. ARCHITECTURE.

(i) Dome of Florence Cathedral. (ii) Ospedale degli Innocenti. (iii) Barbadori (Annunziata) Chapel, S Felicita. (iv) S Lorenzo. (v) Pazzi Chapel, Santa Croce. (vi) Palazzo di Parte Guelfa. (vii) Scolari Oratory, S Maria degli Angeli. (viii) Santo Spirito. (ix) Lantern and exedrae of Florence Cathedral.

(i) Dome of Florence Cathedral. Brunelleschi had been consulted on Florence Cathedral as early as 1404, when he was a member of an advisory commission on the construction of one of the buttresses of the northern tribune of the apse, but it was not until 1412 or 1413 that the octagonal opening of the drum was ready for spanning with a dome. In 1417 he was paid for drawings and by the time that a public competition was announced in 1418 for the solution of the problem of the dome, he had already become deeply involved. The wooden model (possibly that in Florence, Mus. Opera Duomo) on which the final scheme was based was submitted to the cathedral works as a collaborative effort of Ghiberti and Brunelleschi. Construction began in 1420 under their joint supervision, but Brunelleschi—subsequently described as the 'inventor and governor'—soon took over and Ghiberti later withdrew or was dismissed. The great dome, which dominates the city of Florence, was completed in 1436 (*see* FLORENCE, fig. 12); its span makes it one of the greatest masonry domes ever built, and his success in its execution constituted the supreme building and engineering achievement of the 15th century.

The basic dimensions, form and curvature of the dome had been determined by 1367; Brunelleschi was constrained by specific guild legislation to accept the existing model, and there is no indication that he was in conflict with its predicated form. The major problem was that of spanning the 42-m opening of the octagonal drum, a space too wide to be bridged by traditional timber centering. Brunelleschi overcame this difficulty by distributing the stresses between eight major ribs, which spring from the angles of the octagon in continuation of the angle piers, and sixteen minor ribs in pairs between them (see fig. 1). The pitch of the inward-curving ribs was kept steep to prevent them from leaning too heavily on the light centering that was employed, while lateral support for the ribs is provided by interstitial binders or horizontal arches with stone, timber and iron tension chains, the whole so contrived as to be self-supporting as it rose, course by course. The statical formula is still a matter for scholarly debate, but a stability was achieved that made it possible to dispense with the massive and expensive falsework, the use of which had appeared unavoidable. The infill between the ribs and binders is of brick laid in a herringbone bond, the dome being constructed with an outer and inner skin on the double-shell principle, the first instance of this usage; stairs between the skins lead up to the lantern.



1. Filippo Brunelleschi: dome of Florence Cathedral, 1418–36; diagram showing construction

Brunelleschi designed the scaffolding necessary for the construction work and also invented the hoisting equipment to haul up the building materials. Indeed the entire works, from the dome structure itself to the mechanical accessories used for erecting it, were devised by Brunelleschi himself and are the products of his own ingenuity. In this respect, and in his defence of his radical proposal to the cathedral authorities, he assumed a new status for the

6. Filippo Brunelleschi: interior of the Pazzi Chapel (designed 1420s), Santa Croce, Florence

circle of eight chapels (see fig. 4b). Above the central space is a drum and dome supported on a ring of eight angular piers faced by fluted pilasters, probably Corinthian. This central space was intended to contain an altar and to be closed off from the laity by grilles; the monks would have entered from the convent through the eastern chapel, while the laity would have entered through a seven-bay portico on the western side, with access to the interconnected chapels through passageways in the piers. On the sixteen-sided exterior, blank panels alternate with niches set into the outer faces of the pier units.

The sculptural, three-dimensional form of the piers in S Maria degli Angeli gives this design a different character from Brunelleschi's Sacristy and Pazzi Chapel: instead of a space delineated by articulating elements, the spaces in the oratory appear to be moulded from the substance of the building. This is another characteristic of his mature work and is reflected in subsequent designs. A restrained classical vocabulary is used throughout the scheme, with a minimum number of differentiated units and identity of similar parts, but no exact equivalent is traceable to an ancient source, although the ruins of the Temple of Minerva Medica (early 4th century AD), Rome, exhibit a ring of peripheral 'chapels' around a polygonal centre. Many elements seem to be drawn from nearer sources: Florence Cathedral and Baptistery.

(viii) Santo Spirito. Brunelleschi's last great church was begun in 1436 but not finished until 1482, long after his death. It is in many ways similar to S Lorenzo, but without the constraints imposed by working on an existing building. Here he was able to resolve all the inconsistencies inherent in the project for S Lorenzo and, according to Manetti, the Santo Spirito design gave Brunelleschi the most satisfaction. Although retaining the traditional Latin-cross layout required by the clergy, Santo Spirito displays powerful centralizing tendencies and an organic relationship between all of the parts (see fig. 3b; for illustration of the interior *see* RENAISSANCE, fig. 1). The choir and transept arms around the umbrella-domed crossing are of identical dimensions, to which the aisle bays are proportionally related. A ring of identical colonnaded aisle bays (each roofed with a sail vault) and semicircular niched side chapels runs around the entire church—or would have done if Brunelleschi's design had been adhered to: Manetti states that they should have continued across the interior of the entrance front, where there would have been four doors, each opening into a small aisle bay, instead of the existing three. The ring of family chapels, all equal in form and nearly equivalent in prominence of position, made Santo Spirito a classic expression of the 14th-century Florentine ideal of rule by a patriciate of leading families of equivalent power and standing.

The proportions of Santo Spirito were also refined: the height of the nave arcade is the same as the clerestory above, instead of the 5:3 ratio in S Lorenzo, so that the aisle bays of Santo Spirito are half the height of the nave. In addition, the handling of the details reflects a more three-dimensional, sculptural approach, already seen at S Maria degli Angeli and here achieving a monumental, classical grandeur. Instead of flat pilasters flanking the entrances to the side chapels, as at S Lorenzo, for example, in Santo Spirito the equivalent features are half columns that act as responds to the columns in the nave. The semicircular form of the chapels themselves would have been expressed externally by an undulating wall if Brunelleschi's successors had not masked them with planar cladding. The form of the chapels also enabled Brunelleschi to resolve the awkward junction at the corners between the arms flanking the crossing: at Santo Spirito, identical chapels share a three-quarters engaged column at the corner, with the wall between the chapels reduced to a minimum. His perceived aim of achieving homogeneous lighting is satisfied by the careful disposition of windows: round-headed ones in the chapels and clerestory, roundels at the base of the dome, and an oculus at the top of the dome, covered by a lantern, which together ensured a proportional share of lighting throughout.

(ix) Lantern and exedrae of Florence Cathedral. Brunelleschi's chance to contribute his own, mature design approach to the cathedral complex came with the competition (1436) for a lantern to cap the completed dome. Brunelleschi's winning scheme reconciles the essentially Gothic form of the ribbed dome with the Renaissance form of the turret by linking them with a classicized version of flying buttresses (see fig. 7), which clearly express both a structural and an ornamental function. The eight buttresses visually continue the line of the dome ribs with a series of fluted piers, on top of which rest the outer ends of eight decorated volutes—an inversion of the Classical console. Each volute stretches over a pierced, shell-vaulted niche and leans its inner scroll against a Corinthian pilaster folded around the angle of the octagonal turret—a unique