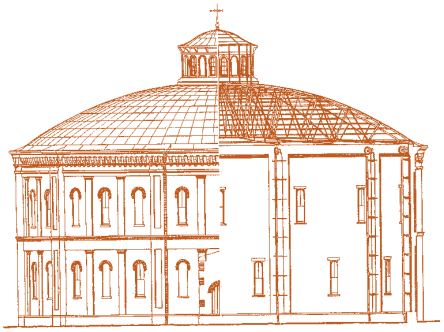
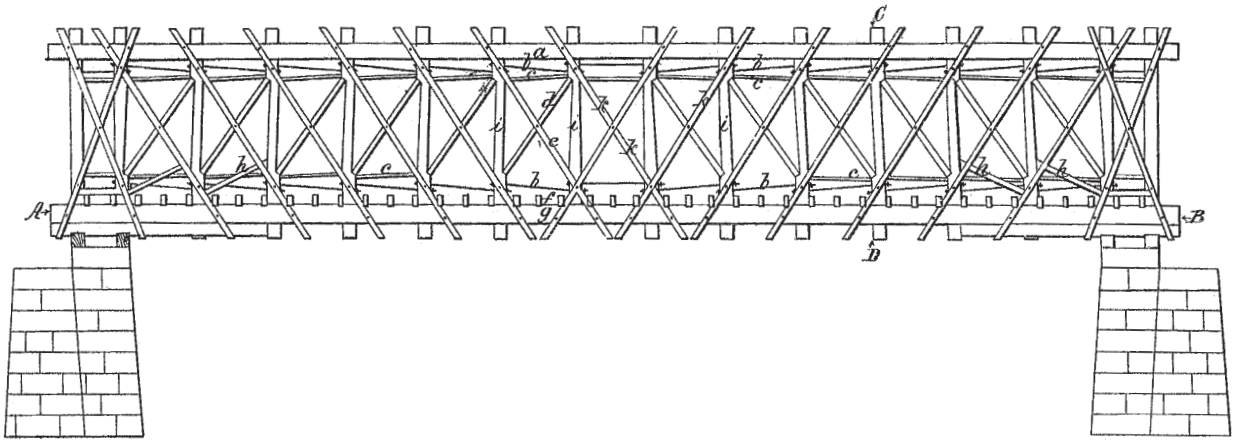


SOCIETY FOR INDUSTRIAL ARCHEOLOGY

Occasional Electronic Publication No. 1

ABSTRACTS & CHRONOLOGY OF AMERICAN TRUSS BRIDGE PATENTS, 1817-1900

by David Guise



2009

The SIA through its publications, conferences, tours, and projects encourages the study, interpretation, and preservation of historically significant industrial sites, structures, artifacts, and technology. By providing a forum for the discussion and exchange of information, the Society advances an awareness and appreciation of the value of preserving our industrial heritage. Annual membership: individual $50; couple $55; full-time student $20; institutional $50; contributing $100; sustaining $150; corporate $500. For members outside of North America, add $10 surface-mailing fee. Send check or money order payable in U.S. funds to the Society for Industrial Archeology to SIA-HQ, Dept. of Social Sciences, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1295; (906) 487-1889; e-mail: *SIA@mtu.edu;* Website: *www.sia-web.org.*

First Ed. Feb. 2009, Rev. Nov. 2009

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Foreword

The Society for Industrial Archeology is pleased to publish Occasional Electronic Publication No. 1 by one of our members, David Guise. This valuable guide draws inspiration from a series of occasional publications printed by the Society in the 1980s, perhaps the most popular of which was Occasional Publication No. 4, the Directory of American Bridge-Building Companies, 1840-1900 by Victor Darnell. The purpose of the occasional publications was then and now to offer a format for making available important information for the industrial archeologist that does not fit neatly within the formats of the SIA's two regular publications, the quarterly SIA Newsletter and the semi-annual scholarly journal IA. The advent of electronic publishing through the Internet has provided an opportunity to revive the practice of occasional publications, since it not only eases the burden of distribution but greatly reduces the costs.

Bridges have been a favorite theme of the SIA since its inception. And it is no small wonder since bridges lie at the intersection of advances in engineering knowledge, material science (particularly critical advances in the making and shaping of iron and steel), and transportation development during the nineteenth century. Since industrial archeologists are concerned with the study and preservation of the physical record of industrial development, bridges remain one of the most visible, accessible, and significant products of our nation's growth into an industrial power. The transition from wood to metal-truss bridges, in particular, lies at the nexus of our understanding of these developments.

David Guise has made a significant contribution to advancing our knowledge of America's historic truss bridges with this research tool. It has long been recognized that bridge patents offer a wealth of information, but using the bridge patents has not been for the faint of heart. The nineteenth-century patents and patent indexes do not use a consistent terminology, can sometimes be cryptic, and are not categorized in a way that would be useful for a researcher trying efficiently to gather information on, say, all patents related to Pratt trusses. David's research has consisted of reviewing the patent indexes, and one-by-one searching out the patents, digesting them, preparing a brief abstract, and categorizing them into the truss topology that is commonly used by today's bridge historians.

Part I of this publication is a list of the truss bridge patents organized alphabetically by the patentee's name with a brief abstract of the patent. The abstract focuses primarily on identifying the truss configuration (e.g., Pratt, Warren, bowstring, etc.) and its principal attributes. Part II is a chronology of the patents grouped by truss configuration and organized with the earliest of the patented configurations (arch-braced trusses) listed first. For those unfamiliar with truss topology, there are brief verbal descriptions and illustrative drawings.

For those wishing to further explore the patents listed in this guide, the U.S. Patent Office now provides patent text and graphic downloads at *http://patft.uspto.gov/netahtml/PTO/srchnum.htm*. Even more impressive are the full text searches that can be achieved at the Google Patents website at *http://www.google.com/patents*.

Patrick Harshbarger
SIA Newsletter Editor

Introduction:
American Truss Bridge Configurations
The Evolutionary Process

The picturesque truss bridges of the mid- to late-nineteenth century that dominated the American transportation system of roads and rails are slowly and inexorably becoming rare phenomena. Time and traffic have simply worn them out. While a tiny handful have been, and are being, preserved, the cost of doing so has usually resulted in their replacement with a new structure capable of handling the increased loads of modern trucks and trains. Steel plate-girders and post-tensioned concrete assemblages are today's means of bridging short- to modest-length crossings. Where steel trusses still sometimes constitute a viable economic solution, variations on only a handful of configurations are now seriously considered and ultimately used – mostly the Warren truss with its repetitive inverted "Vs," or variations of the Pratt truss with its tensile diagonals contained within a rectangular panel.

The hundreds of patented solutions proposed during the nineteenth century lay ignored in the archives, items of intellectual curiosity with no current practical value. Culled from these hundreds of inventions, only several dozen configurations ever proved to be of value, and then for relatively short periods of time. A progression of new construction materials permitted and inspired new forms. The forms that made sense in wood were replaced by new and different configurations made possible by the use of cast and then wrought iron for some, and then all, of the truss parts. Steel brought further possibilities.

Perhaps providing an even greater impact on truss development was the dissemination and dispersal of a scientific understanding of what was actually happening to the various configurations as they strained to carry their imposed loads. The intrinsic, trial-and-error methods employed by local carpenters and village smithies were slowly replaced by more sophisticated understandings. In 1835 Rennsselaer Polytechnic Institute started issuing degrees in engineering. In 1847 Squire Whipple published the first book in America that provided meaningful information as to how truss members dealt with loads – just in time to help cope with the outburst in railroad construction. Herman Haupt added his text four years later. But it took time for the average builder of bridges to acquire the education and ability to understand these texts. Thus proposals were made that seem wild, even comical, in light of today's knowledge.

Stretching over a period of a hundred years, American truss builders sought ways to span greater distances at the lowest possible cost. Initially labor was cheap and the cost of the then-new material, iron, high. Thus the thrust of new ideas concentrated on using the minimum amount of material to get the job done. Compared to contemporary European crossings of similar spans, American pin-connected trusses were marvels of lightweight delicacy. The price of this minimalist design approach was a non-stop replacement of structures in order to cope with the ever-increasing loads bridges were required to carry. The over-designed, often ponderous, more rigid, riveted European plate-girder and Warren-truss crossings, while carrying higher initial costs, possessed far longer life expectancies.

Long life expectancy was not part of the American tradition. The early wagon bridges were timber structures, and no one expected them to last very long. With luck, a ten-year run might be obtained. Roofing the bridges added some cost-effective longevity, creating a countryside of long skinny barn-like looking structures crossing the myriad of small streams. It was not for some time that entrepreneurs even thought about crossing the major rivers. The railroad, without the horse-drawn wagon's ability to forge small steams, exponentially raised the need for bridges. The only viable alternative to trusses was masonry arches. Masonry bridges were far more expensive and entailed much more time to erect. Trusses, especially those built with wrought iron and assembled in the field with pins, were the clear-cut way to go. It was the way America went.

The competition to build these bridges was fierce. Railroads were competing with each other to be the first to connect westward to major industrial hubs and agricultural centers. Time was critical, cost control essential. Tens of thousands of bridges were being built and the competition to obtain a piece of this financial bonanza was intense. Remember that by far the vast majority of these bridges were built over small streams. Only a handful would need to deal with the long spans over the likes of the Ohio, Mississippi, and Missouri rivers, and not until commerce moved far enough west from the populated eastern seaboard.

If a builder could find a way to make a joint better, build it quicker, and most importantly cheaper, then success could be his. The vast majority of the bridge patents concerned themselves with making better connections between the parts. A relative few concerned themselves with devising a new configuration.

It is these new configurations that provide intriguing insight to the evolutionary process. The specifications and claims that accompanied the patent drawings often provide a sense of the concepts that were motivating the engineers to make their proposals: in essence, a catalogue of the issues they saw as problems in the existing forms that needed to be overcome. Hundreds of new ideas were proposed that never saw the light of day as a working bridge. A few dozen new concepts enjoyed a period of use until their flaws became apparent, or their cost proved non-competitive, or a newer idea replaced them. Most concepts were patented, but some relatively successful configurations such as the Post truss and major variations on the Pratt, such as the Baltimore and Pennsylvania trusses, were never patented. Nor was Squire Whipple's “trapezoidal” truss, which is also known as a double-intersecting Pratt. Some concepts such as the Pegram truss were only built by a particular railroad, because its inventor was the chief engineer.

With the clarity gained in the more than one hundred years since the heyday of truss building one can begin to piece together a pattern of development. Out of the close to four hundred or so patents held, we can examine the few dozen that saw periods of success and begin to see how and why even this small number was winnowed down to less than the current handful of surviving configurations. But it is the one-of-a-kind fanciful proposals that provide the clue to the issues, real and perceived, that confronted these builders. Their very impracticality allows us to realize the enormity of the problem. Designers were dealing with concepts without the knowledge necessary to analyze their solutions. If they could have done so, their proposals would never have been made. They had no idea that their proposals were irrational.

Unless the patent holder could obtain a client, his concepts would not see the light of day. Generally, a builder would conceive of a method to build a bridge and patent it to limit competition, or at least

make the competition profitable. Squire Whipple spent much of his life trying to stop others from benefiting from his ideas. William Howe sold the rights to his concept of using vertical rods in the web of a timber truss to his son-in-law, another builder. The father and son team of Thomas and Caleb Pratt patented a timber configuration that could not compete with Howe's, but when eventually built in iron and ultimately steel, it became the singly most common truss type. Does one give the Pratts credit for being ahead of their time, or mutter that they didn't really understand what they were doing and could not have predicted in 1844 that wrought iron would be available to rescue their design decades later? Such are the intriguing questions suggested by research in the patents.

The list of patents in this volume was generated by clawing through annual patent office indexes and checking out each of the patents that might relate to truss-bridge design. During the nineteenth century the vast preponderance of bridge patents related to truss bridges.

If one were to try to list all the patents related to all bridges regardless of structural type, the list would need to cover a large variety of bridge types, not just trusses, a formidable task. Simple girders make the most sense for relatively short spans, and suspension bridges with their draped cables slung from high towers are capable of obtaining the longest spans. Arches of various types and materials, cable-stayed structures, and even pontoons have been utilized to carry people, animals, and vehicles. Under certain circumstances bridges need to be movable to allow for shipping to pass through, and different ways have been devised to accomplish this, including swinging (rotating), tilting (bascule) and vertical lifting.

The initial objective in making this list was to limit entries to truss-bridge configurations. It was then decided to include patents when the listing provided in the patent office index was not conclusive. This inclusion was done to alleviate any concern that a given patent that might be for a truss configuration was overlooked. In all such instances, the abstract will indicate that the patent is not for a truss configuration. In many instances the vaguely labeled bridge patents are for detailed methods for connecting various truss parts. This raises the issue of just when a particular patent crosses the line between being a “patent for a truss” and a “patent for a detail.” Obviously this is a judgment call. The inclusion of both “details” and “full” truss patents in the list permits readers to exercise their own judgments.

ACKNOWLEDGMENTS

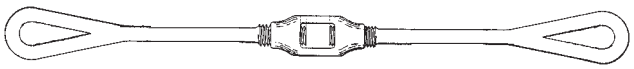
Over a decade ago I began scribbling notes to myself regarding the various truss patent drawings I was able to find on microfilm. I did so to provide a quick reference for my own use. Over time the list grew. Gradually I assembled the notes into what I found to be useful groups to further my attempt to find a pattern in, and make some sense of, the evolution of ideas on how to best overcome issues, real and perceived, that confronted early bridge builders. From time to time I shared the constantly growing list with a handful of friends who held similar interests.

Jim Stewart provided several leads for finding additional patents (one never knew under what heading in the Patent Office one might find a truss bridge). Additionally, he unearthed several patents I had missed. Saul Brody, Marvin Lessen, and Gretchen Grunenfelder read various parts and made constructive suggestions.

I shared my expanding list with Patrick Harshbarger, who encouraged me to revisit my initial abstracts and edit the terse annotations to make them more understandable and useful to others. It turned out to be a much longer and more difficult challenge than I realized. Patrick stood by as judge and jury, reading and critiquing my attempts. Final abstract descriptions often became as much his creation as mine. Simply put, without his input, help, and encouragement, this book would never have happened.

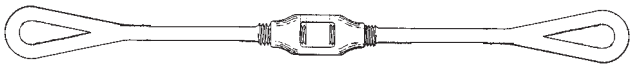
It is my sincere hope that the patent information contained herein will prove helpful to others. If readers are aware of additional patents not included in this text, they are encouraged to contact me so that the missing information can be incorporated in future editions. The wording of many of the descriptions can be second guessed. Errors of commission and omission no doubt remain; they are my errors, and mine alone. Again, please inform me when you discover one. All additions and corrections will be credited to their finder in updated versions.

