

CHIEF ENGINEER'S FILE No. 529

THE BALTIMORE AND OHIO RAILROAD COMPANY
Engineering DEPARTMENT.

Various Types of Truss Bridges.

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Office of Engineer of Bridges,
Baltimore, Md.

March 23, 1914.

THE HOWE TRUSS

The Howe truss is the earliest type of simple truss and was patented in the United States by William Howe in 1840.

In this design of truss the diagonal web members are in compression, the vertical web members being in tension.

The design endeavoured to use timber wherever possible. The top and bottom chords, as well as diagonal web members, are of timber, the bottom chord being the only tension member-built of timber. The vertical web members are usually iron rods.

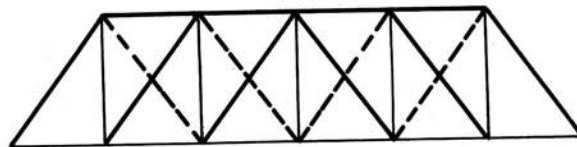
This type of truss has been extensively used in railroad bridges, especially in the earlier days of railroading, when timber was cheap and the loading light. A large number of the earliest bridges on the B & O R R were of this type.

A variation from the above general design made ^{use} of an iron bottom chord instead of timber.

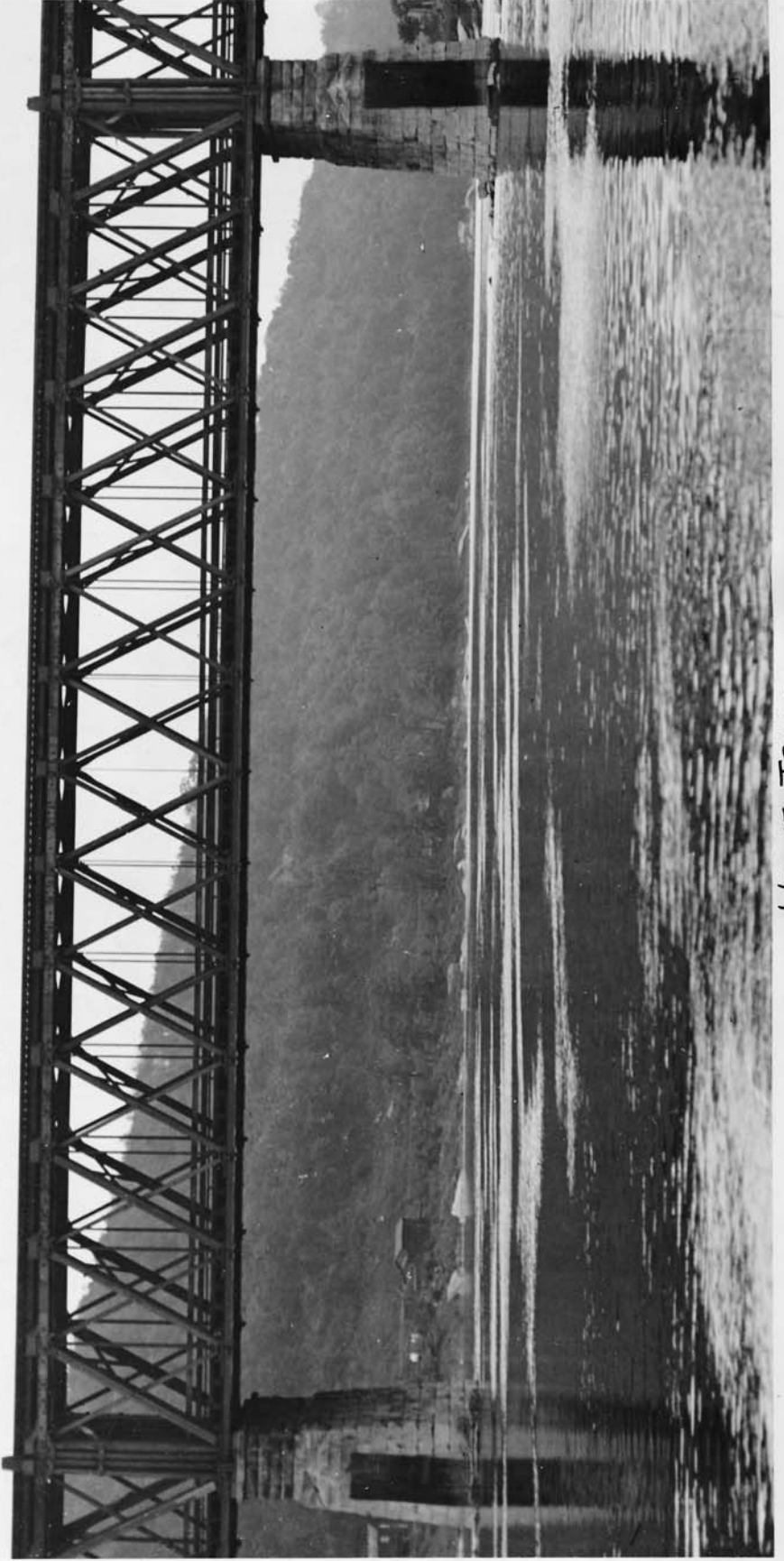
The particular trusses shown by these photographs have steel bottom chords. The trusses are made in 14 panels. Each span is 177' long. Railroad traffic is carried on the upper, and highway traffic on the lower deck.

