SUMMARY OF THE INTRODUCTION TO THE DISCUSSION

1) Supplements to the situation in Europe

Pieter de Vrieze, Holland, cites numerous Dutch examples on the subject and refers to the commencement of the compilation of lists of technical cultural monuments, including 10 steamships, 20 stations, 11 light houses, made in part of cast iron. This is parallel to the listing of stone structures from the 19th century or structures in a mixture of stone and iron (churches, water towers, stone factories and mines, as well as canal locks, bridges, a shipyard, hotels, windmills, stock exchanges and passageways). The state department for the preservation of monuments is concerned with their preservation as are also private associations and an association for the restoration of technical cultural monuments. Approximately 25 technical museums are also involved in this complex.

Guido Bral, Belgium, emphazises that at the beginning of the 19th century iron was employed in Belgium as a building material not yet in its own right. Initially, secularized monasteries were used for industrial purposes, in which cast iron was employed in small functional annexes. Only with the late introduction of coke-fired furnaces (from 1823 on) did a certain development start. A good example, unfortunately demolished, was in St. Peter's Abbey in Ghent. There are parallels between the development of the textile industry and cast-iron construction, just as in England. In Antwerp, for example, the application of cast iron in warehouses and other harbour buildings begins from 1858 on. Iron elements also entered into structures of historism, mainly concealed, however, (roof structure of St. Anna in Ghent, 1851) but were also often shown (cast-iron spire of Belford, Bruges and Eglo), also railway station entrance buildings (southern station in Belford). Bridges have for the most part been destroyed, better preserved, on the other hand, are greenhouses (Ballain) and passageways.

2) Supplements to the several papers

On the Haas Paper

Swittalek reports on the findings alongside canals for anchor ties through iron on medieval Styrian churches during the nineteen-thirties and refers to the cramping of stones with iron in the cornice zone of French cathedrals, copying Roman practice. Then subsequently, for the most part, chain-like braces appear. More exact observation during restoration is desirable. Haas describes the linking of the cornice zones with stone and iron cramps as a particularly effective static system, e.g. in the cupola of Florence cathedral. The decisive change in the history of architecture is the recognition of iron as a loadable member. That is the pre-requisite for purely iron construction. He refers to the unclear terminology in this connection. Ullrich asks with what justification the period after cast iron is described as steel architecture. This term is used, admittedly, only in Germany. Werner refers to the term welded iron which is employed in technology and industry (= malleable iron which is made from puddled iron by welding it together, corresponding to rolled iron or rolled section). He asks about the static

effectiveness of the iron construction employed in medieval structures as it would not be necessary in the case of stone parts subject to thrust. The situation is different in the case of ties to take horizontal thrust, e.g. in vaulting. The system of wooden anchors could, in fact, be more effective. For a history of building statics it would be interesting to know why in this period in particular iron was also selected by the builders, since iron was subject to deformation just like every other material. The thrust from the vaulting is borne by corresponding masonry at the rear which is lacking in iron architecture, so that the statically incorrect construction of the circular vaulting was only discovered in the case of purely iron construction. In reply to a question by Mrs.Wagner-Rieger, Werner confirmed the static effectiveness of ties in medieval churches. The technique of pre-spanning of iron in ties should be applied if occasion demanded.

On the Lipps-Kant paper

Mayr asks about the colouring on the exterior of iron architecture, the documentation of which should be begun without fail. Much was unclear in this respect in the Wilhelma in Stuttgart. Lipps-Kant knows that larger sections were painted in gold bronze, even if this finding has not been reconstructed. There are few references in the relevant literature on the colour treatment of iron architecture (Meyer 1907 with reference to Dutch buildings). Wolff gives the supplementary information that in the papers of Peter Josef Krahe in Brunswick, iron parts are shown in blue. He assumes that this is not a detail of the colouring (synthetic production of blue not until 1823 on, only employed in larger quantities from the mid-19th. century onwards) but as a symbolic designation of iron as a material. Ullrich sees the colouring of iron architecture in connection with the stylistic history of the development of classicism and later of orientalism. In England and France, gold and delicate colours prevail in greenhouses (examples: Brighton, George IV's pavilion, cupolas of Old Towers and Wilhelma), later under the influence of the Crystal Palace in London, especially blue (dark blue and light blue) by Owen Jones after studying the Alhambra in Granada. Cf. also the library in Copenhagen. Boeck refers to the discrepancy between free application of colour and colouring imitating material which also occurs in the theoretical literature of the 19th century. Wagner-Rieger emphasises the co-existence of both methods of colouring during the 19th century. Sperlich has already pointed out the very early change in the surface of the material through the paint. On examination of this material, areas should result which can be delimited both in time and area in which one or the other direction could prevail. Perhaps it would be possible to produce a history of painting style. Boeck considers it necessary to check whether the theoretical statement agrees with the findings on the monuments. Bornheim refers to the very varied colouring, particularly on lattice-work in the 18th century. For the further restoration work on the Wilhelma, the German National Committee of ICOMOS should pass on the request of the participants of the Colloquium to the appropriate authorities in Stuttgart that restoration be carried out with respect for the object involved. Custodis raises the question of the polarity architect-engineer on the basis of the planning of the Wilhelma, as in the first half of the 19th century the architects had little experience with iron (statics, building decoration etc.), on the other hand, technicians such as Mummenhoff and Althans design superb structures without themselves having experience in aesthetics and statics. A façade is placed before the technically perfect