David Guise
Georgetown, Maine
davidguise@myfairpoint.net



Part I

Abstracts of American Truss Bridge Patents



Each entry takes this form:

Patent Holder Name
Patent No. Date of Patent Abstract of Patent

***** An asterisk has been used to identify patents that are not strictly for truss bridges or truss details. They are patents labeled by the U.S. Patent office simply as "bridge" or even as "truss bridge," but in fact are *not* truss configurations or details. They have been listed to dispel concerns that a patent may have been inadvertently overlooked.

Bridge patents clearly identified by the Patent Office as a type other than a truss bridge, such as a "suspension bridge" or "movable bridge," have generally not been listed.

2 Sheets, Sheet 1.

J. S. Adams,

Truss Bridge.

No. 106,760. Patented Aug. 30. 1870.

Fig. 1.

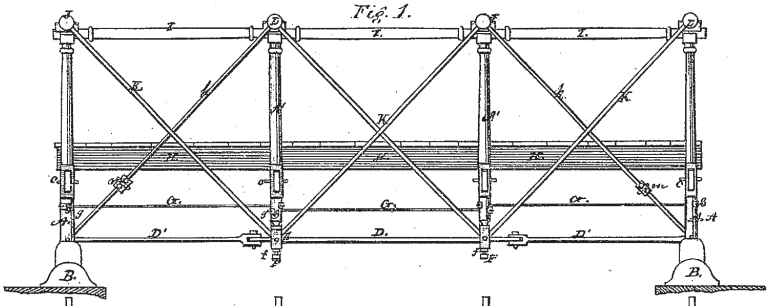


Fig. 2.

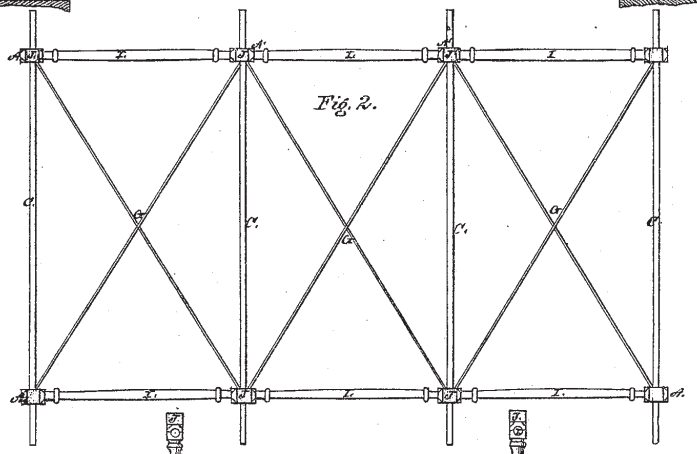
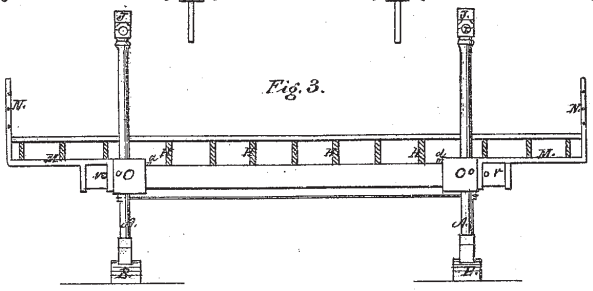


Fig. 3.



Witnesses.
Chas. H. Poole
J. R. Hopkins

Inventor
Jno. S. Adams

A

Abbott, Job – see Hammond & Abbott; Hammond, Adler & Abbott; Hammond, Morse & Abbott

Adams, John

106,760	Aug. 30, 1870	Metal Pratt truss. Swivel connections at bottom of posts. Bottom chord spliced with clevis and pin.

Adler, Michael – also see Hammond, Adler & Abbott

128,350	Jun. 25, 1872	Truss detail. Hollow compression chords composed of plates, tees, channels, and angles.

Alises, John

44,498	Oct. 4, 1864	*Portable swamp-crossing bridge. Trestle-like supports for plank decking. Labeled "truss bridge."

Allen, William – see Perry & Allen

Anderson, James

136,951	Mar. 18, 1873	Metal Howe truss. Bottom-chord bars offset to overlap and secured by lateral metal rods and nuts.

Anderson, John

307,896	Nov. 11, 1884	*Lift drawbridge. Suspended roadbed hung from Whipple truss. Labeled "bridge."

Anthony, Marcus

325,472	Sep. 1, 1885	*Swing-span drawbridge. Warren truss configuration.

Avery, Colby

536,680	Apr. 2, 1895	Queen-post truss. Compression members are pipes. Bottom chord, verticals, and crossed diagonals are metal rods.

Avery, George

17,864	Jul. 28, 1857	Bowstring truss. Tapered laminated timber top chord, vertical rods, and timber cross-bracing.

Avery, John

33,629	Nov. 5, 1861	Howe truss. Tilted deck trusses create a bridge with a W-shaped transverse cross section.

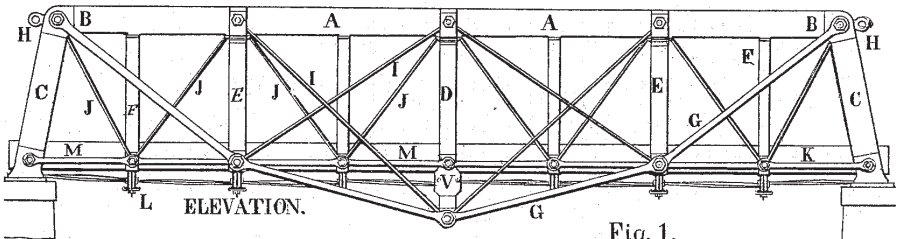
Avery, Oliver Jr. & Caleb Bartholomew

189,170	Apr. 3, 1877	Bowstring truss. Top chord composed of pair of bent railroad rails with their strong axis horizontal. Crossed diagonals.

L. L. BUCK.

Truss-Bridges.

No. 158,197. Patented Dec. 29, 1874.



ELEVATION.

Fig. 1.

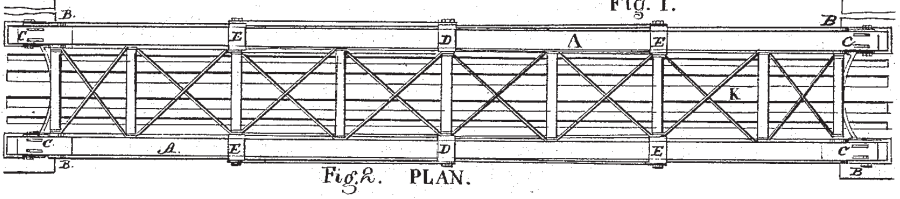


Fig. 2. PLAN.

Fig. 5. PLAN OF BOTTOM CHORD.

Fig. 4. PLAN OF "G."

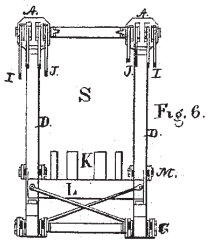


Fig. 6.

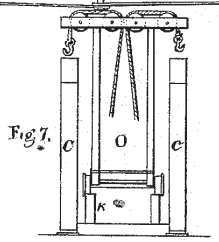


Fig. 7.

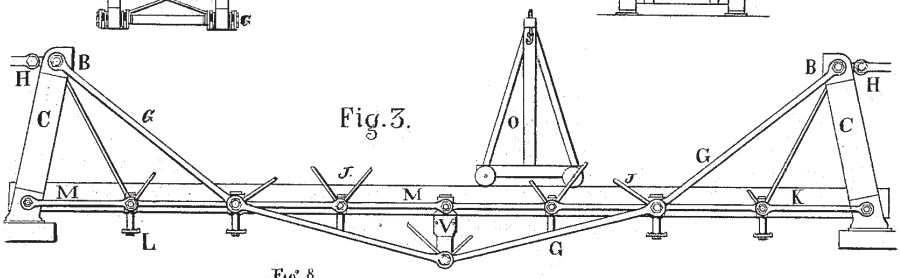
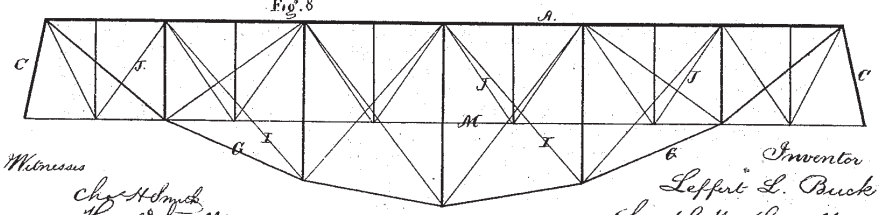


Fig. 3.

Fig. 8



Witnesses

Chas. H. Smith

Harold Serrell

Inventor

Leffert L. Buck

per L. W. Serrell

Atty

B

Baker, Calvin
94,272 Aug. 31, 1869 A-frame. Top chord extends below horizontal bottom chord to masonry abutment.

Baldwin, Eden
11,467 Aug. 8, 1854 *Tubular bridge. Transverse iron bands and longitudinal wood strips. Labeled "truss bridge."

Balet, Joseph
495,621 Apr. 18, 1893 Cable suspension and cantilever truss combination. Labeled "bridge."

Ball, Charles
502,165 Jul. 25, 1893 Queen-post truss. Bent tubular upper chord. Bottom chord, vertical, and diagonal members are metal rods.

Baltimore Truss
Not patented Popular parallel-chord, sub-divided Pratt long-span truss. Developed by the Pennsylvania RR in 1871. Promoted by the Baltimore Bridge Co. for other clients. Occasionally referred to as a Pettit truss.

Bannister, Alfred
141,026 Jul. 22, 1873 *Tied arch. Undulating, vertically woven, layered arch. Web of vertical struts only. Labeled "truss bridge."

Barland, Thomas
264,220 Sep.12, 1882 *Suspension bridge. Labeled "bridge."

Barnes, James
6,230 Mar. 27, 1849 Lenticular truss. Elliptical shape. Bridge deck at mid-height.

Barnes, Lewis
392,094 Oct. 30, 1888 *Culvert. Labeled "bridge."
487,819 Dec. 13, 1892 Truss to support a ditch cover. Web of contiguous U-shaped strapping is unusual. Labeled "bridge."

Bartholomew, Caleb – see Avery & Bartholomew

Barton, Henry
164,511 Jun. 15, 1875 Warren truss configuration with verticals. Timber chords and alternating steeply inclined web members. The two panels at each end and the one to either side of the center panel have vertical rods.

Batchelder, William
48,643 Jul. 11, 1865 Over-complicated spider-web configuration. Intriguing, overblown fantasy.

Bausman, Jacob
155,634 Oct. 6, 1874 Iron. Inverted bowstring deck truss. Arched bottom chord is a cable. Pratt-like web.

Beard, James
41,594 Feb. 16, 1864 *Jointed segmental iron arch. No horizontal tie. Labeled "truss."

Beer, Walter
609,001 Aug. 16, 1898 Trussed tied arch. Supported on two cantilevered inverted trusses. Labeled "construction of metal bridges."

Bender, Charles – also see Bender, Latrobe & Smith
76,041 Mar. 31, 1868 Inverted bowstring truss. Wire bottom chord approximates bending moment curve. Suspended roadway.

Bender, Charles, Charles H. Latrobe & C. Shaler Smith
141,310 Jul. 29, 1873 Hinged cantilevered truss. Tied back to abutment.

Berry, D.
26,156 Nov. 22, 1859 *Automatic sliding drawbridge. Labeled "canal bridge."

Bevan, John
7,374 May 21, 1850 *Metal tied arch. Wire-rope horizontal tie. Web consists of verticals only. Labeled "arched girder."

Bishop, Goodwin
27,963 Apr. 24, 1860 *Tied arch. Surmounted by a Howe-configured trussed arch with a web of crossed struts and vertical ties, plus an additional layer of double-intersecting diagonal ties. The tied-arch chord serves as the bottom chord of the trussed-arch above.

Bissell, Sylvester
237,471 Feb. 8, 1881 *Arch. Post-tensioned masonry blocks.

Black, William (Urbana Bridge Co., Urbana, Oh.)
166,960 Aug. 24, 1875 Inverted bowstring truss. Tension arc. Roadbed is suspended from lower chord.

Blackman, Green & Thomas Blackman
309,289 Dec.16, 1884 Timber Howe truss. Crossed diagonals. Vertical metal rods. Post-tensioning wire rope connecting floor beams below bottom chord.

Blair, Benjamin
568,830 Oct.6, 1896 *Culvert. Clay tile arch. Labeled "bridge."

Bogardus, Ova
150,515 May 5, 1874 Curved-chord double-intersection Warren truss. Verticals at all panel points. Some Howe and Pratt truss characteristics. Top chord and web struts are pipe sections. Verticals and bottom chord are bars. Tension rod inside diagonal pipe struts. Horizontal panel lengths increase toward mid-span, permitting diagonals to be parallel.

Boles, John Jr.
38,552 May 19, 1863 Truss with web of annuli rings and verticals backed by a full-span arch. Exuberantly fanciful.
47,920 May 30, 1865 Truss with U-shaped, curved, web braces plus variety of full-span ties and arches. Exuberantly fanciful.

Boles, John, Jr. (cont'd)

48,013	May 30, 1865	Truss with U-shaped, curved, web braces plus a full-span arch. Exuberantly fanciful.

Boller, Alfred

125,117	Apr. 2, 1872	Slightly tapered, laced, compression vertical for truss bridges. Labeled "improvement in wrought-iron bridges."

Bollman, Wendel – also see Denmead & Bollman (W. Bollman & Co., Baltimore, Md.)

8,624	Jan. 6, 1852	Suspension truss. Radiating diagonals extend to base of each vertical from top of both end posts.

Bonnell, William F.

130,561	Aug. 20, 1872	Pratt truss variation. Sliding link at junctures of diagonal ties with chord.

Bonzano, Adolphus – also see Clarke & Bonzano

127,018	May 21, 1872	*Turntable for swing-span drawbridges.

Bornemann, August (Bornemann & Sons, Lancaster, Oh.)

219,846	Sep.23, 1879	Queen-post configuration. Timber top chord and posts. Diagonals and bottom chord are metal rods.

Boutet, Thomas

114,401	May 2, 1871	Truss configuration with cross-braced panels. Parallel post-stressed cables in deck. End three panels secured to abutment. French in origin.

Bower, Daniel

140,181	Jun. 24, 1873	Timber Howe truss configuration. Block detail for connecting the diagonals. Single diagonal in all panels.

Bradway, Abel & Elijah Valentine

9,090	Jul. 6, 1852	Timber chord truss. Verticals composed of a wood strut and a pair of rods. Slope of timber web diagonals alternates in adjacent panels. Overlapping, two-panel-wide, rods in web are bent into a U-shaped pattern and connected only to the top chord. Convoluted.

