

A HUNDRED YEARS  
OF  
GERMAN BRIDGE BUILDING

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MASCHINENFABRIK ESSLINGEN IN ESSLINGEN  
GUTEHOFFNUNGSHÜTTE, AKTIENVEREIN FÜR BERGBAU UND HÜTTENBETRIEB IN OBERHAUSEN  
GESELLSCHAFT HARKORT IN DUISBURG AM RHEIN  
PHILIPP HOLZMANN & CIE., GESELLSCHAFT M. B. H. IN FRANKFURT AM MAIN  
VEREINIGTE MASCHINENFABRIK AUGSBURG UND MASCHINENBAUGESELLSCHAFT NÜRNBERG A.-G.  
WERK NÜRNBERG (ZWEIGANSTALT GUSTAVSBURG)  
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BY

LUDWIG MERTENS C. E.

WITH 195 ILLUSTRATIONS



BERLIN

JULIUS SPRINGER

1900

Table V.  
Remarkable German Archbridges of a span exceeding 80 metres (98 feet), built between 1860 and 1880\*).

Number	Time of construction	Description of bridge	Designer and builders	Spans		Girder system
				Number	Width in metres feet	
1	1860—62	Road- and Railway Bridge over the Rhine at Constance. Baden State Railways.	<i>Gerwig.</i> Benkiser Brothers.	3	42,4 139	Continuous plate arch without hinges. Artificial adjustment of the action of temperature. Double line of railway.
2	1862—63	Old Rhine Bridge at Coblenz. Coblenz and Niederlahnstein railway.	<i>Hartwich.</i> Harkort Co., Cologne Engine Works.	3	96,7 317	Circular flanges with crossed diagonals. Hinges at the springing. Double line of railway. See fig. 42.
3	1865	Ruhr Bridge near Mühlheim on the Osterrath and Essen line.	<i>Hartwich.</i> Cologne Engine Works.	3	36,1 118	Braced parabolic arch. Double line of railway. In addition 7 arched tide spans.
4	1866	Footbridge over the Böllatfall at Hohenschwangau.	<i>Gerber.</i> Nuremberg Co.	1	35,0 115	Arch without hinges. See fig. 99.
5	1867	Neckar Bridge near Jaxtfeld. Baden State Railways.	<i>Becker.</i> Benkiser Brothers.	5	36,8 121	Arch with braced spandrel and hinges at the springing. Double line of railway.
6	1868—72	Elbe Bridge at Hamburg and Harburg. Venlo and Hamburg railway line.	<i>Lohse.</i> Harkort Co.	7	99,2 325	Lens-shaped girders with arched flanges, connected by verticals. Without horizontal thrust. See fig. 46.
7	1869	Tauber Bridge near Weikersheim. Württemberg State Railways.	<i>Morlock.</i> Esslingen Works.	3	30,5 100	Braced arch with hinges at the springing. Single line of railway.
8	1873	Rhine Bridge at Rheinhausen. M.-Gladbach and Duisburg line.	<i>Hartwich.</i> Gutehoffnungs Works.	4	97,0 318	Like Nr. 2 with tide spans and swing-bridge. See fig. 43.
9	1875—76	Roadbridge over the Neckar at Heidelberg-Neuenheim.	<i>Gerstner. Bär.</i> Esslingen Works.	5	35,0 115	Braced arch with hinges at the springing.
10	1876—77	Obermain Bridge at Frankfort-on-Main**).	<i>Schmick.</i> Ph. Holzmann & Co. Benkiser Brothers.	1 2 2	36,8 121 35,0 115 31,5 103	Arches with braced spandrels, without hinges. Platform on top.
11	1876—79	Rhine Bridge above Coblenz. Berlin and Metz railway.	<i>Hilf, Altenloh, Dörenberger.</i> Gutehoffnungs Works.	2	106,0 348	Like Nr. 2. See fig. 44. With two masonry arches.
12	1878	Moselle Bridge near Güls, Coblenz and Trier line.		3	65,6 215	Arch with crossed diagonals and hinges at the springing. Railway on top.

In Germany the building of archbridges has increased at a surprising rate during the last twenty years of the century (compare table VI). In number, quality and variety of arch structures Germany at present surpasses all other countries, America not excepted, though as far as the span is concerned, the latter country at this moment occupies the first place. For the rest the Americans undoubtedly have been following German practice to some extent, the great *Viaduct at Müngsten* in particular (the erection of which will be described in the Appendix) having served them as a model. This is proved by the erection of the new Roadbridge over the Niagara, with an arched span of about 256 metres (840 feet) and a height of 45,7 metres (150 feet), where, following the precedent of the Müngsten Bridge, the structure at first was made temporarily to act as a three-hinged arch, in order to be able, by the appli-

cation of hydraulic pressure at the crown, to close it as a two-hinged arch in accordance with the assumptions made in the calculation. It is, moreover, gratifying to German engineers to note that this most admirable product of recent American bridge practice was originated by the scientifically trained intellect of German designers. The German-Americans *C. C. Schneider, P. L. Wölfel* and *F. C. Kunz*<sup>44)</sup> of the Pencoyd Ironworks, Philadelphia, together with the stubborn energy of their American cooperators, have brought this great work to a successful issue.