The bridge is known as No. 467, Pittsburgh Division, crossing the Allegheny River at Foxburg, Pa.

SIMPLEST FORM OF HOWE TRUSS



Heavy Lines-Compression Members
Light Lines-Tension members-
Dotted lines-Members subject to
counter strain-



Br. No 467 Pittsburg Div. - Crossing Allegheny River at Foxburg Pa.
HOWE TRUSS



HOWE TRUSS
Br. No 467 Pittsburga Div. crossing Allegheny River at Foxburg, Pa.

THE BOLLMAN TRUSS

The Bollman truss was introduced by Wendel Bollman about 1850, and bridges of this type were built extensively up to 1875.

This is the earliest type of bridge in which iron was used exclusively in the construction.

In this type of truss the vertical loads are carried from each panel point through the vertical posts into the inclined web members and to the supports at ends of span. Where a bottom chord is used, this member carries no direct strains from the vertical loads, but is placed for increased stiffness of the structure. The inclined diagonal rods which extend over one panel only do not form a part of the main truss system, but are distributing members placed in order to carry part of the panel loads over to the adjoining panels.

In the Bollman truss all compression members are usually cast iron; all tension members wrought iron.

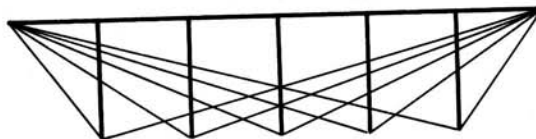
A large number of structures of this type were built for the B & O R R., particularly on the present Cumberland Division. One of the largest structures of this type was The B & O R R bridge over the Potomac River at Harpers Ferry, which has since been remodeled and is now in service as a highway bridge.

The particular bridges shown by these photographs are :

Deck truss span, 148'9 $\frac{1}{2}$ " long, consisting of 10 panels. This bridge is known as Bridge 117, Valley Railroad of Virginia, and crosses North River at Mt. Crawford, Va., and was built in 1872.

Through truss span, 104'4" long, in seven panels, known as Bridge 33, Main Line, Shenandoah Division, and crossing Opequon River at Wadesville, Va. This structure was built in 1875.