solution in the second half of the 19th century. The distinction between architect and engineer determines then the second half of the 19th century for the most part and is only overcome again partly in the 20th century.

No questions were asked and no supplementary remarks were made on the papers by Sperlich and Eller.

On the Werner paper

Bergius makes the additional comment to the Werner paper that the static links presented were of great importance for art historians, namely in regard to the aesthetic interpretation of a building for questions of conservation in the field of monument preservation. The example of the preservation of Sayn foundry clearly showed the co-operation between static engineers and those concerned with the preservation of monuments, something indispensable for iron architecture.

On the Bergius paper

Ullrich emphasises a greater co-operation between static engineers and engineers and also art historians in the field of iron architecture, also with regard to the form language still to be created for structures of technology and for the presentation of their aesthetic basis. Werner: In your systematic account you brought a description of the variety of forms of trussed structures. It is very difficult to obtain a thorough knowledge of this variety for the purpose of systematisation. One should distinguish whether a supporting unit such as the lenticular beam is primarily a trussed beam or primarily an arched supporting unit. From my point of view, I should like to add that in the early examples of this supporting unit, what one should regard as the primary structure is the upper arch rising upwards subject to pressure and the lower webbing hanging down subject to a thrust and cancelling the horizontal thrust. Interesting in this connection is the fact that Laves, who thought out this supporting unit, at first did not have a truss-like structure between the two curved webbings. The supplementary trussed structure was indeed only thought out at all because these first iron supporting units, in which the load-dispersing substance is reduced to just a few lines, react extraordinarily sensitively to lack of symmetry in loads, namely in the form of very pronounced and assymetrical deformations. Lack of symmetry in loading is a characteristic of bridge supporting units compared with those employed in construction of buildings. For instance, one need only think of the tremendous load of a locomotive when standing on one side of a bridge.
In order to counter these severe deformities, triangular lattice trussing was one solution, as the triangle is very stable in form. However, this was initially the result of trial and error until Culmann and Schwedler in Germany -- but also a Russian and an American engineer -- discovered the secret of the technical-scientific system applicable here, still known today as the truss theory. Only with this truss theory, with the bold assumption of the flexible support arrangement of all rods at their panel points and the constructive approach to this later, also permitted the coming into being of lenticular beams. Wagner-Rieger emphasizes the great importance of the interrelated conditioning and influence of material, construction, structural task and function, precisely in the case of iron architecture. The subject was mentioned in many papers, but should be dealt with in more detail. Bergius also

considers a further treatment of precisely these questions to be necessary. Hartung refers to the present discussion about a new form of architecture no longer exclusively determined by function. It remains to be examined whether material and function really determine the building task or whether the performance limit of a structural form is the reason for turning to new materials (example: suspension bridge). Bergius raises the question of the cooperation between decoration and construction (there are no decorated steel cables). Stelzer makes the supplementary comment that the beauty of a building is not dependent on the decoration. For instance, a constructively correctly hung cable on a suspension bridge leads to aesthetic beauty. Not decoration, but the totality of all complexes makes the architecture beautiful.