Brayton, William

632,985	Sep.12, 1899	*Bascule drawbridge. Labeled "bridge."

Brelsford, William

531,768	Jan. 1, 1895	Queen-post truss. Timber top chord. Verticals, diagonals, and bottom chord are rods.
624,618	May 9, 1899	Queen-post truss. Tubular top chord and posts. Bottom chord and cross diagonals are rods. Unique joint detail.

Brenner, August

241,919	May 24, 1881	Arched truss. Ends of arched bottom chord are divided into two curved pieces, each having a different rate of curvature. Top chord is horizontal. Mid-span ties are metal rods.

Briggs, Alfred

20,987	Jul. 27, 1858	Timber Warren truss. Rods for tensile diagonals. Special bearing blocks.

Briggs, John

22,106	Nov. 2, 1858	Detail for timber trusses. Rubber pads under posts bearing on bottom chord. Labeled "truss bridge."
38,653	May 26, 1863	Timber lattice truss configuration. Compression diagonals omitted in middle third of span.

Brochocki, Thomas DeDienheim

377,887	Feb. 14, 1888	Warren truss. Kit of parts for a variety of configurations, including double-layered, or stacked, Warren trusses. Based on a French patent.

Brown, Josiah

17,722	Jul. 7, 1857	Timber double-Warren truss configuration. Vertical at mid-span. Bolted joints.

Bruce, George

34,102	Jan. 7, 1862	Overlapping timber A-frame trusses. Vertical rods. No top chord. Arched bottom chord also has ties. Several conflicting concepts at work.

Brundage, Henry

100,254	Mar. 1, 1870	Pratt truss configuration. Crossed diagonals. Tapered verticals. Convoluted joints.

Buchanan, Samuel

389,951	Sep.25, 1888	Tied arch. Complex configuration is truss-like but functions as a tied arch. Timber chords. Floor beams suspended directly from top chord. All web members are metal rods. Verticals are laterally crossed. Patent is mainly concerned with crossing of verticals for lateral stability. Labeled "bridge."

Buck, Lefert

158,197	Dec.29, 1874	Suspension truss. Warren-like web with superimposed draped metal rods. Labeled "truss bridge."

Buckley, Thomas

374,887	Dec.13, 1887	Howe truss configuration. Timber chords. Reinforced with wire cables below bottom chord.

Burneson, Andrew

154,644	Sep. 1, 1874	*Detail for an arch composed of angled plates. Labeled "iron-bridges."

Burke, Joseph

117,042	Jul. 18, 1871	Howe truss. Timber chords. Steeply sloped timber diagonals. Verticals are rods with a slightly reversed slope.

Burr, Theodore

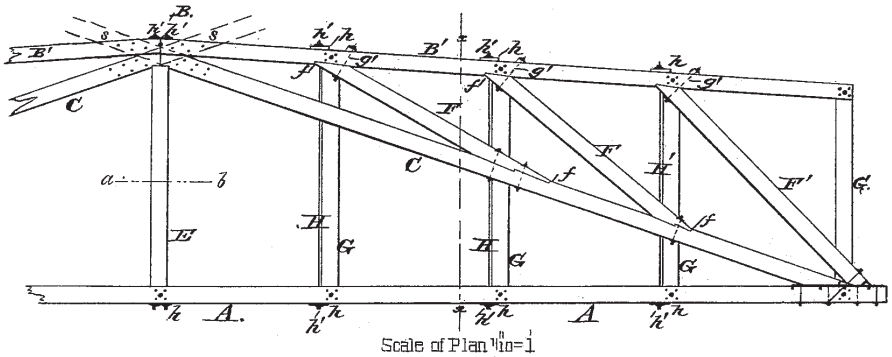
2769X	Apr. 3, 1817	Burr arch-truss. Timber, parallel-chord truss with compression diagonals and superimposed timber arch. Original patent destroyed by fire.
	Mar. 31, 1837	Signed specification for 1817 patent. No drawing. Labeled "disclaimer." (Burr died in 1822).

Butterworth, Joshua – see Woodruff & Butterworth

G. W. COOLEY.
Truss for Bridges.

No. 208,155. **Patented Sept. 17. 1878**

Fig. 1.



Scale of Plan 1/10=1

Fig. 2.

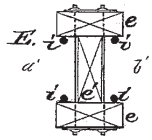


Fig. 3.

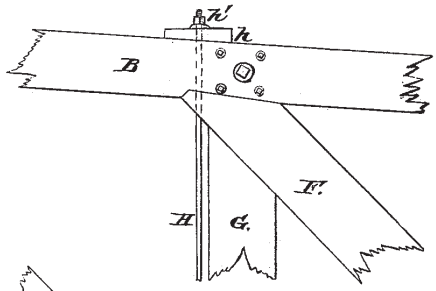


Fig. 5.

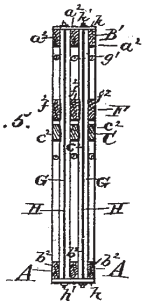


Fig. 4.

Scale of Details 1"=1.

ATTEST:
Leroy J. Buffington.
B. W. Fisk

INVENTOR:
Geo. W. Cooley

C

Campbell, Alexander

110,546	Dec.27, 1870	Indefinable configuration of Rube Goldberg forms. Labeled "self-bracing compensating suspension bridge." Irrational exuberant fun.

Canda, F.E.

88,446	Mar. 30, 1869	Pratt truss configuration. Crossed diagonals. Tapered verticals and top-chord segments.

Canfield, August

7,621X	Jun. 29, 1833	Iron Howe truss configuration. Single compression member in each panel. Top chord is a series of tension bars anchored at abutments. Essentially a cantilevered bridge.

Carpenter, Edward

77,800	May 12, 1868	Detail for a wedge driven between two-piece verticals to produce camber. Example given is a timber truss with crossed diagonals in all panels.

Carr, Charles & George Carr

328,758	Oct. 20, 1885	Howe truss configuration. Timber top chord and diagonals. Bottom chord of iron rod segments with turnbuckles. Vertical rods, plus paired iron yokes supporting floor beams.

Carr, William

539,506	May 21, 1895	Timber Pratt truss configuration. Metal plate secured to top chord to shed water and provide lateral bracing. Crossed tension rods in web panels

.

Cartter, Milo & Hosea Cartter (M. S. Cartter & Co., St. Louis, Mo.)

104,110	Jun. 14, 1870	Howe truss configuration. Timber upper chord and diagonals. Lower chord of interlocking iron plates. Single iron shoe to receive both diagonals at panel points.
127,564	Jun. 4, 1872	Howe truss configuration. One-piece shoe to receive the timber end post, timber diagonals, vertical metal rod, and end of iron-bar bottom chord.

Champion, Samuel & Thomas Champion

11,322	Jul. 18, 1854	Continuous-cantilever truss over two piers. Inclined top chord. Suspension rods and struts radiate from piers. Labeled "truss bridge."

Childs, Horace

4,693	Aug. 12, 1846	Howe truss configuration. Timber chords, verticals, and diagonals. Tension-rod counters in end panels.

Clarke, Thomas – also see Clarke & Bonzano; Clarke Bonzano & Griffen (Clarke, Reeves & Co., Philadelphia, Pa.)

132,803	Nov. 5, 1872	Detail for trusses. Post to floor beam connection.
140,888	Jul. 15, 1873	Arched truss. Erected by pivoting two cantilevers into place. Double-intersecting diagonals.

Clarke, Thomas & Alphonse Bonzano (Clarke, Reeves & Co., Philadelphia, Pa.)

117,047	Jul. 18, 1871	Connection detail for tubular truss members (i.e., Phoenix columns).
117,048	Jul. 18, 1871	Connection detail for tubular truss members.

Clarke, Thomas & Alphonse Bonzano (cont'd)

117,049	Jul. 18, 1871	Connection detail for tubular truss members.
117,050	Jul. 18, 1871	Connection detail for tubular truss members.
130,479	Aug. 13, 1872	Metal block connection joint for tubular members.
132,254	Oct.15, 1872	*Turntable for swing-span drawbridges.

Clarke, Thomas, Alphonse Bonzano & John Griffen (Clarke, Reeves & Co., Philadelphia, Pa.)

140,471	Jul.1, 1873	Whipple trapezoidal truss configuration. Quadruple-intersecting diagonals. Stacked set of four cross-braces between alternate verticals due to extreme height.

Clymer, George

413,172	Oct. 22, 1889	*Suspension bridge. Web of verticals with diagonal cross-ties.
416,054	Nov.26, 1889	*Short-span I-beam bridge supported on metal mud sills.
534,032	Feb. 12, 1895	*Short-span cable-trussed I-beam bridge.

Colby, Ellery

187,513	Feb. 20, 1877	Bowstring truss. Top chord made of bent railroad rails. Vertical and crossed diagonal are metal rods.

Cole, L.K & H. Soule, Jr.

52,536	Feb. 13, 1866	Howe truss. Timber upper chord. Threaded rod for the bottom chord. Single diagonal in all panels.

Conklin, Solon

153,540	Jul. 28, 1874	Truss web configured to facilitate insertion of pipes for transmission of water, gas, and electricity. Labeled "truss bridge."
174,120	Feb. 29, 1876	Truss with a lozenge pattern. Formed with straight members and mid-height horizontal chord.
210,754	Dec.10, 1878	Timber truss with double-panel-length crossed diagonals called "double hip arches." Verticals at intersection of web cross-bracing.

Cooley, George

208,155	Sep. 17, 1878	Truss with timber chords. Half-span diagonal strut with single panel "rafter" struts between half-span diagonals and top chord. Verticals composed of both rods and timber struts.

Cooper, William

135,970	Feb. 18, 1873	Bowstring truss. Tubular arched chord. Crossed diagonals intersect at circular ring in center of panel.

Corey, G. W.

66,799	Jul. 16, 1867	Timber Howe truss variation. Crossed timber diagonals notched into double chords between vertical panel points.

Cottrell, Albert

2,334	Nov. 10, 1841	Timber lattice truss. Cantilever arms project from both sides of span. Erected without centering.
43,099	Jun. 14, 1864	*Corbelled timber bridge. Stacked cantilevered beams secured with vertical pins.

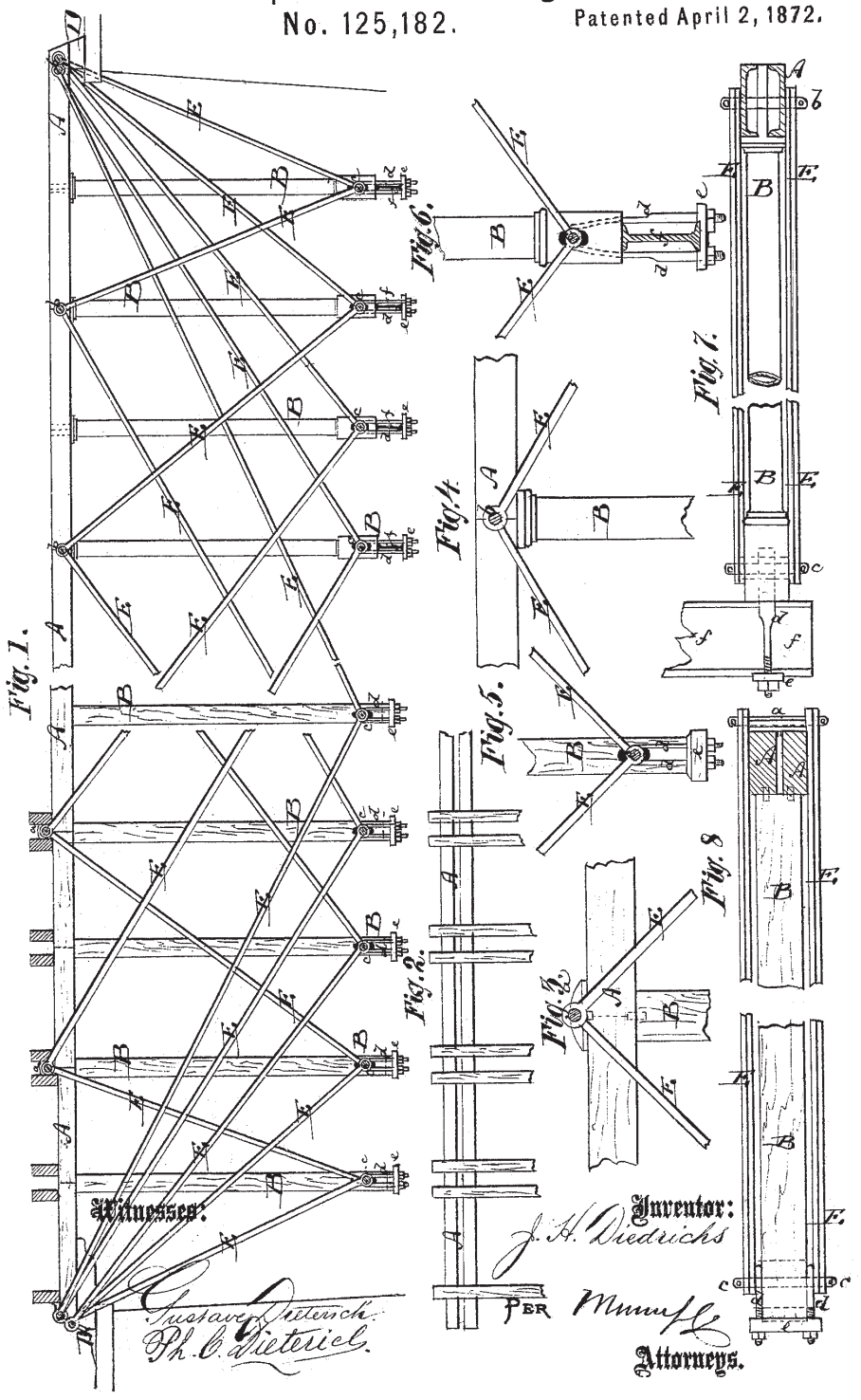
Coultas, George

365,970	Jul. 5, 1887	Inverted king-post configuration. Timber top chord and post. Diagonal metal rods.

JOHN H. DIEDRICHS.

Improvement in Bridges.

No. 125,182. Patented April 2, 1872.



D

Daigle, Marcelin

332,058	Dec. 8, 1885	*Sliding retractable drawbridge. Cable-stayed beams. Labeled "bridge."

Dandridge, Alexander

595,906	Dec. 21, 1897	*Suspension bridge. Labeled "bridge."

Davenport, Joseph

72,611	Dec. 24, 1867	*Tied arch. Latticed arch chord. Radial web suspension rods support bridge deck.
82,388	Sep. 22, 1868	Bowstring truss. Latticed arch chord. Tension diagonals at third panel point supplement horizontal tie. Cross-braced radial ties.