No better examples of the successful working together of theory and practice can be found than the Müngsten and Niagara Bridges just referred to. They decisively prove the possibility of building up even statically undetermined structures in perfect agreement with the assumptions of the design and with a sufficient degree of safety,

\*) Among remarkable archbridges of smaller span the following may be mentioned here: The railway bridges over the Trankgasse and the Lupusplatz at Cologne, designed by *Hartwich* and constructed (in 1859) by *Harkort*, the roadbridges over the Kinzig near Gelnhausen and over the Lahn at Ems, built in 1862—63 by *Schmick*, further the two Rhine Bridges at Basle, built in 1877—82, and the Fulda Bridge near Hannoversch Münden, built in 1879—80<sup>45)</sup>, all by *Lauter* (of the firm of Ph. Holzmann & Co. at Frankfort).

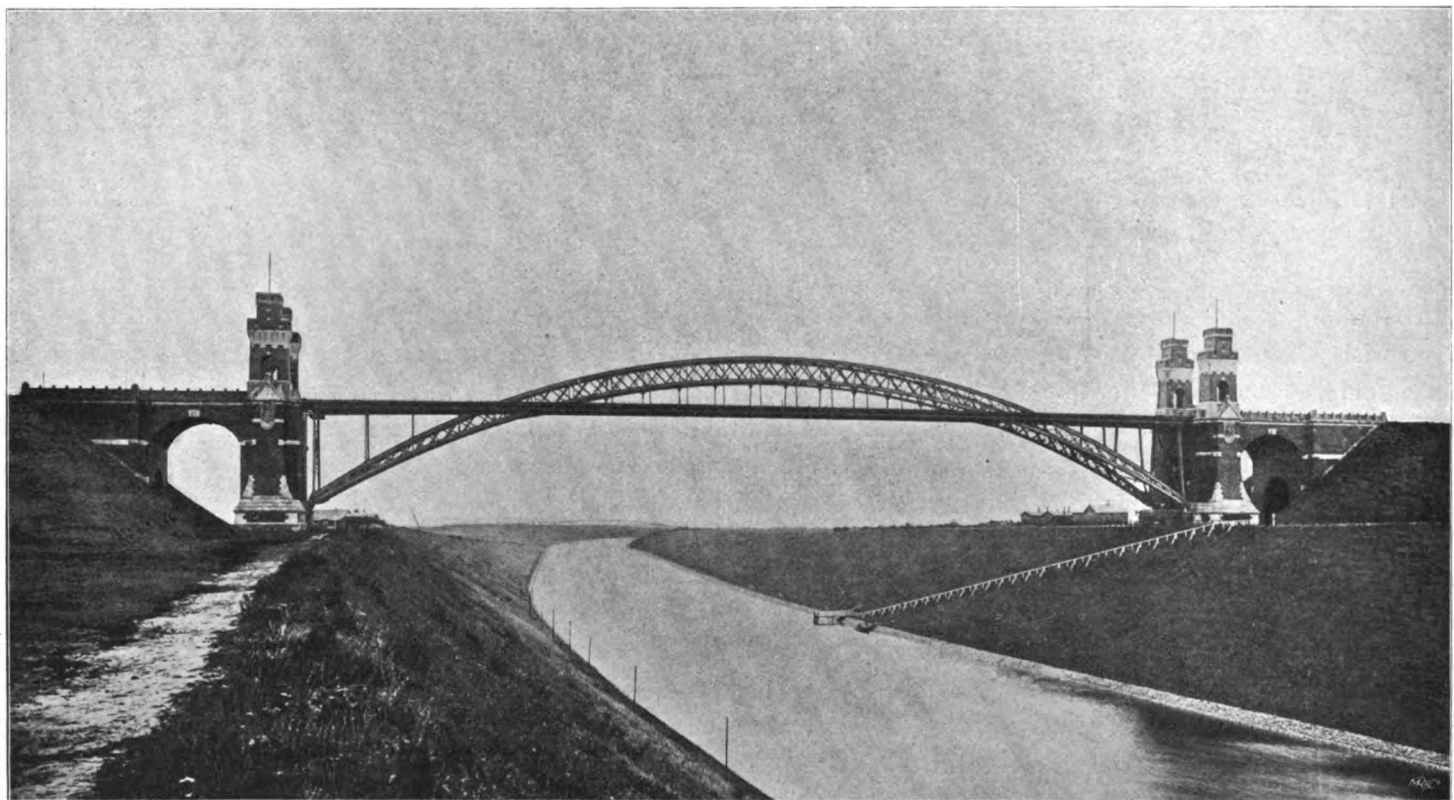
\*\*\*) The Untermain Bridge, built by *Schmick* in 1871—74, is of similar design.

by making use of modern methods of calculation as well as suitable mechanical appliances at the erection. If a *temporary hinge* has to be inserted at the crown for that purpose, as was done first at the erection of the Müngsten Bridge, this expedient appears quite as efficient as that of Harkort Company in case of tied arches, viz. the *freely suspended and freely moveable platform*, as described in detail in paragraph 22, deserves particular attention. Fig. 102 represents a tied arch of smaller span, viz. the footbridge over a branch of the Spree near the Mühlen-

Fig. 99. Footbridge over the Böllatfalls at Hohenschwangau. Gerber 1866.



Fig. 100. Road- and Railway Bridge over the North Sea-Baltic Canal at Grünenthal. 1891-92.



the so-called *open joints*, often resorted to at the building of masonry arches of wide span.

Quite recently the *stiff tied arch*, lying above the platform, has come into great favour; on page 30 it has been already compared to the arch stiffened by a beam. A novel constructive arrangement, first introduced by the

damm, Berlin, which deserves to be mentioned on account of the tasteful design of its ornamental ironwork. Some further details of bridges enumerated in table VI will be found in the *Appendix*, which contains a description of the exhibition of German bridge works at Paris.