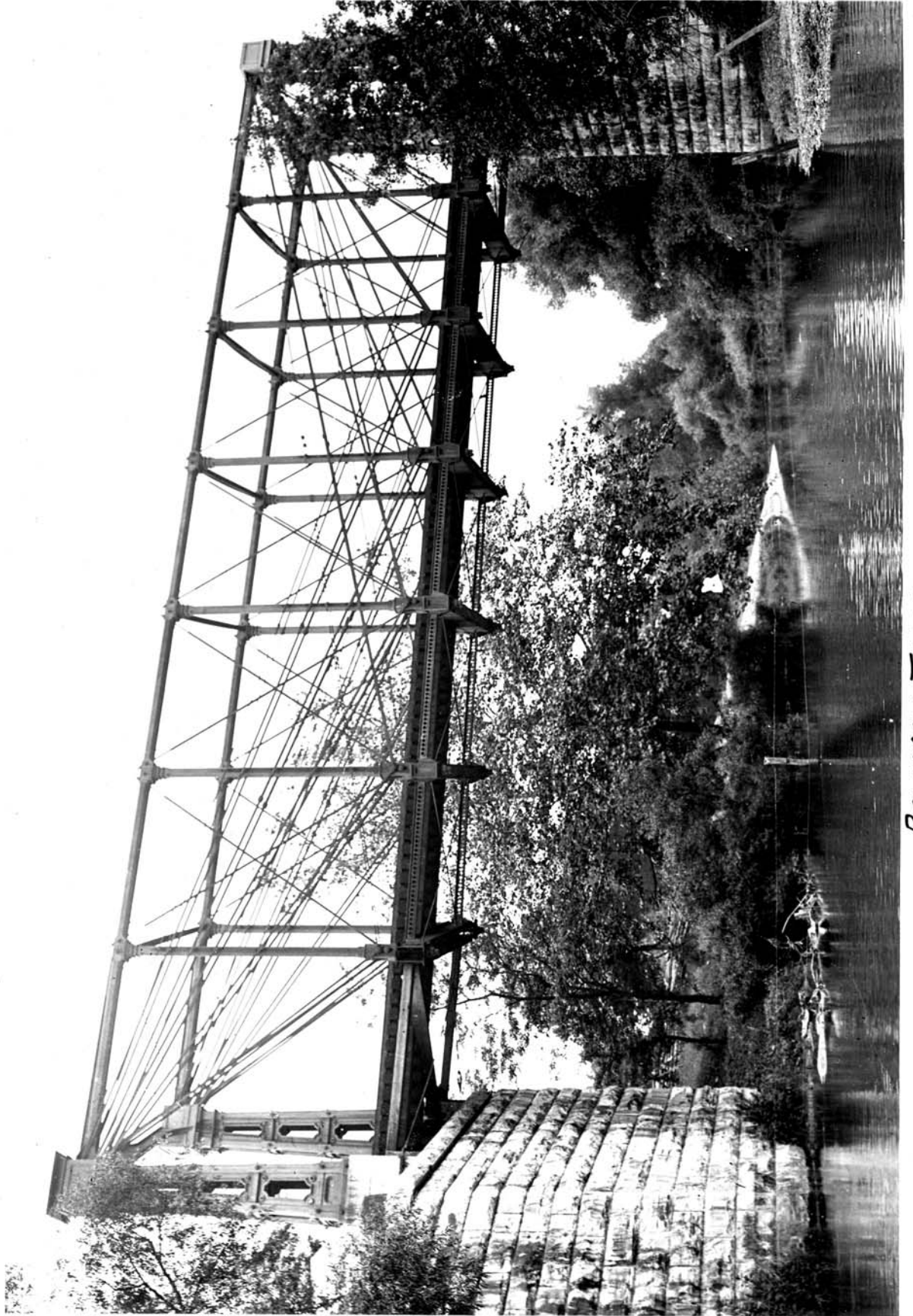
SIMPLEST FORM OF BOLLMAN TRUSS



Heavy Lines-Compression Members
Light Lines- Tension Members-



Br. No 117 Valley Railroad of Virginia - crossing North River at Mt. Crawford, Va.
BOLLMAN TRUSS



*BOLLMAN TRUSS
Br. 1933 Main Line - Shenandoah Riv. crossing Shenandoah River at Wadesville Va.*

THE FINK TRUSS

The Fink truss was introduced by Albert Fink in 1852. and was used to a large extent in deck structures for railway as well as highway traffic up to 1880.

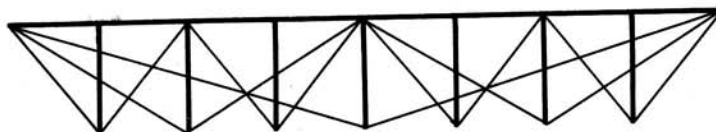
This type of truss is a development from the Bollman truss. While in the Bollman truss the individual panel loads are carried directly into the supports at the ends of the span, the Fink truss employs series of inverted "A" trusses which gradually carry the loads from the smaller trusses into the large trusses and to the supports.

The earlier bridges of this type employed cast iron for compression members and wrought iron for tension members.