Davidson, James

605,474	Jun. 14, 1898	Double-intersection Warren truss variation. Third chord at mid-height. Fish-plate connections throughout.

Davies, Robert

90,562	May 8, 1877	Double end-posts and end-tie diagonals to protect truss from impact. Whipple trapezoidal truss configuration shown.

Davis, Benjamin

143,125	May 26, 1873	Bowstring truss. Verticals plus radiating struts from mid-span of bottom chord.
311,064	Jan. 20, 1885	*Cantilevered bridge. Radiating set of cables extend from top of center mast to sloping booms. Vertical cables from booms hold roadbed. Intriguing cable-stayed variation.

Davis, Nathan

574,887	Jan. 12, 1897	King-post truss. Deck truss created from an I-beam that has been slit longitudinally and the bottom flange heated and drawn out to create the sloped bottom chord.

Denmead, Edward & Wendel Bollman (Patapsco Bridge & Iron Works, Baltimore, Md.)

78,073	May 19, 1868	*Method for securing verticals to bottom chord with cushioned clamps. Labeled "truss bridge."

Dennis, John

319,798	Jun. 9, 1885	Howe truss configuration. Curved upper chord. Vertical ties are radial. Single diagonal struts in each panel. Deck bridge with triangular webbing above the truss to support the deck. Labeled "railway bridge."

Densmore, Lyman

188,107	Mar. 6, 1877	Howe truss configuration. Timber top chord and crossed diagonals. Number of metal rods used in successive panels of bottom chord increase toward mid-span.

Derr, John

198,580	Dec. 25, 1877	Heel detail for timber trusses. Labeled "through-brace bridge."

Derrom, Andrew
48,530 Jul. 4, 1865 *Trestle. Labeled "truss bridge."

Dibble, Chauncey
293,427 Feb. 12, 1884 Bowstring truss. Arched roadbed. Pairs of rods in V-shaped patterns between vertical struts.

Dieckman, Ferdinand
113,030 Mar. 28, 1871 Lenticular truss. Mid-height horizontal cable tie. Second set of web-bing between cable and bottom chord.

Diedrichs, John
125,182 Apr. 2, 1871 Suspension truss. Timber top chord and verticals. No bottom chord. Pair of tie rods at equal angles from the bottom of each post.

Dixon, Ephraim
230,929 Aug. 10, 1880 *Timber arch. Composed of several interlocking straight timbers. Labeled "truss bridge."

Douglas, William (Berlin Iron Bridge Co., Berlin, Conn.)
202,256 Apr. 16, 1878 Lenticular truss. The configuration of both the top and bottom chord is composed of three slopes, including a horizontal center section.
315,259 Apr. 7, 1885 Lenticular truss. All panel points lie on a parabolic curve. Chord segments between panel points are straight segments. Wind strut in end panels. This is the classic Berlin Iron Bridge Co. lenticular config-uration.

DuBois, John
36,606 Oct. 7, 1862 *Method for erecting a bridge on a floating foundation secured to piles. Labeled "truss bridge."

Dundas, Charles
320,859 Jun. 23, 1885 Method for anchoring timber trusses to piling with diagonal rods. Examples shown are king and queen-post trusses. Labeled "bridge."

Durden, Thomas
20,414 Jun. 1, 1858 Tied tubular arch that carries a stiffening truss above. Conflicting concepts. Top chord is a tension rod connecting to all verticals. Labeled "truss bridge."

Durfee, James
142,776 Sep. 16, 1873 *Bridge composed of a series of parallel segmental ribs (mini tied-arches). Labeled "bridges."

Duval, Martin
384,196 Jun. 5, 1888 Kit of truss parts for a variety of configurations including a double-intersection Warren truss with verticals at alternate panel points. French origin. Labeled "metallic bridge."
384,197 Jun. 5, 1888 Kit of truss parts for a variety of configurations. French origin. Labeled "metallic bridge."

S. Ensign,
Truss Bridge.

No. 96,569. Patented Nov. 9, 1869.

Fig. 1

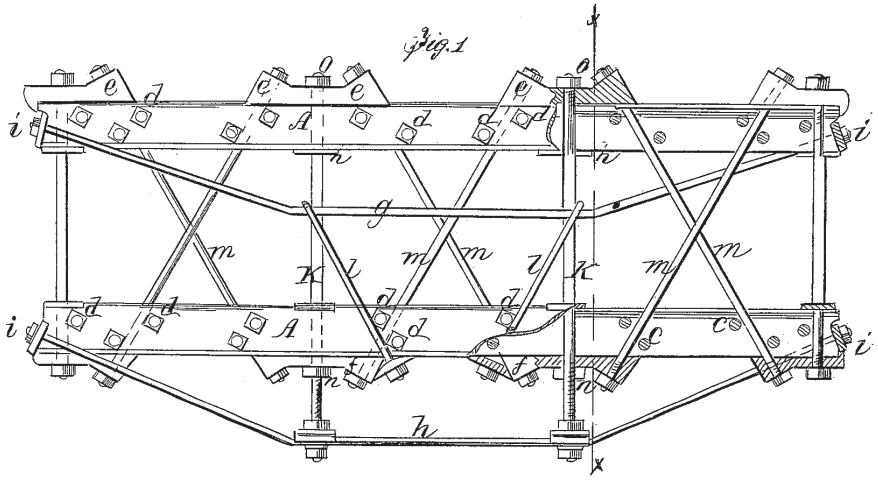


Fig. 2

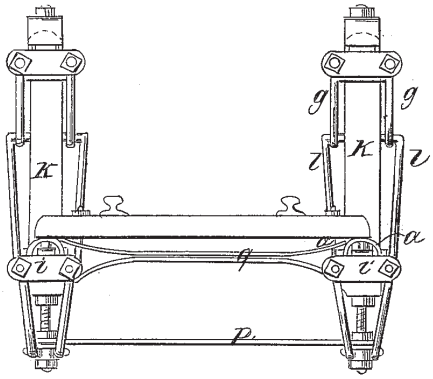
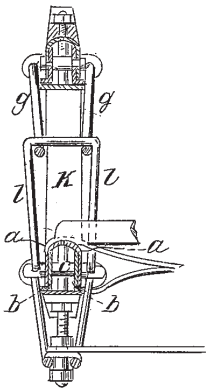


Fig. 3.



WITNESSES.

Geo. N. Mabee

INVENTOR.

S. Ensign

per Munn & Co

Attorneys.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

E

Eads, James – also see Eads & Flad

83,912	Nov. 10, 1868	*Metal arch. Expansion joint at center span. Labeled "truss bridge."
89,745	May 4, 1869	*Metal arch. Compensating lever and thrust bars to prevent oscillations of piers in multi-span arched bridges. Labeled "truss bridge."
142,378	Sep. 2, 1873	*Truss carried above metal arch on posts. Labeled "bridges."
142,379	Sep. 2, 1873	*Trussed arch. Method of erecting from piers outward. Labeled "iron bridges."
142,380	Sep. 2, 1873	*Construction method. Two cantilevered half-span segments built parallel to river and swung into place. Labeled "iron bridges."
142,381	Sep. 2, 1873	*Pair of opposite leaning lenticular trusses create a three-hinged arch carrying a roadbed above. Labeled "iron bridge."
142,382	Sep. 2, 1873	*Foundation for arch bridge.
144,519	Nov. 11, 1873	*Heel joint detail to relieve horizontal thrust on arch bridges. Labeled "bridges."
162,045	Apr. 13, 1875	*Hydrostatic piston in heel joint used to control horizontal movement. Labeled "iron bridge."
162,357	Apr. 20, 1875	*Attachment of heel joint to permit expansion and contraction. Labeled "iron bridges."
163,854	Jun. 1, 1875	*Metal-arch skewback anchor to lessen amount of masonry in abutment. Labeled "metallic-arch-bridge."
169,791	Nov. 9, 1875	*Modification of patent no. 142,381 of 1873.

Eads, James & Henry Flad

95,784	Oct. 12, 1869	*Rollers on top of pier to relieve horizontal thrust of arches on either side. Labeled "truss bridge."

Earle, Charles

18,196	Sep.15, 1857	*Short-span drawbridge.

Eddy, Daniel

389,694	Sep.18, 1888	*Cable-stayed bridge.
510,064	Dec. 5, 1893	Combination of several truss and suspension bridge features, as well as a bowstring configuration. Masts at each one-fifth span point support radiating diagonals. Picturesque fantasy of conflicting forms.

Eikenberry, Lewis

22,715	Jan. 25, 1859	Two, almost concentric, arches secured to a truss-like web of verticals and quadruple intersecting diagonals. No horizontal chords. Labeled "truss bridge."
31,157	Jan. 22, 1861	Half-span diagonal struts secured at center span to a truss-like web of verticals and quadruple intersecting diagonals. No chords or horizontal ties. Labeled "truss bridge."

Ensign, Samuel

96,569	Nov. 9, 1869	Chords are trussed beams. Web consists of crossed diagonals and verticals that do not intersect the chords at common points.

Evans, James

144,751,	Nov. 18, 1873	*Tied arch. Supported on raised metal abutments. Web contains only verticals to support roadbed. Sheathed-wire tie.

J. P. Fisher

Truss Bridge.

Sheet 1, 2 Sheets.

No. 28,845. Patented Jun. 26, 1860.

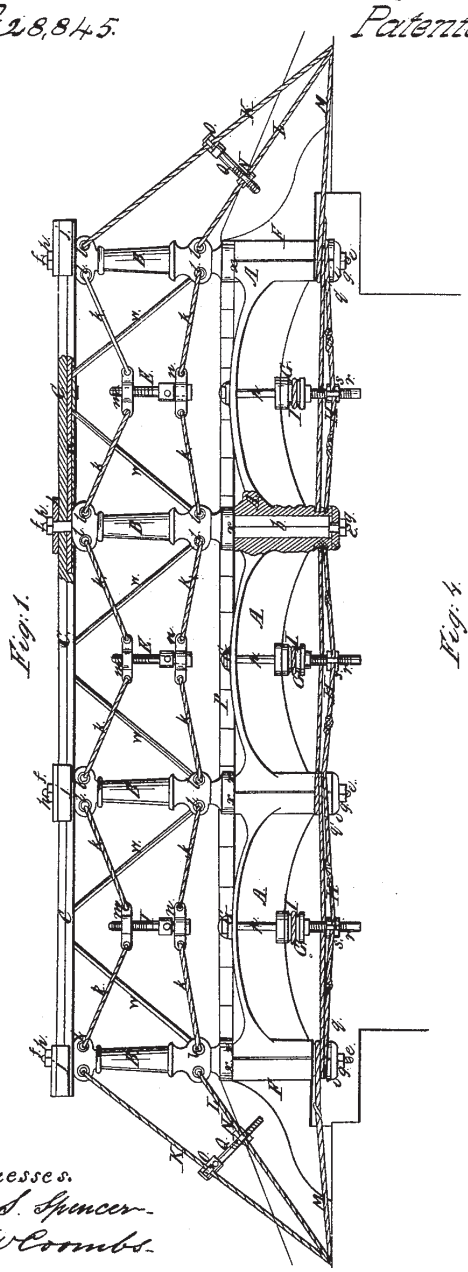


Fig. 1.

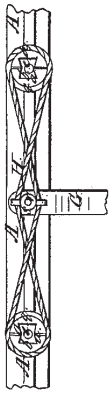


Fig. 4.

Witnesses.
R. S. Spencer
J. W. Coombs

Inventor.
J. P. Fisher
per Munn & Co.

F

Farnsworth, Edwin

159,084	Jan. 26, 1875	Bowstring truss. Upper chord composed of two channels and plates. Diagonals do not meet at same points as verticals.

Fenn, Jason

530,265	Dec. 4, 1894	King-post truss. Railroad rail members, except for vertical metal rod with bent connection around rail.

Ferguson, Benjamin

460,856	Oct. 6, 1891	Queen-post truss. Timber except for vertical rods. Diagonal struts in end panels.

Fidler, T.C.

174,510	Mar. 7, 1876	*Suspension bridge with stiffening truss. Labeled "construction of bridges."

Fink, Albert

10,887	May 9, 1854	Suspension truss. Multiple pairs of diverging diagonals support the bottom of verticals. Deck truss variation has no bottom chord. Most used and best known of Fink's designs.
16,728	Mar. 3, 1857	Howe truss configuration. All panels have crossed diagonals plus ties from diagonal intersections to lower chord. Timber chords.
63,714	Apr. 9, 1867	Warren truss configuration with hanger rods at alternate panel points. Timber top chord and diagonals. Bottom chord and first web diagonal are rods.
RE 4,093	Aug. 9, 1870	Reissue of No. 63,714 with minor revisions.
116,787	Jul. 4, 1871	Warren truss. Long-span, subdivided with three verticals in each panel.
RE 9,575	Feb. 15, 1881	Reissue of No. 63,714 with minor revisions.

Fisher, David

591,832	Oct. 19, 1897	Timber Howe truss. Three adjustable cables from top of end posts passing through center post.

Fisher, J.P.

28,845	Jan. 26, 1860	Truss panels of wire-rope webbing between verticals, above a lower chord composed of a series of cable-tied arches. Picturesque overkill.

Fisher, Peter

230,410	Jul. 27, 1880	Protection for the inside of the truss from impact of train cars. Labeled "railroad-bridge."

Flad, Henry – also see Eads & Flad

132,271	Oct. 15, 1872	*Jacks used to control expansion and contraction in cable-stayed bridges. Labeled "improvement in bridges."

Foreman, John

78,797	Jun. 9, 1868	Truss with timber chords and inclined posts. Double-intersecting diagonal rods.
104,295	Jun. 14, 1870	Connection detail for securing diagonals to chord of Post or Warren truss configurations. Labeled "truss bridge."

Foster, Josiah – also see Sullivan, Kessler & Foster

183,291	Oct. 17, 1876	*Parallel tubes. Labeled "girders for bridges."

Frees, Peter & King, Zenus [sic] (King Iron Bridge & Mfg. Co., Cleveland, Oh.)

33,384	Oct. 1, 1861	*Metal hollow-plate tied arch. Arch depth and width increase toward mid-span. Verticals are perpendicular to curve of arch.

Fritz, Milton

294,606	Mar. 4, 1884	Howe truss configuration. Lateral deck beams are hung directly from splayed vertical metal rods extending from timber upper chord. Bottom chord is a pair of metal rods.

(No Model.)

J. E. GREINER.

TRUSS FOR BRIDGES, ROOFS, &c.

No. 535,695. Patented Mar. 12, 1895.