On the Custodis paper

Wagner-Rieger asks whether in view of the obvious ecclesiastical trend of the structural form of the Sayn foundry, the structural form of the church was really necessary here, or whether other forms could not equally well have been chosen. Strobel refers to the material loading of Gothic building constructions in the Gothic system for the hall cross section of Sayn foundry. The pressure form is an optimal form for a solid structure and it was thus applied for other great hall structures in industry and for railway stations. Apart from the (modern) material importance of this form, the ideal form (in connection with ecclesiastical architecture) runs parallel. Apart from this, there is also recourse to other historical architecture forms, whereby the connection in the case of railway stations (station building, classicist, neo-Gothic, etc., and a trend rather to a Gothic iron train shed) can become particularly clear. The question is posed again of the divergence of engineer and architect in the 19th century. The increasing understanding of building mechanics did indeed lead precisely to the selection of iron as a building material and to the selection of the "Gothic" construction of large halls. Wagner-Rieger asks whether it is an accident that in the case of the iron rooms, the ecclesiatical notion of the building (basilica) moves into the foreground, whereas in the case of stone buildings, temple motifs or other borrowings from Graeco-Roman structures dominate. Strobel replies that this was not the case, just as little as the inspiration from bridge construction are accidental for construction work. However, considerations of building statics are certainly not solely decisive for the form of the building in each case. Bornheim here recalls the remarkable association between blast furnace and high altar in Sayn foundry. Ullrich regards the trend towards tradition, common in many fields, as also being present in iron architecture. The motor-car and the railway also turn to earlier models. Slotta asks what is actually Gothic about Sayn foundry. Boeck warns about too ready a transfer of stylistic classification to iron structures. Here there is, it is true, a hint of historical forms, the complete structure is, however, a modern structure for the time of its creation, in its mixture of various historical forms of architecture from various periods.

On the Slotta paper

Ullrich emphasises the ethical point of view presented by Slotta with regard to iron architecture, in particular in the connection between national character, ethics and working material. The ethical considerations in this form only exist in Germany, whereas in England, for exemple, iron was increasingly regarded as a commodity

in t[illegible]rse of the Industrial Revolution

There were no supplementary comments on the papers Ullrich, Werner and Seib.

On the Hartung paper

Bergius emphasises the importance of the connection between iron architecture of the 19th century and forms of present-day architecture The importance of iron architecture in the last century is also to be found precisely there. Conversely, the modern application of glass and iron enables us to understand the iron structures of the 19th century more easily. Ullrich emphasises the fine scale of earlier iron architecture which is coming to be increasingly appreciated as disenchantment with modern functionalism in architecture grows. The rediscovery of iron architecture was also a result of this recognition.

On the Paulinyi paper

Hartung regrets that the economic aspect of the role of industry in the development of iron architecture has come in for too little discussion. Taking the example of England and France, the parallel development of cast and wrought iron, and hence also the influence of industrial mass production on the architectural form, is to be observed. Precisely the mass production of goods from the door handle to the beam of a construction determines for the most part the present appearance of architecture. It would thus be interesting to research into their historical pre-requisites in the 19th century from the economic history point of view. Bergius refers to the absence of a history of the building trade and building industry, which, in contrast to many fields of economic history, has yet to be written.

On the Beutler paper

Bergius emphasises the link presented between the roof construction of the Théâtre Français and the Pont des Arts and thus the reciprocal influence of building and bridge construction on the use of iron construction. Also problems of town planning which have been dealt with briefly owing to the lack of time (market halls, exhibition halls, etc.) should be covered thoroughly at a possible later colloquium. Wagner-Rieger asks about the motives behind the trend of iron forms to follow the traditional forms of other building materials. The aspect of fantasy in reaction to technical questions, so greatly emphasised by Beutler, should be examined more closely. Bergius requests that Beutler's paper should be expanded to cover aesthetic aspects and that these should be added to the paper given before the Colloquium.

On the Wagner-Rieger paper

Ullrich points out that the development of iron architecture occurs in centres (Belgium, London, Paris, Vienna) and less in the greater provinces. Wagner-Rieger does not consider Vienna a part of this on the basis of the existing material and considers it necessary to study less definite centres with their differences in time rather than the tasks and their importance, e.g. market halls, green-houses, etc. in their social setting. Thus the question also arises whether an iron construction without panelling is to be shown.

Bornheim would like the application of iron as a material for buildings in Europe to be further studied. Gubler draws attention to the fact that in some building regulations (Basle, Zürich, Berlin), iron as a previously untested material had to be panelled. Questions of fire protection also arose.

On the Sestoft paper

Sestoft makes the supplementary comment that after 1860 considerably more iron was used for building in Denmark, admittedly this development was quantitative, not qualitative.

