

Discussion on the paper by T.F. PETERS

Ullrich would be very interested to learn more about the practical cooperation between J. Paxton and the Fox & Henderson company, particularly about their respective participation in the technical development work. For J. Paxton had experimented with wood in his glasshouse constructions in Chatsworth in Derbyshire - particularly in his "Great Stove". Thus it has also not been clarified how much Paxton owed to J.C. Loudon's previous studies concerning the use of cast and wrought iron instead of wood. For his own glasshouses in Bayswater in London, Loudon, together with the firm of Bailey, had developed a wrought-iron bearing glass-holding section, the renowned "sash bar", which permitted a much higher passage of light by comparison with the wood constructions. But just how difficult it is to gather research material on technology is described by Hix in his book "The Glass House" for his source research on R. Turner who constructed the Palm House in Kew together with D. Burton. Peters refers to Fox & Henderson's great experience in railway and bridge construction. Werner observes that the phenomenon of heat expansion was taken much too little into consideration by many architects. Steel and reinforced concrete change by 1 mm in length for a length of 10 m with a change in temperature of 10°. In the case of the first iron bridge, that at Coalbrookdale that was also not taken into account. Traditional building forms were gradually translated into the new material iron. Cologne Cathedral as a stone construction has no expansion joints as the heat expansion coefficient of stone is very much less. The Crystal Palace was able to stand despite its construction faults (cf. E. Werner: Der Kristallpalast zu London 1851, Düsseldorf 1970). The theory of technology only gradually adopted physical and mechanical principles for employment in its structures. The Crystal Palace does show exactly how the new material could nevertheless be converted into architecture. Peters points out that the Palace was not a skeletal structure, but a reference to future constructions of this kind. Beutler supplements this with the reference that the successor building at the universal exposition in 1855, the Palais de l'Industrie, looked different with its classical exterior in stone and a glass and iron construction for the hall in the manner of railway station sheds. This was probably a correction of the weaknesses of the Crystal Palace. Peters supplements this with a reference to the South Kensington Museum of 1862. Nieuwmeijer asks what materials were used for the Crystal Palace, which, according to Peters, were wooden beams, cast and wrought iron. He also remarks that precisely the not quite stable construction gave it the non-calculated initial possibilities and held as a result. The facade in wood also bore itself. Ullrich refers in this connection to the numerous successor constructions which took the Crystal Palace as a model either as a motif or as a construction. Particularly worth mentioning is A. Bedborough's "Royal Aquarium, Summer and Winter Garden" in Westminster in London from 1875-76. The building, which is no longer in existence today, displayed a considerable agreement in its hall cross sections and its iron construction with Paxton's Sydenham Palace of 1854, e.g. in the pillar cross sections with their four bevelled, rib-like reinforcements for side connections. Or as far as the characteristic division of the 80 foot (24.38 m) - in Sydenham 72 foot - span arched girders with two diagonal crosses above each other are concerned, the fourfold pillar

positioning of the main bearing structures in front of the alignment of the side wings and their cast-iron stiffening latticework which are continued as girders - clearly visible from the room - beneath the gallery ceilings, the radial aureolas of the glazed gable areas, everything recalls Paxton's proven constructions.

Peters emphasises that the adoption of the idea of the glasshouse with its breadth, size, brightness, the slender dimensions and the filigree character was more important than the individual motifs and elements which were being constantly technically improved. The triumph of British industry linked with the production of the required quantities of glass and iron impressed the world. Sartory stresses that it was precisely the transparency of the Crystal Palace which dominated in contemporary descriptions. The removal of the technical faults of this construction by building round the structure led to the abandoning of the building's main characteristic, namely its transparency. Thus successor buildings of this kind are regressive. Peters doubts whether the transparency of buildings was progressive. Sartory refers to railway station sheds which did not have fixed roofs. Bornheim supplements this with a reference to the striving for extended rooms since the Baroque period (Orangeries and tent-like rooms, right down to the Olympic Stadium in Munich). Ullrich mentions the importance of transparent rooms in the literature of the nineteenth century. Slotta asks about the strange foundations of the Crystal Palace which Peters thinks were perhaps made necessary by the short period of construction.

Discussion on the paper by D. DERCSENYI

Slotta praises the achievement of the Hungarian department for the preservation of monuments. In Germany, by contrast, numerous important technical cultural monuments have been demolished by the German Federal Railway. Beutler points out the similarity between the Budapest station and the Gare d'Austerlitz in Paris. In reply to a question by Breitling on the composition of the Budapest prize jury which pushed through the preservation of the station, Dercsényi only mentions one curator of monuments, all the rest were railway specialists and state engineers. Werner asks about the art historical importance of the Budapest pillars, for which Wörner and Beutler mention Viollet le Duc's paper and the nineteenth century's understanding of Gothic.

Discussion on the paper by R.M. ULLRICH

Beutler stresses the difficulty of the documentation for this group of structures on account of the numerous changes. Basically it is a building type with a large interior courtyard in which daylight and the flow of light are of importance. He asks about the relationship between interior courtyards, storey height and display area. Ullrich confirms this. Light was required as light from above as the side areas of the buildings were storage areas. It was in department stores that the gallery floor type of structure was first carried through and varied systematically. The origin is the Crystal Palace. The stock exchanges in Paris and London are stone structures. See also the Kurhaus theatre in Göppingen. Peters describes the gallery structures as a basic type of skeletal structure with its forerunner in Baroque theatre construction. The link proposed by Custodis between palace theatre, staircase and evangelical protestant church as a gallery structure was not accepted. Beutler sees rather a link with the bazaar

type and, over and above this, a typically French achievement of the nineteenth century. Alt mentions costs and construction time. Ullrich adds that England did not adopt the building type because of the danger of fire, but Germany did in trade-fair buildings. Slotta asks about the origin of the double skinned cupola. Ullrich mentions the department of store builder, Boileau. The cupolas served to avoid the formation of condensation and variations in temperature, and also for aesthetic reasons. Wörner mentions the multi-skinned design of the cupolas as characteristic for Paris.