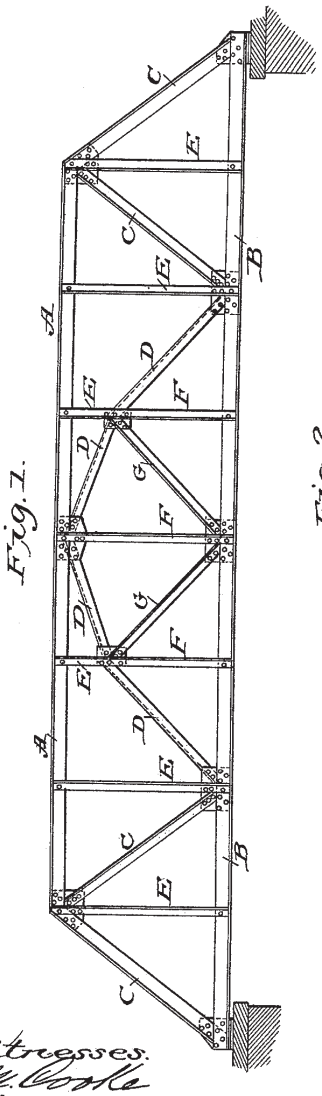


Fig. 1.

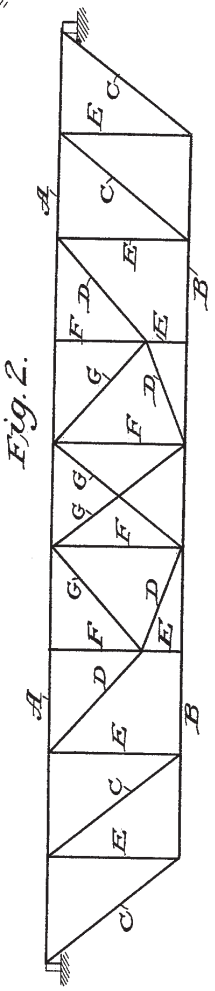


Fig. 2.

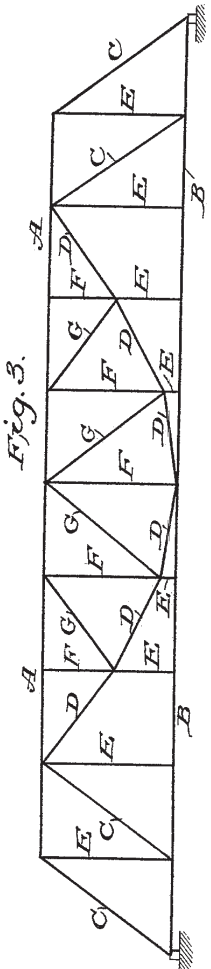


Fig. 3.

Witnesses.
G. W. Cooke
J. R. Mercier

Inventor.
John Edwin Greiner
by Ashton Ramsay
Atty.

G

Gassaway, Samuel

5,297	Sep. 18, 1847	Suspension deck-truss bridge. Iron chain bottom chord with multiple vertical posts. The specifications mention, although the drawing does not show, diagonal braces that would make it a true truss.

Gates, James

135,705	Feb. 11, 1873	Howe truss. Timber top cord and crossed diagonals. Slope ended. Panel-length cables between blocks secured below bottom chord at each vertical.

Gay, Lowman

4,837	Nov. 4, 1846	Timber arch-truss. Reinforced with a superimposed arch from abutments to upper chord at mid span.

Gilbert, John

58,094	Sep. 18, 1866	*Arch consisting of a pair of circular segment-shaped plates. Labeled "truss bridge."

Glass, John, George Schneider & William Rezner (Ohio Bridge Co., Cleveland, Oh.)

71,868	Dec. 10, 1867	*Tied arch. Oval-section tubular arch. Web of radial struts plus two diagonal struts at non-congruent panel points.

Godman, Solomon

263,333	Aug. 29, 1882	Pratt truss configuration. Metal-covered laminated timber upper chord. Mid-height row of horizontal rods. Cast-iron verticals.
267,189	Nov. 7, 1882	Pratt truss configuration. Timber top chord. Rods used for lower chord and diagonals. I-beam verticals.
336,104	Feb. 16, 1886	Subdivided Pratt truss. Cross-braced panels. Mid-height horizontal ties. Hangers extend from intersection of crossed diagonals to bottom chord.
349,345	Sep. 21, 1886	*Knee braces under bridge deck. Labeled "bridge."

Good, Francis

450	Nov. 4, 1837	*Short-span crossing, secured to cambered timber beams. Labeled "truss bridge." Strangely, no truss configuration is indicated in patent documents.

Goodwin, John

142,785	Sep. 16, 1873	*Timber beams for short-span crossings. Labeled "bridges."

Gorrill, Richard

224,677	Feb. 17, 1880	Howe truss configuration. Timber top chord and diagonals. Metal bottom chord and verticals. Sub-top-chord in center panels.

Gottlieb, Abraham

230,185	Jul. 20, 1880	Truss connection details. Labeled "bridge and bridge-iron."

Graham, Benjamin

146,332	Jan. 13, 1874	Howe truss configuration. Pony truss with inclined top chord in last two panels. Laterally crossed verticals provide stability.

Gray, John

26,583	Dec. 27, 1859	Metal shoe to secure counterbraces. Labeled "truss bridge."

Gray, Richard

489,946	Jan. 17, 1893	Pratt truss configuration. Half-hip. Tubular top chord. Web and bottom chord of metal rods. Slight upward pitch to bottom chord in end panels.

Green, William

458,161	Aug. 25, 1891	Pratt truss configuration. Cross-braced panels. Segmented tubular chords.

Gregory, Thomas

105,195	Jul. 12, 1870	*Adjustable abutment support. Labeled "truss bridge."

Greiner, J.E.

528,940	Nov. 13, 1894	Howe truss configuration. All members fabricated from used railroad rails. Single-diagonal panels. B&O RR overhead bridge.
535,695	Mar. 12, 1895	Superimposed bowstring in center of truss having either Pratt or Howe end panels with single diagonals. Railroad rails not mentioned in specifications but known to have been used in built examples.

Gridley, J. B

9,093	Jul. 6, 1852	Timber Howe-like truss configuration. Knee braces at abutments. Half-span diagonal struts with single compression diagonals in panel areas below strut and cross diagonals in panel areas above. Timber braced. Half-span diagonal struts.

Griffen, John – see Clarke, Bonzano & Griffen

Grotz, Remig

63,507	Apr. 2, 1867	*Ferry guard. Listed under "bridge" in Patent Office index. Specifications titled "improvement in bridges." Patent drawing labeled "ferry guard."

Groves, Hugh

249,038	Nov. 1, 1881	Bowstring truss. Sheet metal on top of arched timber chord provides protection. Vertical rods and crossed diagonals are secured to lateral floor beams. Additional diagonal struts extend from bottom of vertical at mid-span.

Guiou, Peter

14,313	Feb. 26, 1856	Bowstring truss. Web has full, half, and quarter span braces. Radiating verticals.

Gunn, William

629,902	Aug. 1, 1899	*Splayed towers for suspension bridges. Labeled "bridge."
639,804	Aug. 8, 1899	*Splayed towers for suspension bridges. Labeled "bridge."

Sheet 1, 3 Sheets.

Hammond & Reeves.

Bridge Truss.

No. 86,538. Patented Feb. 2, 1869.

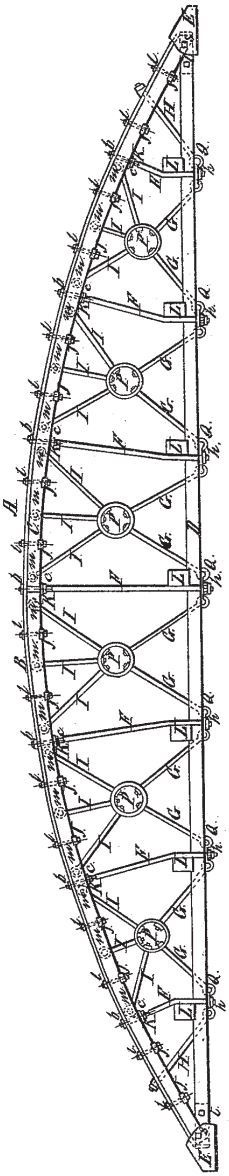


Fig: 1.

Witnesses.
Ruth. H. Abbott
Ed. A. Bribou

Inventor:
David Hammond.
H. P. Reeves
By Jab. Abbott
ATTORNEY.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D.

H

Hagg, Lewis – see Webb & Hagg

Halstead, George

91,124	Jun. 8, 1869	Connection detail. Truss block to receive diagonal rods. Labeled "truss bridge."

Ham, Joel

24,460	Jun. 21, 1859	Iron Howe truss. Curved top chord and three additional full-span concentric arches superimposed on the truss.

Hamilton, Edward

78,202	May 26, 1868	*Plate girder swing-span drawbridge. Labeled "truss bridge."

Hammond, David – also see Hammond & Abbott; Hammond, Adler & Abbott; Hammond Morse & Abbott; Hammond & Reeves (Wrought Iron Bridge Co., Cleveland, OH)

56,043	Jul. 3, 1866	Bowstring truss. Radiating verticals and cross-bracing in all panels.
184,521	Nov. 21, 1876	Wrought-iron post for truss bridge.
184,522	Nov. 21, 1876	*A pair of T-shaped flanges connected by a web of lattice bars arranged in a pattern of repetitive triangles.

Hammond, David & Job Abbott (Wrought Iron Bridge Co., Cleveland, OH)

102,392	Apr. 26, 1870	Bowstring truss. Tubular-arch top chord. Web diagonals and radiating verticals attach to flanges of top-chord sections. Connection points of web diagonals and chord are inset from radiating verticals. A variety of top-chord sections are proposed.
102,393	Apr. 26, 1870	Bowstring truss. Tubular-arch top chord. Web diagonals and radiating verticals penetrate the top chord. Connection points of web diagonals are inset from radiating verticals. A variety of top-chord sections are proposed.
102,394	Apr. 26, 1870	Sub-divided Pratt truss configuration. Additional verticals extend from intersection of crossed diagonals to bottom chord.
150,151	Apr. 28, 1874	Pratt truss configuration. Pony truss with outrigger. All panels have diagonal cross-bracing. Channel top-chord, star-iron verticals.
150,152	Apr. 28, 1874	Pratt truss configuration. Pony truss with outriggers. All panels have diagonal cross-bracing. Top chord composed of channel and tee. I-beam verticals.
150,153	Apr. 28, 1874	Pratt truss configuration. Top chord composed of channels and a plate. I-beam verticals.
153,483	Jul. 28, 1874	*Abutment support.

Hammond, David, Michael Adler & Job Abbott (Wrought Iron Bridge Co., Cleveland, Oh.)

135,802,	Feb. 11, 1873	Bowstring truss. Several hollow chord proposals for long-spans. All panels have diagonal cross-bracing between verticals.

Hammond, David, Henry Morse & Job Abbott (Wrought Iron Bridge Co., Cleveland, Oh.)

184,520	Nov. 21, 1876	Pratt truss configuration. Two panel counters and single panel diagonals.

Hammond, David & William Reeves (Wrought Iron Bridge Co., Cleveland, Oh.)

43,202	Jun. 21, 1864	*Tied arch. Vertical and radiating web members originate from adjacent points along bottom tie. Labeled "truss bridge."
86,538	Feb. 2, 1869	Bowstring truss. All panels have cross-braces intersecting at a ring. Sub-vertical strut from the ring to the top chord.

Harbach, Frederick
4,694 Aug. 12, 1846 Metal Howe truss configuration. Crossed diagonals in all panels, multi-tubular chords, knee braces at abutment.

Hardesty, James
485,689 Nov. 8, 1892 Queen-post configuration supported on metal posts. Timber top chord. Metal verticals, crossed diagonals, and bottom chord.

.
Harding, George
132,398 Oct. 22, 1872 *Lenticular truss in appearance. Created by opposing arch and catenary chords that are connected by vertical tension rods. Deck is hung below catenary chord on vertical rods. There are no web diagonals, therefore not a true truss.

Harman, William
383,880 Jun. 5, 1888 *Folding bascule drawbridge. Labeled "bridge."

Hassard, Thomas
4,359 Jan. 15, 1846 All-timber Howe truss configuration with clusters of struts radiating from ends of bottom chord. Vertical timbers bolted to chords. Diagonals butt into iron shoes.

Hastings, Samuel
132,284 Oct. 15, 1872 Truss configuration with a curved top chord and a flatter curved "compensating arch" fastened to the top chord. Web of crossed diagonals between verticals. Unwieldy contraption.

Haupt, Herman
1,445 Dec. 27, 1839 Triple-intersecting Howe truss configuration. Additional half-span diagonal struts.

Hawes, George
499,631 Jun. 13, 1893 *Metal abutment support. Labeled "truss for bridges."

Haynes, Warren
360,347 Mar. 29, 1887 Lattice truss. Finely meshed. Interlaced with horizontal and diagonal wires. Less than 3:1 span-to-depth ratio. Labeled "truss suspension bridge."

Heath, George
35,374 May 27, 1862 Iron Howe truss. Slightly curved top chord. Sloped end posts. Forked diagonal struts and no counters in each panel. Threaded tension rod for bottom chord.

Hedrick, Ira – see Waddell & Hedrick

Hemberle, Edward
152,489 Jun. 30, 1874 Warren truss. Top chord has curved ends.

Heming, George – see Yerk & Heming

Hendrick, Peter

71,483	Nov. 26, 1867	*Suspension bridge. Labeled "bridge."

Henszey, Joseph

91,745	Jun. 22, 1869	*Tied arch. Top-chord section composed of two quarter-round Phoenix sections and plate. Web of vertical bars. No diagonals.

Herrmann, Ludwig – see Rust & Herrmann

Herthel, George Jr.

59,769	Nov. 20, 1866	Bowstring truss. Segmental parabolic chord. Crossed diagonals rods and vertical struts in web.
71,484	Nov. 26, 1867	Bowstring truss. Crossed diagonal rods. Vertical posts. Ties threaded through vertical posts to control undulations. Tubular arch chord.
86,227	Jan. 26, 1869	Cross-braced truss panels with additional half-height verticals from the intersection of the diagonals to the top chord. Pipe sections used for chords and web.
90,263	May 18, 1869	Bowstring truss. Double-intersecting diagonals and tapered posts.
98,866	Jan. 18, 1870	Double-intersection Pratt truss configuration. Diagonals pass through posts. Posts pass between parts of upper chord.

Hervey, Horace – also see Hervey & Osborn

14,314	Feb. 26, 1856	Combination of a curved chord truss and a suspension cable. Lenticular appearance. Cable drapes below bottom chord. Labeled "suspension arched truss."