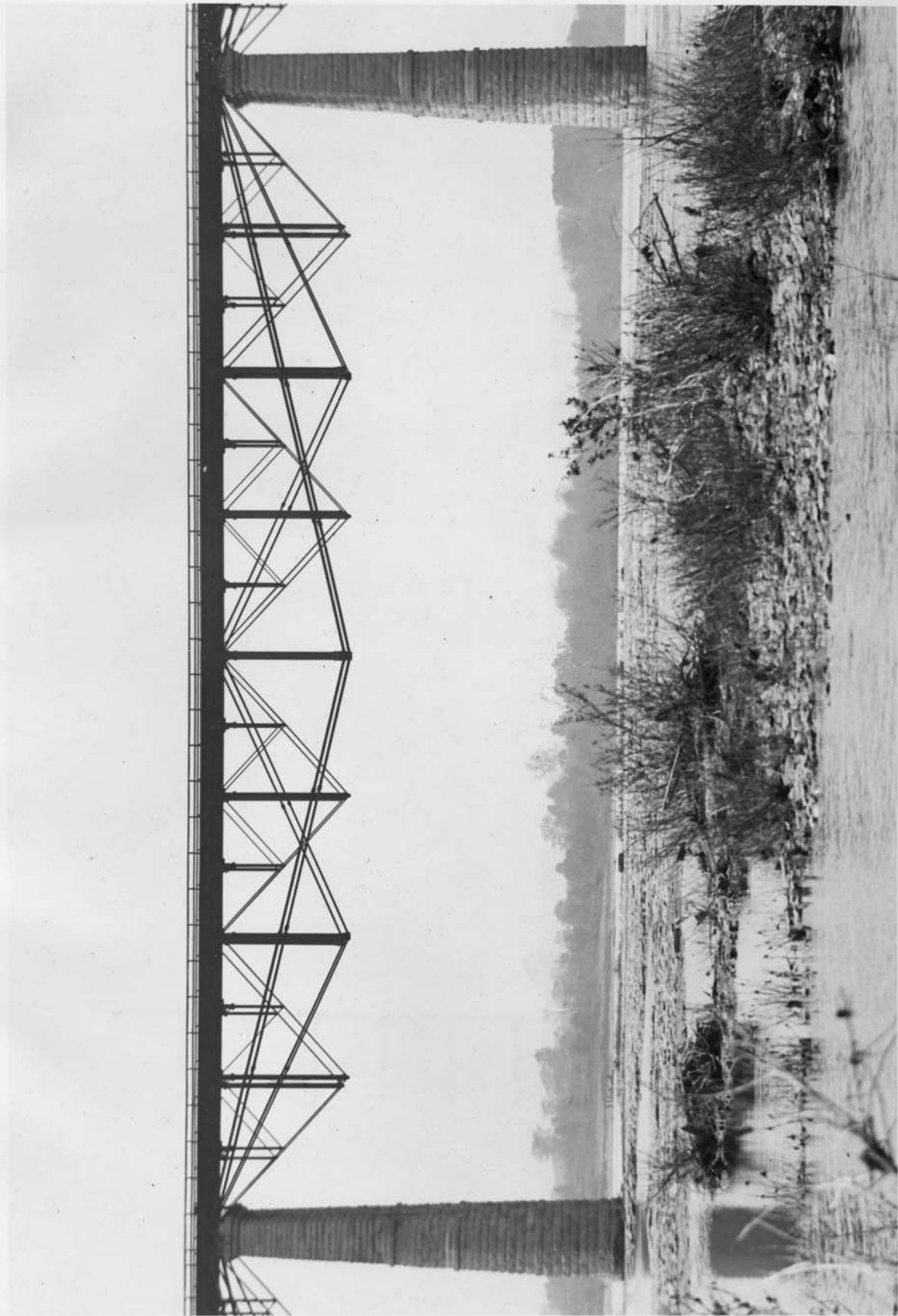
A modified form of this truss is used extensively in steel construction for roof trusses.

The particular truss shown by photograph is part of a highway bridge over the Ohio River at Louisville, Ky. The span is 245'6" long and the structure was built in 1870.

SIMPLEST FORM OF FINK TRUSS



Heavy Lines- Compression Members
Light Lines Tension Members



*FINK TRUSS
Br. over Ohio River at Louisville, Ky.*

THE PRATT TRUSS

The Pratt truss was first introduced in 1844 by Thos. and Caleb Pratt, as a modification of the Howe truss.

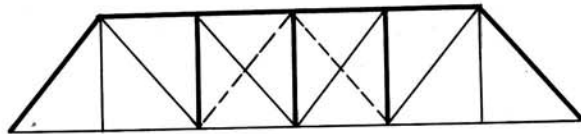
In this type of truss the vertical web members are in compression and the diagonal members in tension.

The truss, as first introduced, provided for timber compression members, but very few bridges were built in this manner. After 1850 the type came in ^{to} general use as an all iron truss, at first using cast iron for the compression members, and later with the use of wrought iron throughout. The connections of the members at the panel points are usually made by pins.