#### Discussion on the paper by Chr. BEUTLER

Ullrich stresses the importance of the Grand Palais for the development of the conception of the building whole in the nineteenth century on account of the difficulty of linking glass and iron constructions to masonry structures. Mayer points out the similarity of this exhibition building to department stores, also to the GUM building in Moscow. This is perhaps due to the fact that the observer came more to the fore for the objects on exhibition and goods on display. He asks whether this could be determined from contemporary documents. Beutler replies that there are probably no sources available on this. The requirements made of a building were varied, even if both represent an emphasis on the optical aspect. The department stores are here more modern in structure and form. In the exhibition building, on the other hand, there is a clear iconographic programme. Both proclaim their loyalty to tradition and at the same time offer a prospect of the future. Thus iron construction and building tradition stand alongside one another. This was also the content of the national architectural contributions during the universal exhibition of 1900 which avoided any biased definition. Sperlich refers to the differences between a museum and an exhibition hall. Bornheim supplements this with a reference to the top-light halls which can be common to both museums and department stores, and inquires about their origins which Beutler says were the no longer extant staircase in the palace of Versailles and also further examples from the eighteenth century. Ullrich refers to the fact that the department stores adopted the element of display from the exhibition hall. Alt calls the subject a guide to buildings for students of architecture, which it was not at that time possible to develop for department stores, so that it was likely that ideas were adopted from museums or exhibition building construction. Werner refers to the technical possibilities and the purpose of the girder webs which should not be unnecessarily weakened in their measurements as they transmit the thrust. In the examples shown, the web surfaces are completely covered with decoration.

#### Discussion on the paper by M. WEHDORN

Peters stresses the fact that the constructions employed for the false ceilings in the Burgtheater are, in fact, a preliminary form of reinforced concrete. Both steel (iron) skeletal structures and reinforced concrete structures were employed towards the end of the nineteenth century alongside each other. Beutler refers to the French stone constructions of the same period which were erected completely independently of the steel constructions and did not aim for any permeation of both possibilities. Wehdorn calls the glasshouse erected in 1905 in the garden of the Hofburg in Vienna an example of separate construction, with a glass roof above a stone plinth. Werner reminds us of the fact that there was no corresponding architectural theory in existence for this, but these constructions came about through practice. Mayer provides a further example of the existence of both types alongside each other with a reference to Herrenchiemsee. Ullrich sees a link between the ever more frequent and more complex steel skeletal construction employed and the new large room programmes which Wehdorn would prefer to have known as building organisation in the case of the in part gigantic structure. Bornheim expresses the conviction that the Prussian surbased barrel vault, which came into use along the Rhine from about 1850 onwards with Zwirner, continues the tradition of vaulted rooms as such; the

circles in the iron constructions' spandrels came from Gothic architecture, particularly that of France. Wehdorn refers once again to the connection between the constructions he described and the first Viennese Building Ordinance of 1829, which in particular laid down fire safety regulations and thus prescribed surbased barrel vaulting. In the case of rooms for representation purposes this construction was thus partially concealed.

Discussion on the paper by D. LIBAL

Swittalek points out the parallels between an Innsbruck exhibition building and the Prague Machines Hall of 1899. According to Libal it is quite possible that it was adopted there from Prague. Ullrich emphasises the importance of the glasshouse in Lednice for the development of glass and iron architecture.

Discussion on the paper by A. TOMASZEWSKI

Sperlich emphasises the question of iron architecture in Poland as a special problem within the Colloquium. Wörner recalls the decrease in enthusiasm for technical architecture towards the end of the nineteenth century in Europe in general. The development can be traced in Poland, emphasised by the country's political and economic fate. Of especial interest here too is the influence of Berlin architecture in the Russian-occupied part of Poland. He asks for more details on this. Tomaszewski has deliberately not produced a catalogue of forms of those forms which were extant in Europe anyway, but has drawn on those aspects in the development of Poland's iron architecture which are of importance for Europe, especially also the relationship between architect and engineer. Beutler is particularly interested in the change from stone to iron for the pillars in the Raczynski town mansion in Posen (Poznań) at the owner's request. Tomaszewski confirms that they were painted in stone colour.

Discussion on the paper by H.J. WÖRNER

Ullrich stresses the importance of the Handbook of Architecture by Durm on account of its details of sources and literature. Various participants, including Ullrich, Liessem and Wehdorn dispute art nouveau's alleged hostility towards iron.

Discussion on the paper by B. HOBERG

Sperlich asks about the construction of the Turkish tent in the park at Drottningholm which, according to Hoberg, is a wood and copper construction.

Discussion on the paper by G. HARTUNG

Schulz asks about the influences on the construction of winter gardens and whether elements were adopted from ship construction, as a ship-building nation's desire for form could see its models here. Hartung refers to the available construction experience gained in ship-building (I.K. Brunel, Britannia Bridge, etc.). Werner refers to the wealth of new forms in the major British bridges, e.g. The Royal Albert Bridge, Tower Bridge or Britannia Bridge, especially through the attempts at stiffening made necessary under the influence of the railways. He refers further to the withdrawal of iron from building

construction, as in the event of fire it loses its bearing capacity at about 400° C. Ullrich supplements Schulz's question about the effect of elements from ship-building with a reference to Pevsner (The Buildings of England). It was already possible to observe this in the Middle Ages. Bornheim supplements this with a reference to Strzygowski. Hartung replies to a question from Beutler that all the British bridges have been freshly painted and are in excellent condition.