Hervey, Horace & Robert Osborn

13,461	Aug. 21, 1855	Combination of a curved chord truss and a suspension cable. Lenticular appearance.

Holman, William

290,054	Dec. 11, 1883	Timber truss. Chords composed of tiers of two or more parallel, small, square-section timbers rotated 45 degrees to normal. Square, paired vertical timber members rotated 45 degrees to plane of truss. Labeled "bridge."

Holt, Samuel

215,223	May 13, 1879	Timber truss. Sloped top chord. Paired chords. Radial verticals. Paired, one-third-span, diagonal struts extending from abutment to top chord.

Hoover, Reuben

215,522	May 20, 1879	Bowstring truss. Timber arched chord. Bollman truss-like pattern of rods in web.

Hopler, Frank

518,648	Apr. 24, 1894	*Culvert with a triangular cross section. Labeled "bridge."

Horton, Charles (Horton & Co., Duluth, Minn.)

595,629	Dec. 14, 1897	Bowstring truss. Crossed diagonal rods and rods in a pattern of inverted Vs in all web panels. Radiating struts. Clips used for connections in lieu of pins, bolts, or rivets.

Horton, Charles (cont'd)

621,672	Mar. 21, 1899	Details of clamps, lugs, and bent flanges used to join members of a sub-divided Pratt truss.

Houts, Benjamin

222,499	Dec. 9, 1879	Bollman-truss configuration of cables superimposed on timber Vierendeel truss. Trussed bottom chord.

Howe, William

1,685	Jul. 10, 1840	Timber truss configuration. Web pattern of verticals and Vs. Additional (third) chord above bottom chord. Superimposed arch.
1,711	Aug. 3, 1840	Timber truss. Double-intersecting diagonals. Vertical rods.
4,726	Aug. 28, 1846	Timber arch-braced truss. Timber chords and crossed diagonals in web. Vertical rods.

Hunt, Platt

549,643	Nov. 12, 1895	*Girder. Timber members hollowed to receive inserted metal tube. Labeled "bridge."

Hunter, Henry & Jesse Rice

141,056	Jul. 22, 1873	Timber truss. Third horizontal chord at mid-height. Two pairs of eccentrically crossed diagonals between verticals.

Huygens, George

14,584	Apr. 1, 1856	Compensating combination of trussed-arch and superimposed inverted trussed-arch.

W. IRELAN.

BRIDGE.

No. 190,437. Patented May 8, 1877.

Fig. 1

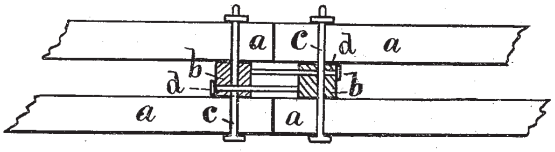
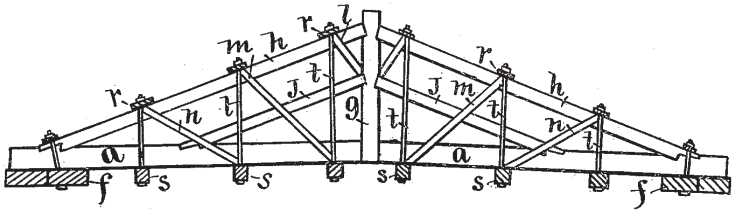


Fig. 2



Attest,
C. A. Johnson.
Le B. Lathe.

Inventor,
William Irelan
By Thomas G. Orwig,
Attorney.

I

Ibel, Justus

250,921	Dec. 13, 1881	*Timber tied-arch set within a tied-arch. No diagonals. Inserted tied-arch attached to verticals.

Irelan, William

190,437	May 8, 1877	Howe truss configuration (compression diagonals). Sloped top chord. Mid-height struts parallel to sloping top chord.
205,799	Jul. 9, 1878	Howe truss configuration. Redundant timber and metal-rod, crossed diagonals. Wood vertical from diagonal intersection to top chord.
220,382	Oct. 7, 1879	Pratt truss configuration. Redundant compression and tension cross-bracing in panels. Improvement on Jul. 9, 1878 patent.
254,978	Mar. 14, 1882	Pratt truss configuration. Sloped end posts. Timber top chord. Single web diagonals. Stress-equalizing devices in top and bottom chords.
307,770	Nov. 11, 1884	Eccentric “self adjusting” pin connection for trusses.

P. JARVIS
Bridge.

No. 212,941 Patented Mar. 4, 1879.

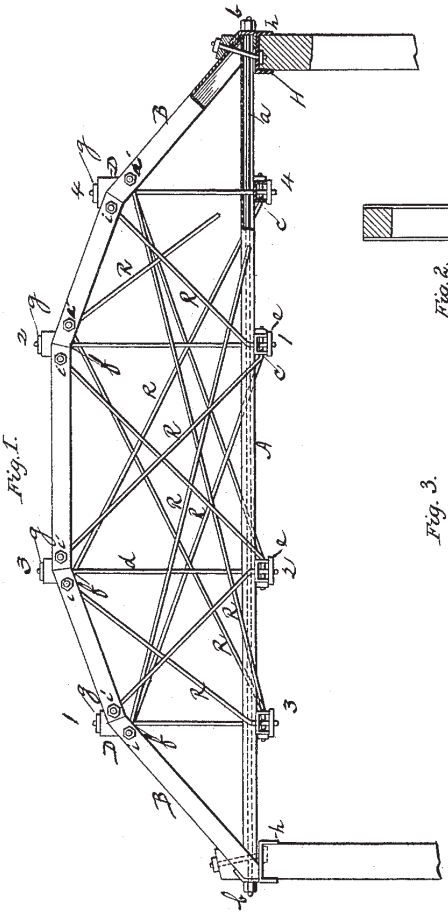


Fig. 1.

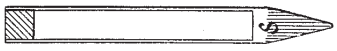


Fig. 2.

Fig. 3.

Witnesses:
Clarence Poole
R. K. Evans

Inventor:
Philip Jarvis
by A. H. Evans & Co
Attys

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

J

Jacobs, Enoch
26,680 Jan. 3, 1860 Pratt truss configuration. Timber chords. Web of continuous intersecting metal-strap cross braces between timber verticals.

Jarvis, Philip
212,941 Mar. 4, 1879 Bowstring truss. Timber segmental top chord. Web of intersecting and vertical rods in a Bollman truss-like configuration.

Jayne, John
215,364 May 13, 1879 Bowstring truss. Timber-arch top chord. Crossed diagonal metal rods in panels. Rods threaded through wood verticals.

Johnson, James
343,322 Jun. 8, 1886 *Drawbridge.

Johnson, John
129,479 Jul. 16, 1872 *Post-tensioned segmented arch. Labeled "improvement in bridges."

Johnson, Joseph – see Yandell & Johnson

Johnson, Phelps
144,766 Nov. 18, 1873 Bowstring truss. Twin tubular-arch top chord. Cross-braced panels.

Johnson, William
109,628 Nov. 29, 1870 Eccentric washer for adjusting the tension of truss diagonals. Labeled "truss bridge."

Jones, John
318,626 May 26, 1885 Timber truss. Multi-layered web of inclined verticals, plus cross-braced and multi-panel diagonals.

Jones, Jonathan
30,577 Nov. 6, 1860 Howe truss. Iron members with crossed pipe diagonals bolted at intersection. Sloped end posts.
39,447 Aug. 4, 1863 Howe truss. Iron members with crossed, tapered pipe diagonals bolted at intersection. Sloped end posts. Adjustable camber.

Jones truss
not patented ca. 1860s Configurations with tension verticals and compression diagonals, and thus would be called Howe trusses today, were referred to as "Jones trusses" for a period of time.

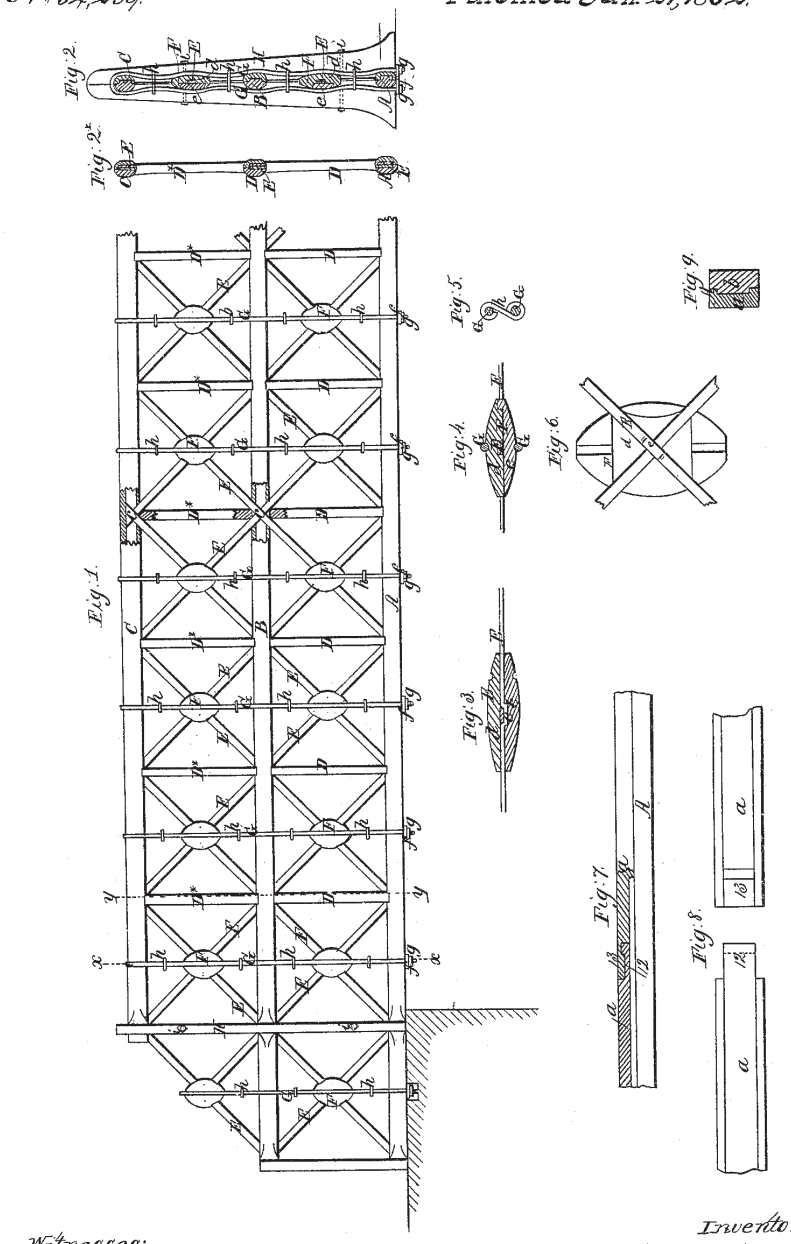
Josel, Francis
150,327 Apr. 28, 1874 *Lattice timber arch. Labeled "bridges."

Junkins, John (Junkins & Son, Upper Sandusky, Oh.)
32,480 Jun. 4, 1861 Bowstring truss. Timber upper chord. Lower chord of rod and paired timbers. Web configuration of radiating rod verticals and crossed timber diagonals.

S. D. Kendall.

Truss Bridge.

No. 34,209. Patented Jan. 21, 1862.



Witnesses;
James Laird
Robertson Gourley

Inventor;
Saml. D. Kendall.

K

Kandeler, G.F. Theodore

343,377	Jun. 8, 1886	*Swing-span drawbridge. German origin. Labeled "bridge."
346,591	Aug. 3, 1886	Connection permits continuous top plate for bottom chord. German origin. Labeled "construction of bridges."
348,020	Aug. 24, 1886	*Swing-span drawbridge. German origin. Labeled "bridge."
348,467	Aug. 31, 1886	*Swing-span drawbridge. German origin. Labeled "bridge."
356,283	Jan. 18, 1887	*Swing-span drawbridge. German origin. Labeled "bridge."

Kauser, Joseph

50,827	Nov. 7, 1865	*Three-hinged trussed arch. Labeled "truss bridge."

Keating, Edward

530,425	Dec. 4, 1894	*Trussed hollow box girder. Girder composed of interlocking segments. Trussing rods below, with numerous vertical braces. Labeled "girder for truss bridges."

Kellogg, Charles

87,174	Feb. 23, 1869	Truss connection detail. Diagonals to cast-iron chord. Labeled "truss bridge."
104,036	Jun. 7, 1870	Pratt-truss configuration with additional diagonal ties to mid point between verticals. Patent is for a joint detail and number of pieces at the joint. Overall configuration has become commonly known as a "Kellogg truss."
162,077	Apr. 13, 1875	Detail of pin and pin-cap. Labeled "construction of iron truss bridges."
196,299	Oct. 23, 1877	*Machine for making eyes in eye-bars.

Kelly, John

88,181	Mar. 23, 1869	Bowstring truss configuration. Wire rope bottom chord. Radial verticals with diagonal cross-bracing.

Kendall, Samuel

34,209	Jan. 21, 1862	Metal lattice truss. Center-height third cord. Alternating compressive and tension verticals. Double-intersecting diagonals. Excessive.

Kessler, Jacob – see Sullivan, Kessler & Foster

Kersten, Max

308,501	Nov. 25, 1884	*Sequence of inverted king-posts under segmented beam. Undulating appearance.

King, George (King Iron Bridge & Mfg. Co., Cleveland, Oh.)

196,154	Oct.16, 1877	*Method for securing verticals to tubular arches. Labeled "tubular bridge."

King, Zenas – also see Frees & King (King Iron Bridge & Mfg. Co., Cleveland, Oh.)

45,051	Nov. 15, 1864	*Pivoting drawbridge.
58,266	Sep. 25, 1866	Bowstring truss. Hollow arched chord is wider and deeper at ends. Diagonals connected to chord with hooks and eyes.

Kirkups, Lancelot

120,282	Oct.24, 1871	Bowstring truss. Vertical posts and crossed diagonals meet at alternate points along chords.

Kittinger, Levi

119,466	Oct. 3, 1871	*Tied arch. Vertical rods in web branch downward forming inverted Vs. No diagonals.

Knudson, Hans

356,407	Jan. 18, 1887	Series of overlapping king-post trusses without top chord. Also included is a balancing device for weighing traffic. A novelty.

Koch, Henry

627,509	Jun. 27, 1899	*Trussed beam with cable ties above. Labeled "bridge."

Koshure, Thomas

478,438	Jul. 5, 1892	Continuous cable-stayed systems to support the bottom chord of a truss bridge. Warren trusses shown. Labeled "bridge."

Kremser, Marten

52,860	Feb. 27, 1866	Timber lenticular truss. Lattice web. Mid-height deck also supported by struts from lower chord.

Krusi, Hermann

338,755	Mar. 30, 1886	Truss connection detail. Metal socket. Labeled "bridge."