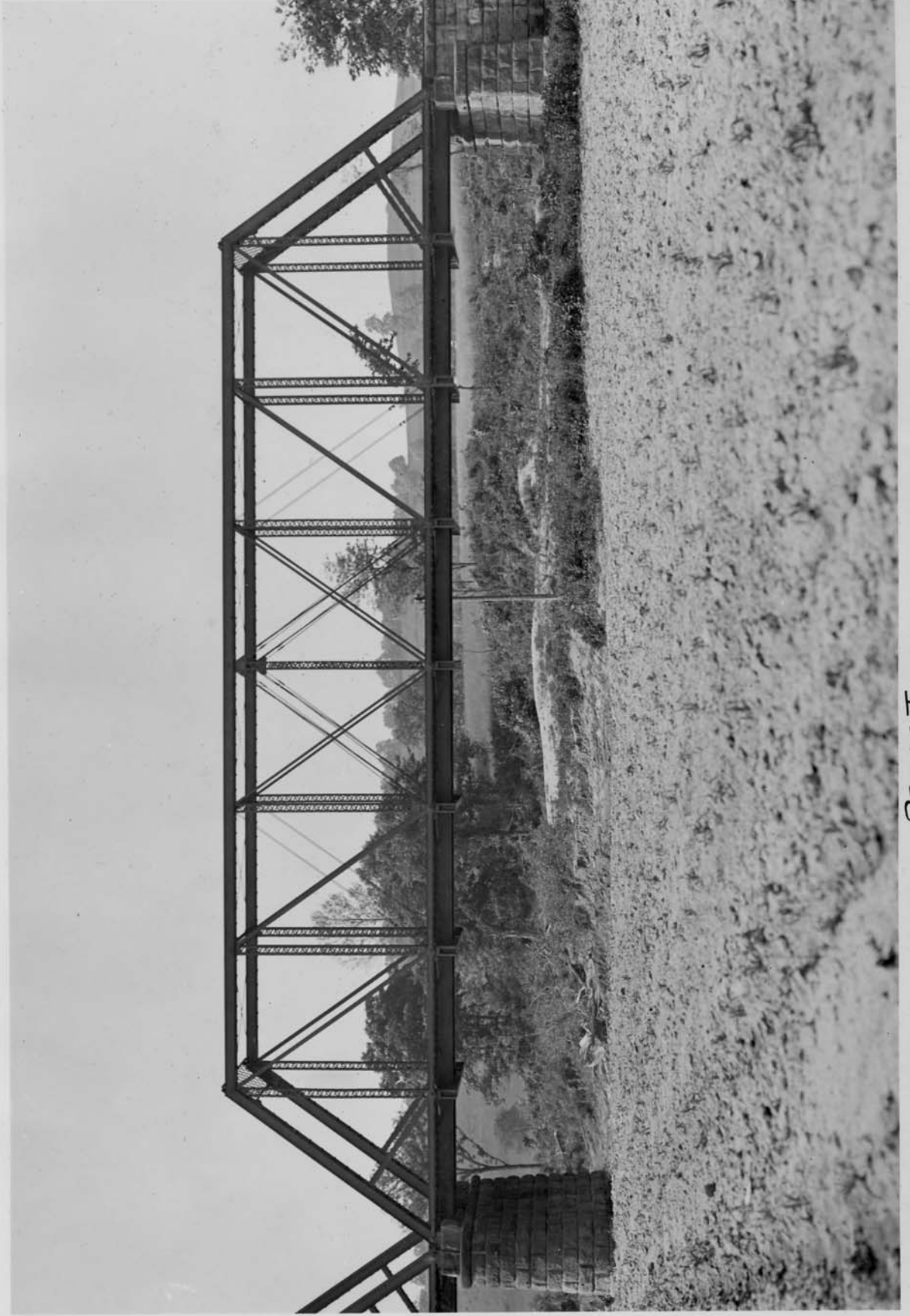
Practically all of our truss bridges, of span length varying from 100 ft. to 200 ft., which were built between 1880 and 1905 are of this type.

The particular truss shown in attached photograph is 150'3" long, consisting of 8 panels. This bridge is known as No. 173/07, Ohio Division, crossing Hocking River, at Stewart, Ohio, and was built in 1891.

SIMPLEST FORM OF PRATT TRUSS



Heavy Lines-Compression Members
Light Lines-Tension Members
Dotted Lines- Members subject to counter strain.



PRATT TRUSS
Br. No 17367 Ohio Div. - crossing Hocking River at Stewart, O.

THE WHIPPLE TRUSS

The Whipple truss was first introduced in 1847 by Squire Whipple, as a development of the Pratt truss, using a double system of web members, each diagonal generally extending over two panels.

This type of truss has been used largely in wrought iron construction for spans of longer length than the ordinary Pratt truss.

The longest structures of this type which were constructed on The Baltimore and Ohio Railroad were :

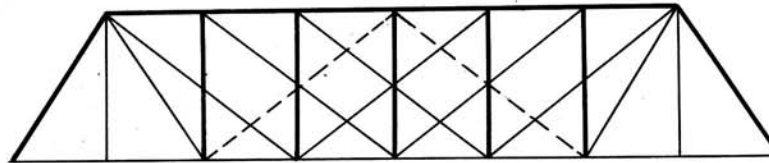
1-515' deck truss span and four 475' deck truss spans which were built across the Susquehanna River in 1886 and were replaced in 1909.