On the Gubler paper no comments.

On the Steinmetzer paper

Steinmetzer adds that in Luxembourg iron architecture and structural details, French influence dominated. The explosive development of the Luxembourg iron industry from approximately 1870/80 on led, unfortunately, to a widescale loss of older monuments which were replaced by modern industry constructions.

On the Stelzer paper

Bergius requests that the question of conservation for iron architecture, touched on in the paper, should be taken into account to a greater extent at a later colloquium. Custodis emphasizes the common feature in the Prussian productions on the Rhine and in the Prussian heartland, which is to be traced back in parts to the same models (Schinkel, England).

In conclusion, numerous participants from home and abroad requested further treatment of the problem of iron architecture, first presented under its various aspects in Bad Ems. The restriction of the subject matter to the first half of the 19th century, which was recognised as being necessary, should definitely be complemented by treatment of the second half of the century. This is also the case for continuation on an even broader international basis. The present papers from Austria, Switzerland, Denmark and Luxembourg make the addition of those European countries not represented appear desirable precisely on account of the special aspects of the development of those countries which has been indicated. Further points of view, apart from the study of questions of conservation already requested, would be a more exact investigation of the technical-economic links, questions of the colouring of iron architecture, the cross relationship between design and material, the inclusion of questions of town planning, the influence on the architecture of the 20th century. It would further be desirable that collections of material already in existence (literature, plans, lists of addresses, etc.) should be complemented und made generally accessible for a further colloquium on the subject of iron architecture.

3) On Iron Architecture's becoming accepted as Monuments

Werner Bornheim gen. Schilling

Ladies and Gentlemen, permit me to make a few comments on the final day of our colloquium from the point of view of the organisers.

As far as we can see, the Pont des Arts in Paris (1803-1804) for the

first time deliberately employed an iron monument as an axis between two buildings of importance, themselves regarded as monuments, the Louvre and the palace of the Institut de France, both considered as monumental poles from the very outset.
One could say something about this decisive step, also about the importance of the Conseil des Bâtiments Civils which was explicitly founded in 1795, and its rôle in iron construction in the first half of the 19th century. Napoleon did not approve of the bridge and undoubtedly felt it to be unworthy from the point of view of the pathos of the modern cult of the monument just after the turn of the century. The bridge was later widened,but the French Department of Public Monuments is at the moment engaged in removing these extensions. Thus the bridge is again intended to provide a light span between the stone poles on either side of the Seine. The decorative embelishment employs circular motifs from the tracery of Gothic cathedral architecture (these remained modern until the eighteen-sixties). The bridge at Conway Castle was not thought of so specifically from the monumental point of view. The Seine bridges in Paris, on the other hand, vary the pathos of iron and stone right down into our own century.
The Sayn foundry conciously seeks to increase a pathos of the material in its foundry hall after the secularisation, with a basilican expression. The salterns in Cheaux precede this ideologically and in mood with temple-like architecture which architects again and again sought to emulate in Silesian foundry construction from the late 18th century down until after 1850. But they remain rooted in conceptions derived completely from stone. The chimneys are often here also disguised as obelisks, as in Sayn, and furthermore arranged symmetrically, with hints of towers in the angle between transepts and choir, as for instance in Romanesque church construction.
In Paris, the Pont des Arts is being restored at the moment and the side extensions added at a later date are being removed again. In Sayn we are restoring the western part of the "nave" to its original conditions, as far as possible. In the course of this, stylistic problems of changes in iron construction in the course of one generation are being discovered.
Zwirner's iron architecture was, on the other hand, stone-like. This even extended as far as coloured coatings, e.g. in St. Apollinaris in Remagen. On the inside of the iron spires, in contrast, the seams and plugs remained visible. It is very regrettable that Zwirner's lantern tower in Cologne Cathedral, which had for the most part survived, was greatly changed after 1945. The Apollinaris church in Remagen has its counterpart in the castle chapel in Stolzenfels, however, there everything is in stone, except the stairs to the gallery in the interior. In Remagen, on the contrary, the iron gallery in the western part of the church acts like stone and wood architecture. The Neo-Gothic reconstruction of the moated castle of Paffendorf near Berghausen an der Erft near Cologne was still in Zwirner's sense, originally with battlements in a sort of tin casting which melted in the fire catastrophe of the Second World War. There were dormer windows of a similar kind in Sayn Castle about 1850. At about the same time, Zwirner created the magnificent main staircase, constructed systematically in iron in Arenfels Castle near Bad Hönningen in the District of Nassau.