(No Model.)

3 Sheets—Sheet 1.

D. F. LANE.

TRUSS BRIDGE.

No. 531,048. Patented Dec. 18, 1894.

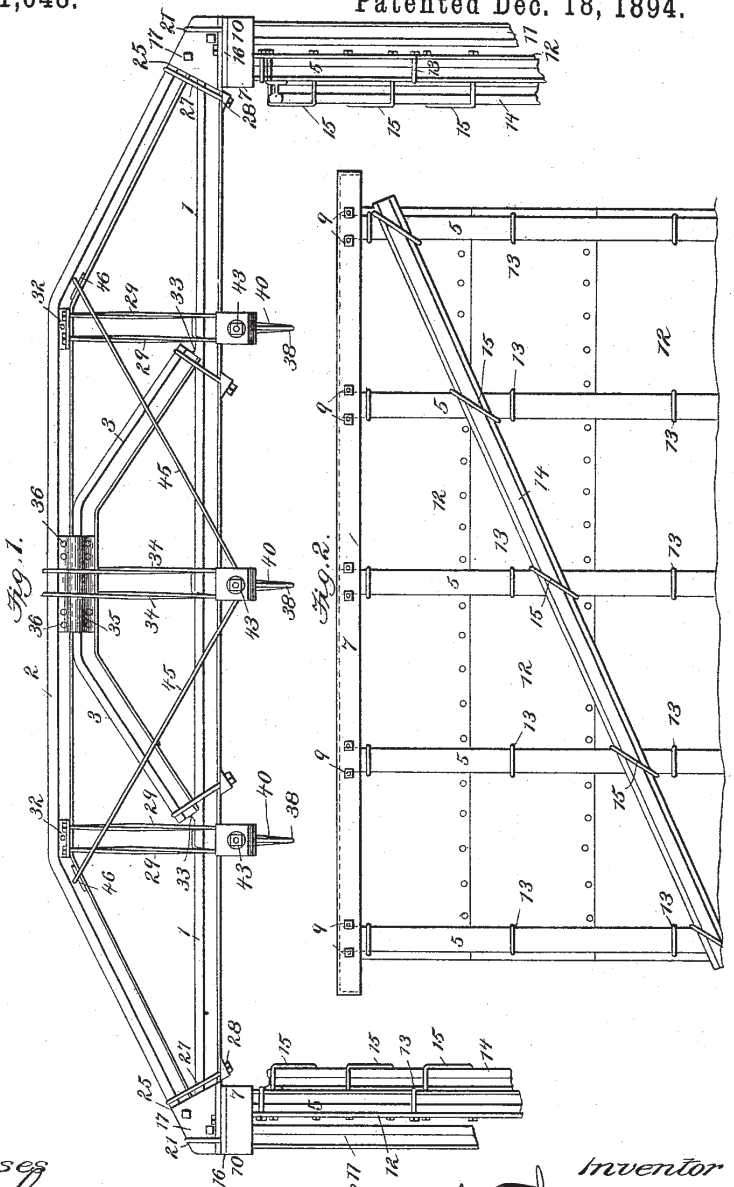


Fig. 1.

Fig. 2.

Witnesses
Geo. A. Johnson
Howell Battle

Inventor
Daniel F. Lane
By Johnson & Johnson
his Attorneys

L

Laird, John (John Laird & Co., Canton, Oh.)

94,321	Aug. 31, 1869	Bowstring truss. Trussed-arch top chord. Radial struts and diagonal cross-bracing to different panel points.
94,322	Aug. 31, 1869	Bowstring truss. Radial struts and diagonal cross-bracing to different panel points.

Laird, William

146,916	Jan. 27, 1874	Bowstring truss. Tubular-arch top chord. Crossed diagonals in all panels. Radial struts and diagonal cross-bracing to different panel points.

Lamont, Robert

544,733	Aug. 20, 1895	*Bascule drawbridge. Labeled "bridge."

Lane, Daniel F. (Lane Bridge Works, Painted Post, N.Y.)

424,318	Mar. 25, 1890	Howe truss configuration. Bent railroad-rail chords. Metal rod web members. Four-panel truss.
531,048	Dec. 18, 1890	Howe truss configuration. Bent railroad-rail chords. Rod counter-ties.

Lanergan, Henry

7,305	Apr. 23, 1850	*Three overlapping bowstring arches. Radiating web members only. Unique. Labeled "truss bridge."

Lape, George

60,199	Dec. 4, 1866	*Tied segmental metal arch. Labeled "truss bridge."
7,741	May 12, 1869	*Segmental arch. Labeled "truss bridge."

Latrobe, Charles H. – see Bender, Latrobe & Smith; Smith, Latrobe & Smith

Lawrence, Robert De T.

238,130	Feb. 22, 1881	Truss web composed of Warren-like end panels and double-Warren center panels with verticals. Continuous wires alongside of web diagonals. Trussed bottom chord.

Lee, Benjamin

8,781	Mar. 2, 1852	*Arrangement of canal, tunnel, and bridge to accommodate land and water traffic simultaneously. Labeled "truss bridge."

Leopold, O.G.

60,205	Dec. 4, 1866	*Plate girder. Labeled "truss bridge."

Levake, Winfield

104,969	Jul. 5, 1870	*Tubular tied arch. Labeled "truss bridge."

Lindenthal, George

277,039	May 8, 1883	*Trussed suspension bridge. Pair of tilted trusses form a triangular cross-sectioned bridge that carries a suspended trolley hung from their intersection above. Labeled "bridge."

Linville, Jacob – also see Linville & Piper (Keystone Bridge Co., Pittsburgh, Pa.)

34,183	Jan. 11, 1862	Detail for the use of drilled eye-bars for lower chord. Double-intersection Pratt truss configuration shown. Labeled "iron truss bridge."
84,288	Nov. 24, 1868	Connection detail of crossed web members at intersection to reduce length. Double-intersection Warren truss configuration shown. Labeled "truss bridge."
145,114	Dec. 2, 1873	Detail. Flat ends for rods. Labeled "truss-frames for bridges."

Linville, Jacob & John Piper (Keystone Bridge Co., Pittsburgh, Pa.)

50,723	Oct. 31, 1865	Improvement in eye-bar fabrication. Double-intersection Pratt truss configuration shown.

Linville truss

Not patented	ca.1861	Common name for Whipple's trapezoidal truss that utilized wide, forged eye-bars and wrought-iron posts. Popularized by Jacob Linville (see above).

Liscom, Levi

76,212	Mar. 31, 1868	*Corbelled timber beams extending to mid-span support, and are in turn stiffened by a truss carried above them. A bowstring truss is used as an example. Labeled "truss bridge."

Litell, William

265,331	Oct. 3, 1882	Timber lattice truss. Three intermediate chords.

Locke, James

627,859	Jun. 27, 1899	*Cable-trussed, built-up, timber girder configuration. Additional double intersecting struts in end panels.

Lockwood, Rembrandt

51,328	Dec. 5, 1865	*Segmental arch. Labeled "truss bridge."

Long, George Washington

Not assigned	Mar. 10, 1830	All-timber "Howe" truss. Polygonal top chord. Single compression diagonal in all panels. Patent, although listed in the Patent Office Index, is missing. However, it was published in several journals including Sillman's *American Journal of Science and Arts*, Vol. 18 (1830), pp. 123-5. By today's standards, its configuration would be known as a Howe although it preceded Howe's patent (which contained iron verticals) by a decade.

Long, Richard

146,397	Jan. 13, 1874	*Tied arch. V-shaped stirrups suspended from arch to carry floor beams.

Long, Stephen

5862X	Mar. 6, 1830	Timber truss. Cross-braced rectangular panels. Knee braces under bottom chord at abutments.
9340X	Jan. 23, 1836	Timber truss. Cross-braced rectangular panels. Double top chord. Vertical iron tie anchors into abutments.
1,397	Nov. 7, 1839	Change to 1830 patent. Knee brace extends to top chord.

Long, Stephen (cont'd)

1,398	Nov. 7, 1839	Change to 1830 patent. Double end posts. Diagonal struts from abutment to mid span.
5,366	Nov. 13, 1847	Change to 1830 patent. Double end posts. Inclined verticals in end third of span.
21,203	Aug. 17, 1858	Change to 1830 patent. Double end posts. Inclined verticals in end third of span. Superimposed inverted arch.

Loomis, Hiram

482,017	Sep. 6, 1892	Truss with a web composed of intersecting circles plus a suspension cable from towers to mid-span. Fanciful.

Lounsberry, John

453,342	Jun. 2, 1891	*Rollers under floor beams to control expansion and contraction. Labeled "iron bridge."

Lowthorp, Francis C.

17,684	Jun. 30, 1857	Straining plate for connecting verticals and diagonals to lower chord. Labeled "truss bridge."
18,548	Nov. 3, 1857	Method of connecting vertical posts with rounded ends so they can "vibrate." Whipple configuration shown. Labeled "truss bridge."
27,457	Mar. 13, 1860	Connection to receive enlarged ends of iron chord rods. Labeled "truss bridge."
62,278	Feb. 19, 1867	Iron casting for securing cross-bracing rods at mid point of verticals. Labeled "truss bridge."

del.)

T. K. MARKS.

TRUSS BRIDGE.

No. 346,118. Patented July 27, 1886.

Fig. 1.

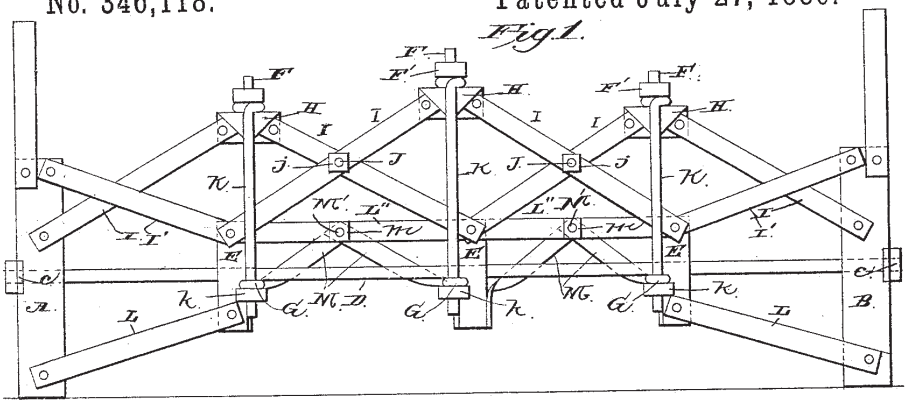


Fig. 2.

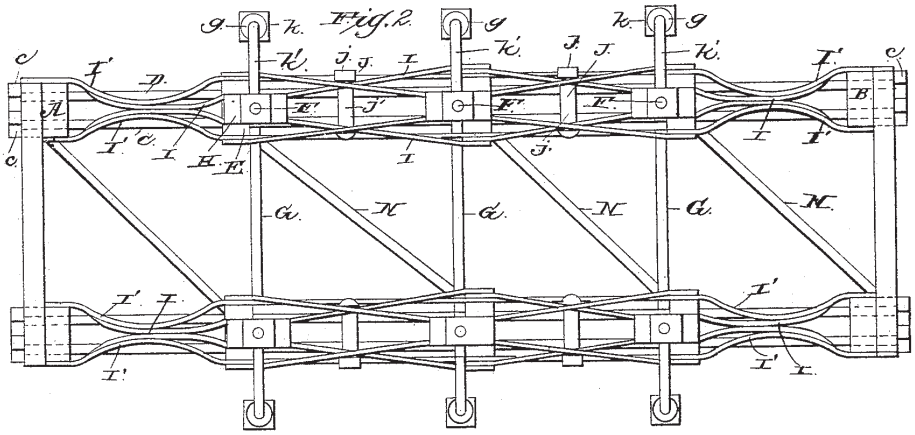
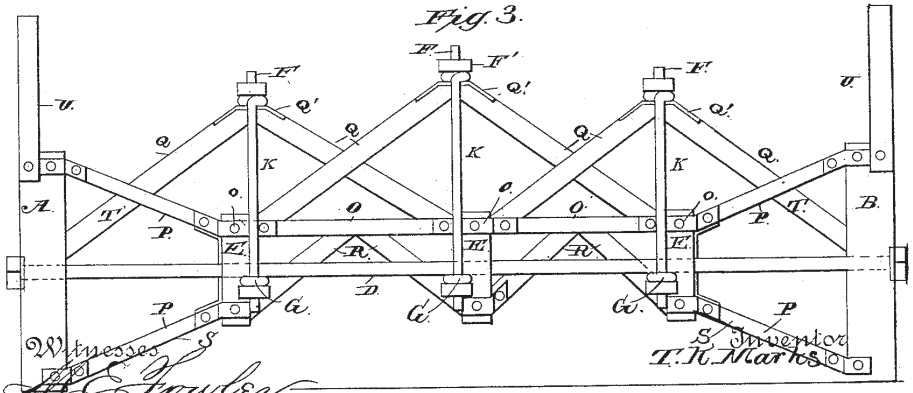


Fig. 3.



Witnesses:
A. C. Fowler
H. F. Barnhart

Inventor
T. K. Marks
By his Attorneys
A. C. Fowler

N. PETERS, Photo-Lithographer, Washington, D. C.

M

Maish, Joseph

264,724	Sep. 19, 1882	Bowstring truss. Twin-tube arched chord. Crossed, diagonal, metal rods. Pair of rods used for bottom chord and verticals.

Manley, Gervais

64,340	Apr. 30, 1867	Double-intersecting Warren truss (iron lattice). Light-weight mid-height third chord.

Marks, Thomas

346,118	Jul. 27, 1886	Verticals and cross-braced panels. No top chord. Knee braces at abutments. Convoluted combination of adjustable parts.

Matlock, David

272,568	Feb. 20, 1883	Angle-block detail for coupling lower joints. Sloping end posts have strut and tie. Labeled "truss bridge."

McCallum, Daniel C.

8,224	Jul. 15, 1851	Timber three-chord truss. Flat-curved top chord just below a horizontal top chord. Crossed diagonals in web panels extend from bottom chord to curved chord. Slightly radiating verticals extend to horizontal top chord. Iron tension diagonals in third and fourth full panels. Radiating struts from abutment to underside of curved chord.
16,446	Jan. 20, 1857	Timber except for diagonal tension rod in fourth panel from abutments. Curved top chord. Radiating struts in end panels.

McCurdy, David (McCurdy & McDurmut, Lima, Oh.)

104,867	Jun. 28, 1870	*Tied arch. Labeled "truss bridge."
104,868	Jun. 28, 1870	King-post truss. Curved top chord. Single vertical at mid-span. Labeled "truss bridge."
104,869	Jun. 28, 1870	*Detail for a tied pair of struts. Labeled "truss bridge"

McDonald, Joseph

173,863	Feb. 22, 1876	Timber Vierendeel truss configuration. Additional mid-height chord combined with an A-Frame. Bottom chord is a rod.