The particular trusses shown on the photographs are:

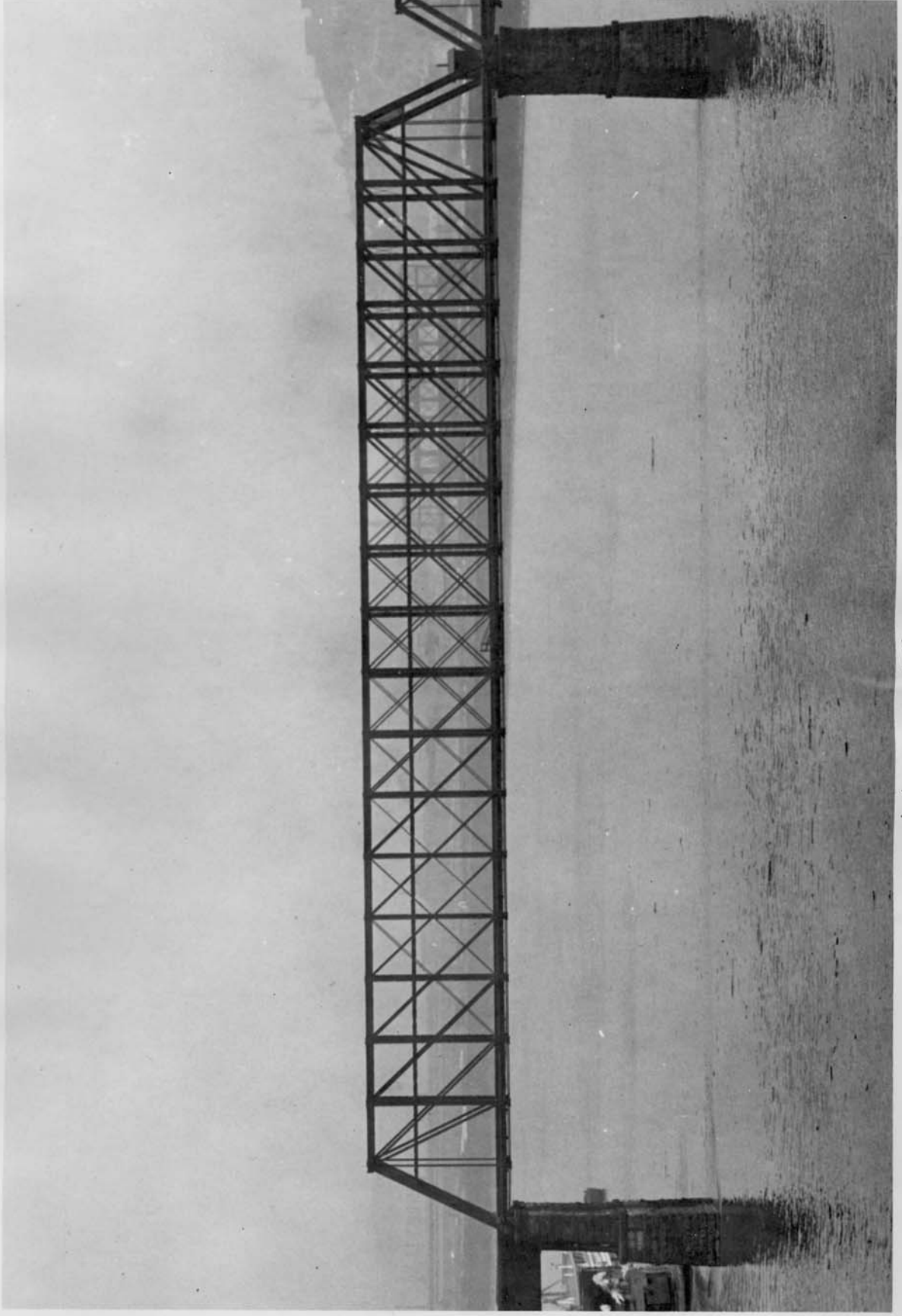
1-295' $3\frac{1}{2}$ " through truss, forming the main river span in Bridge 74, Pittsburgh Division, over the Monongahela River at Wheeling Junction, Pa. This truss consists of 19 panels, and the structure was built in 1882.

1-147' 0" deck truss in 12 panels, known as Bridge 120, Valley Railroad of Virginia, Shenandoah Division, and crossing North River at Cave Station, Va.-built in 1872.

SIMPLEST FORM OF WHIPPLE TRUSS



Heavy Lines- Compression Members
Light Lines- Tension Members
Dotted Lines- Members subject to counter strain.



*WHIPPLE TRUSS
Br. No 74 Pittsburgh Div. - crossing Monongahela River at Wheeling Junction, Pa.*



WHIPPLE TRUSS
Br. No 120 Valley Railroad of Virginia Crossing North River of Cave Station, Va.