The owner of Stolzenfels, the Prussian crown prince and later king, expressly wished that for the reconstruction the castle should be made just as it was prior to its destruction. But a completely new whole was produced with many characteristics of empire style. For the first time in a profane structure in the Rhineland, window

crossbars in iron were employed, undoubtedly adopted from ecclesiastical architecture. Zinc sheets were chosen as a roof covering, hidden behind the crenellations and completely unmedieval, as used in Berlin royal court buildings in the eighteen-forties; an externally practical but not very durable construction in the long run. In Stolzenfels, iron only had a practical but in no wise a representative function.
The first Rhine castle to be reconstructed, Rheinstein below Bingen, the very beginning of architectonic castle romanticism, uses light iron stairs as a matter of course, leading up to the observation tower on the Rhine side on the outside. This was probably constructed shortly before 1830. The idea comes, undoubtedly, from the little castle on the Peacocks' Island near Berlin, where it was put into effect in the first decade of the 19th century.

The St. Geneviève Library in Paris takes the final consequence of the climax pre-formed in Sayn Foundry. After this, the connection between stone architecture and iron comes to the fore in Paris again more markedly. The iron exterior galleries of the small castle of Weil near Stuttgart -- a type which is much varied in North American Colonial Style -- are to be found again in Rolandseck Station in the 1860's, convincing and more conciously emancipated. They are there added more emphatically to the still classicist stone central structure than in Weil, a central structure which is, by the way, copied from contemporary castle architecture with Italian leanings, as the Cavalier's House of the Villa Ludwigshöhe at Edenkoben near Neustadt in the Palatinate showed. The Rolandseck iron decorations still correspond to the "classical", i.e. Gothicising system of circular struts. More recent iron structures employ "more modern" forms for technical usefulness, e.g. the lock bridge over the Eiderkanal near Kiel. However, circular-shaped typologies remained in esteem until about 1850-1860, as for instance in the ceiling construction in Hohenschwangau between 1835-1840.

In Rolandseck, problems of the first coloured version of the iron architecture presented themselves as characteristic for the lability of the state of research.

A coat of black paint would seem to have been chosen right from the outset contrasting the galleries very greatly, but filigree-like from the light-coloured main structure, whereas in Weil near Stuttgart the light-coloured first paint used linked the gallery closely in colour with the rest of the exterior walls, thus not contrasting the galleries.
Whereas in England iron architecture remained primarily material-accented even after the middle of the 19th century, France turned ever more to the pathos of stone architecture, linked to the attainments of the possibilities of iron. To follow that up here would exceed the bounds of our colloquium. We would just refer to the Eiffel Tower and the development of the Trocadero.
The chain of development of iron architecture and its becoming concious can only be completely reconstructed and, perhaps, brought to a conclusion after study of structures which have disappeared. The cupola roofing which Georg Moller added to the eastern main tower of Mainz Cathedral in 1828 at the moment still remains a technical and aesthetic phenomenon and unique instance.Stylistically, certain trends towards Islamic-Moorish architecture may have played a role even then. The now-vanished Palm House on the Peacocks' Island near Berlin presented a beautiful example of such a type. Blechen painted it in 1834.

It can be quoted here as a preliminary stage for the Wilhelma in Stuttgart.
To stabilize the subject, the passages and galleries, for instance in Bath and Brussels, and their predecessors in wooden construction, should also be mentioned. Not to speak of the exhibition halls which were only planned and erected on a temporary basis yet which like, for instance, the triumphal arches in Baroque, precede the circus halls, seeking to present tent architecture on a long-term basis, and, like the Halle de Blé in Paris, to become in the long run pioneering for the great railway station train sheds, of which St. Pancras Station in London is one of the finest creations.

Iron as a material still needed generations before it finally began to be employed in monument preservation as reinforced concrete in Worms Cathedral at the beginning of the 20th century. But already in the 19th century it was doing this, like no material before it, offering a variety of possibilities which, right from the very start, hindered one from having to expect typologies of iron alone. The climaxes which it attained in the first half of the 19th century were even more astonishing, climaxes which were never to be exceeded.

Without wishing to anticipate any other of the colloquia which we should like to hold on the subject in the future, we can note that the purely iron structures represent the most perfect structures of their type. But they were not to experience any further improvement and soon linked up again with stone architecture.