THE WARREN TRUSS

In the Warren truss, as originally introduced, all the web members were inclined, being alternately subject to compression and tension.

This type has never been in general use for pin connected bridges, on account of the pinwear due to reversal of strain in web members.

Since the introduction of better riveting methods, this truss, modified by the introduction of vertical members for the supports of the panel loads, and with riveted connections at the panel points, has largely replaced the Pratt truss for short spans.

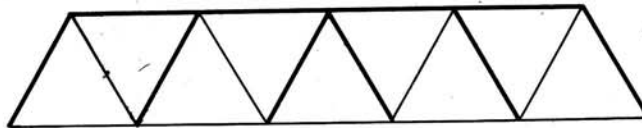
The longest span of this type in service on The B & O System is 236'4" long and was constructed in 1914 over the Miami River at Hamilton, Ohio. This structure is known as Bridge 2, Indianapolis Division.

The particular trusses shown by these photographs are:

1 through truss 160'8" long, consisting of 8 panels. This bridge is known as Bridge 92, Cumberland Division, crossing Cheat River at Rowlesburg, W. Va., built in 1910.

1 deck truss 118'6" long, consisting of 6 panels. This span crosses the Penna. R.R. at Havre de Grace, Md. and forms part of the East approach at Bridge 34A, Philadelphia Division. This span was built in 1907.

SIMPLEST FORM OF WARREN TRUSS



Heavy Lines- Compression Members
Light Lines- Tension Members



WARREN TRUSS
Br. No 92 Cumberland Div. - crossing Cheat River at Rowlesburg W Va



WARREN TRUSS
Br. No. 92 Cumberland Div. - Crossing Cheat River at Rowlesburg W. Va.



WARREN TRUSS
Br. No 34 A Philadelphia Div. crossing P.R.R. at Havre DeGrace, Md.

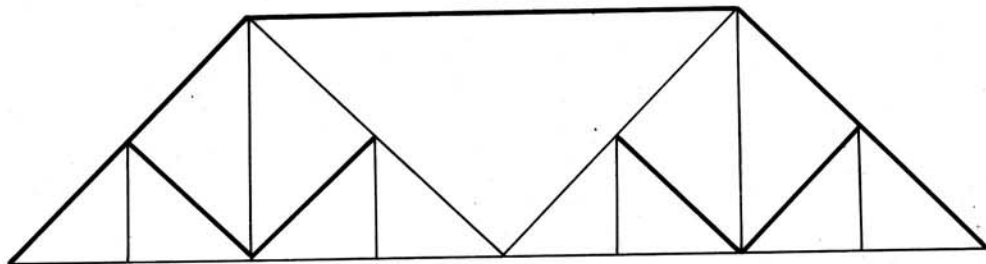
THE WARREN TRUSS WITH SUB-DIVIDED PANELS

The Warren Truss With Sub-Divided Panels has been used occasionally for long spans.

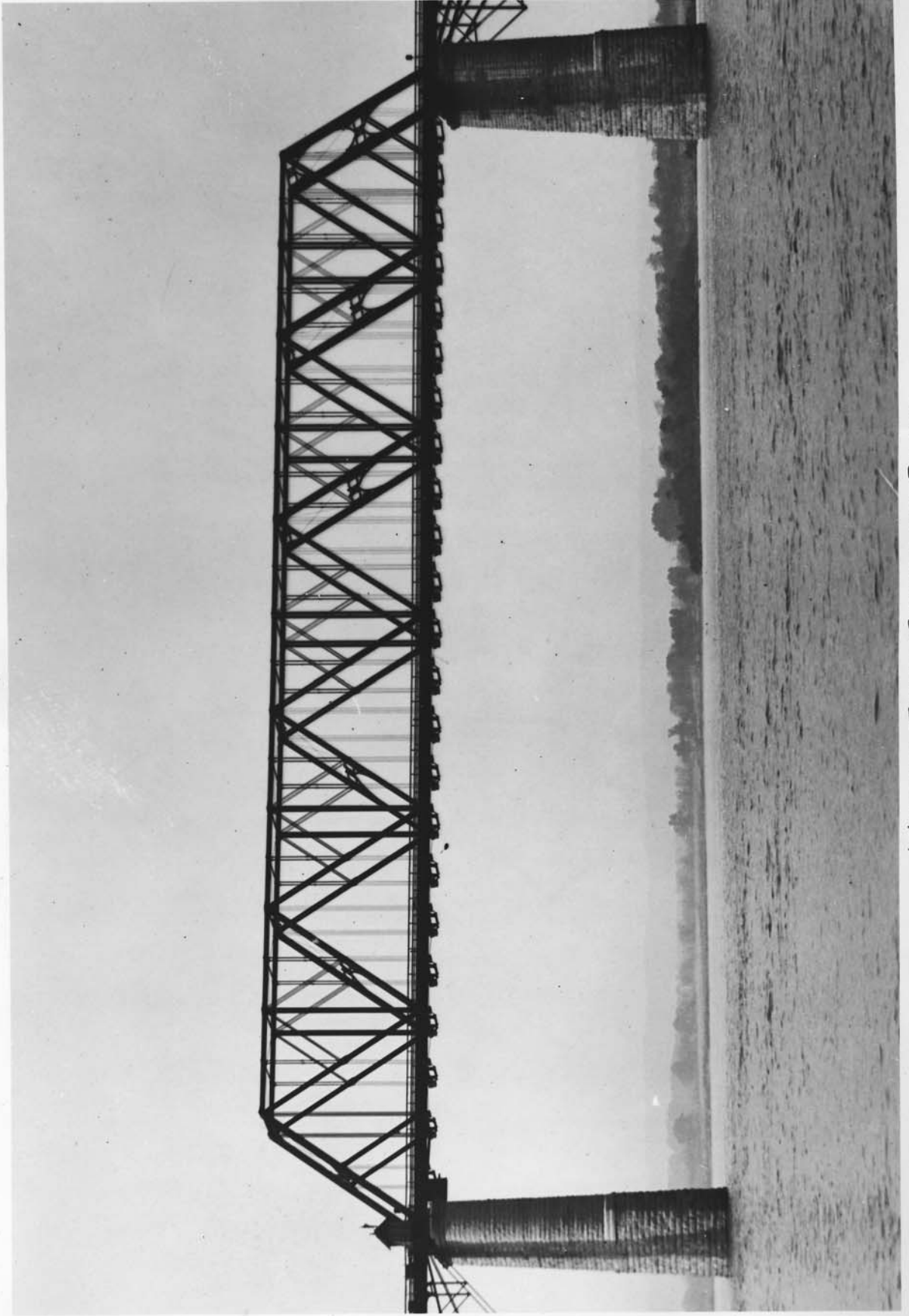
The particular span shown on the photograph is 390' long and carries highway traffic over the Ohio River at Louisville, Ky.

The truss consists of 6 main panels, which, by subdivisions, are converted into 24 panels for the floor system. The structure was built in 1869.

SIMPLEST FORM OF WARREN TRUSS WITH SUB-DIVIDED PANELS



Heavy Lines- Compression Members
Light Lines- Tension Members.



WARREN TRUSS - SUBDIVIDED PANELS.
Br. over Ohio River at Louisville, Ky.

THE PENNSYLVANIA TRUSS

The Pennsylvania truss is a development of the Pratt truss, using sub-divided panels and curved top chords for through trusses and curved bottom chords for deck trusses.

This type of truss is used for long spans where economical construction cannot be obtained by simple Pratt or Warren trusses.

The connections at the panel points are usually made by pins, but in some cases the erection conditions have necessitated the use of riveted connections to a large extent in the structure.

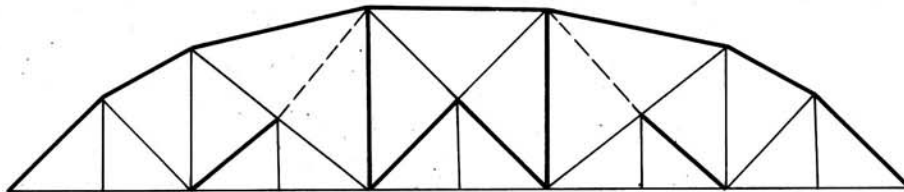
The longest spans constructed of this type is the Municipal bridge over Mississippi River for the City of St. Louis, Missouri, which consists of 668' through spans designed to carry two railroad tracks on the lower level and two street car tracks, one roadway and two sidewalks on the upper level.

The particular truss shown on the photograph is 377' long and consists of 12 panels.

The span crosses the East Channel of Susquehanna River at Havre de Grace, Md. and was built in 1909. The bridge is known as 34A, Philadelphia Division.

There are in this structure another through truss span of the same type, 518' long, and one deck truss span of the same type, 517' long.

SIMPLEST FORM OF PENNSYLVANIA TRUSS



Heavy Lines- Compression Members
Light Lines- Tension Members
Dotted lines- Members subject to
counter strain.



Br. No. 34A Philadelphia Div. - crossing East Channel of Susquehanna River at Havre de Grace, Md.

PENNSYLVANIA TRUSS