McDowell, H. S.

98,699	Jan. 11, 1870	Timber Howe truss configuration with polygonal end panels. Vertical rods. Paired, crossed diagonals are splayed.

McGiffin, Nathaniel

443,714	Dec. 30, 1890	Timber king-post truss with vertical metal rod and outriggers.

McGuffie, Archabald

33,954	Dec. 17, 1861	Bowstring truss. Tubular arch chord. Verticals extend above arch chord to a laterally braced horizontal member.
34,311	Feb. 4, 1862	Inverted bowstring truss. Hangers support roadbed below. Labeled "suspension bridge."
34,765	Mar. 24, 1862	Bowstring truss. Tubular arch chord. Verticals extend above arch to a laterally braced horizontal member.
35,381	May 27, 1862	Timber bowstring truss. Radiating timber verticals extend above arch to a laterally braced horizontal member. Crossed diagonals are rods.

McKay, John

90,767	Jun. 1, 1869	Double-intersecting Warren truss. All chords and web members are timber.
111,622	Feb. 7, 1871	Connection piece detail for an all-timber double-intersecting Warren truss. Labeled "truss bridge."

McKibbin, William

19,573	Mar. 9, 1858	Connection detail for iron bars in a Long truss configuration. Labeled "truss bridge."

McPherson, John

252,486	Jan. 17, 1882	Timber king-post truss. Vertical metal rod. Wire-rope horizontal chord.

Meigs, Montgomery & Samuel Reeves

24,323	Jun. 7, 1859	*Tied bowstring arch. Web diagonals radiate from common point, mid-span, slightly above bottom chord.

Mertens, Henry

424,427	Mar. 25, 1890	Metal fishplate connections to control posts bending due to deflection of floor beams.

Merrill, Rufus

78,000	May 19, 1868	Corbelled iron channels reaching to mid-span support and are stabilized by a truss. Bowstring truss configuration is used as an example. Labeled "truss bridge." (Iron version of Liscom's patent no. 76,212)

Miller, George

467,013	Jan. 12, 1892	*Girder supported at mid-span by cable stays. Labeled "bridge."

Miller, Mahlon

103,911	Jun. 7, 1870	*Tied arch. Multi-plate arch chord. Web of radiating pipes without diagonals. Labeled "truss bridge."

Miller, William

185,185	Dec. 12, 1876	Howe truss configuration. Web of contiguous octagons each containing a single compression diagonal.

Mills, Theodore & Byron Smith

132,975	Nov. 12, 1872	Clamping system to create hollow girders and truss chords from a group of individual pieces.

Miner, John

156,936	Nov. 17, 1874	*Top chord is horizontal over center pair of panels and slopes down in pair of end panels. Vertical rods support bottom chord. No diagonals. Functions as a flat tied-arch. Labeled "truss bridge."

Mitchell, Hirtie

562,191	Jun. 16, 1896	Detail for lateral, under the deck, bracing system for bowstring truss.

Mitchell, Joseph

368,483	Aug. 16, 1887	Combination truss. A-Frame in center of truss, with a Pratt-truss panel on each side. Timber compression members. Metal rod tension members in web. Wire cable bottom chord.
440,490	Nov. 11, 1890	*Tied arch. Web contains only verticals.

Monroe, Freedom

54,004	Apr. 17, 1866	*Roofing system to protect timber bridge. Labeled "truss bridge."

Montgomery, Richard – also see Montgomery & Montgomery

25,210	Aug. 23, 1859	*Short-span tied arch. Three verticals in the web. Labeled "truss bridge."
76,795	Apr. 14, 1868	Truss with curved top chord. Crossed diagonals plus third eccentrically located diagonal in each panel. Truss is not symmetrical. Patent mainly concerned with use of corrugated members.

Montgomery, Richard & Mary Montgomery

81,666	Sep. 1, 1868	Methods for connecting corrugated-metal truss members. Example truss configuration has crossed diagonals between verticals and a vertical at their intersection. All truss members are corrugated metal. Mary Montgomery is the only 19th-century female bridge-patent holder.

Morgan, George

118,258	Aug. 22, 1871	Pratt truss configuration. Wire-rope used for bottom chord and the crossed diagonals in all panels.

Morrison, David (Columbia Bridge Co., Dayton, Oh.)

20,082	Apr. 27, 1858	Connection block for timber truss diagonals. Labeled "truss bridge."
70,245	Oct. 29, 1867	Bowstring truss. Strong-axis of arched I-beam top chord set horizontally. Cross-braced panels.

Morse, Henry – see Hammond, Morse & Abbott

Morse, Charles & Frank Sylvester

577,443	Feb. 23, 1897	Double-intersection Warren truss. Diagonals cross slightly below top chord. Configuration is illustration provided in a drawbridge patent.

Moseley, Thomas (Moseley & Co., Cincinnati, Oh.; Moseley Iron Building Works, Boston, Mass.; Moseley Iron Bridge & Roof Co., New York, N.Y.)

16,572	Feb. 3, 1857	*Tied arch. Web of closely spaced rod hangers, perpendicular to the arch. Labeled "truss bridge."
59,054	Apr. 2, 1866	*Three parallel circular segment plates. Rectangular tie-plate secured along bottom of middle plate. Labeled "truss bridge."
103,765	May 31, 1870	Bowstring truss configuration. Top chord is a diamond-shaped section tubular arch with an inserted plate. Web diagonals "when necessary" would make it a truss.
106,855	Aug. 30, 1870	Combined forms. Top chord is an arch superimposed on the top chord of a king-post truss. Diagonal ties from the bottom of the king-post vertical. Vertical ties support the road bed. Optional cross ties would cause it to function as a true truss. Labeled "truss bridge."

Moyer, Abraham

625,051	May 16, 1899	*Mud sill. Labeled “bridge.”

Mullin, Thomas

192,450	Jun. 26, 1877	Timber queen-post truss with vertical metal rods. Truss protected with vertical siding.

Munzinger, Peter

184,888	Nov. 28, 1876	Connecting pins for iron-bar members of bridges.

Murphy, John

28,240	May 8, 1860	Detail for inserting packing between truss members. Labeled “truss bridge.”
32,199	Apr. 30, 1861	Pin-connection detail for slotted eye-bars. Labeled “truss bridge.”

Murphy-Whipple truss

Not patented	ca.1863	Common name for Murphy's improved version of Whipple's trapezoidal truss. A pin-connected version that utilized wrought iron for both tension and compression members. John Murphy was chief engineer of the Lehigh Valley Railroad.

R. B. OSBORNE.
Truss-Bridge.

No. 197,286. Patented Nov. 20, 1877.

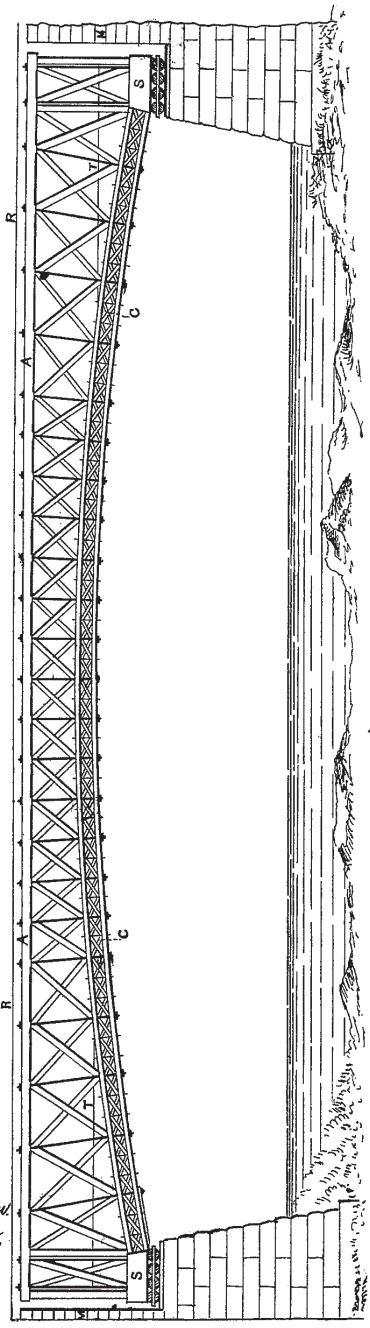


FIG. I.

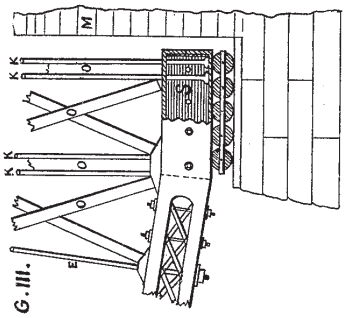


FIG. III.

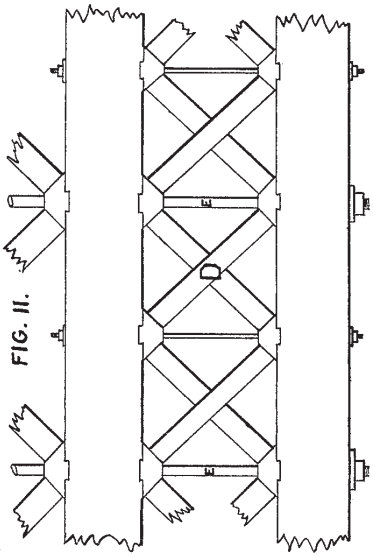


FIG. II.

WITNESSES:
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F. E. Hewlett

INVENTOR:
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by Gilbert W. J. Howard,
Attorneys.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

N-O

Newburg, John

565,020	Aug. 4, 1896	Truss web consists of overlapping semicircular arches and mid-height horizontal chord. This truss is hung from the third points of a trussed arch which is the principal part of the patent.

Nowlan, Samuel

136,935	Mar. 18, 1873	*Shallow arch of interlocking metal voussoirs. Labeled “construction of bridges.”

Ogden, John

326,322	Sep. 15, 1885	*Cable railway swing-span drawbridge system. Swing-span is a truss. Cable passes through an underwater tube.

Osborn, Robert – see Hervey & Osborn

Osborne, Richard

197,286	Nov. 20, 1877	Howe truss configuration. Horizontal top chord. Latticed bottom chord is slightly arched.

Oudry, Alphonse

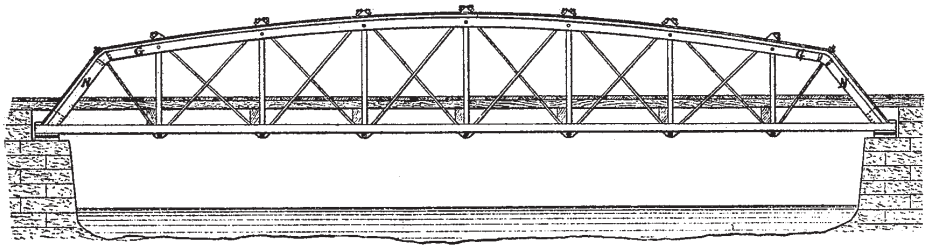
35,251	May 13, 1862	*Suspension bridge with lattice stiffening truss. French origin.

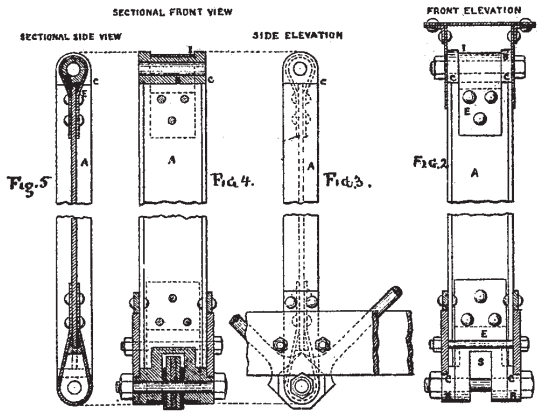
C. H. Parker,

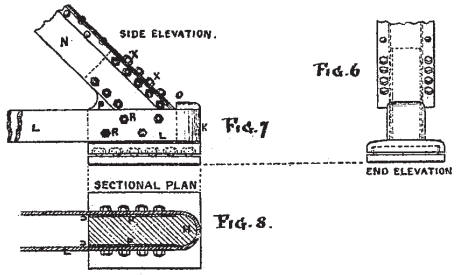
Truss Bridge.

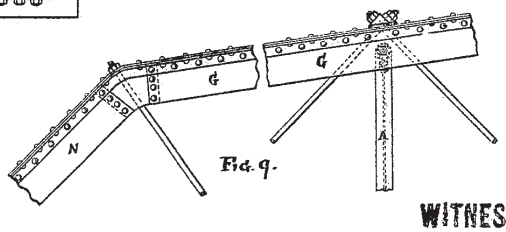
No. 100,185. Patented Feb. 22, 1870

Fig. 1.









Witnesses: C. Bailey, Wm. H. McCabe

Charles H. Parker by his attorney A. Hollock

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

P

Paisley, John

400,704	Apr. 2, 1889	Metal Howe truss. Two-panel configuration. Tubular horizontal and diagonal members. Verticals are metal rods.

Palmer, Charles

176,991	May 2, 1876	*Tied arch. Timber upper chord. Cable bottom chord and cables inside two-part timber posts. No diagonals in panels. Similar in appearance to a queen-post truss.

Palmer, Timothy

Not assigned	Dec. 17, 1797	Timber, three-span continuous truss. Radiating verticals extend from three-arched bottom chords between piers to slightly arched top chord. Compression diagonals in each panel.

Palmer, Winfield

501,534	Jul. 18, 1893	*Parallel girders. Labeled "bridge."

Parker, Charles (National Bridge & Iron Works, Boston, Mass.)

93,638	Aug. 10, 1869	Combination of a bowstring truss for moving loads, and a cantilevered suspension truss for dead loads.
98,620	Jan. 4, 1870	*Suspension bridge.
100,185	Feb. 22, 1870	Pratt truss configuration. Slightly curved top chord. Slope of inclined ends can vary to adjust bridge length.
103,233	May 17, 1870	*Suspension drawbridge.

Parker, William

394,877	Dec. 18, 1888	*Deck supported by diagonal metal rods from top of a row of piles. Labeled "truss bridge."

Partridge, Reuben

127,791	Jun. 11, 1872	Timber double-intersection Warren truss configuration. Web ties set at 60 degrees, struts at 45 degrees.

Patterson, John & Andrew Sprague

146,400	Jan. 13, 1874	Howe truss configuration. Inclined end posts. Crossed diagonals in all panels. Improvement in connections.

Peale, Charles

Not assigned	ca. 1796	*Trussed timber arch. Patent drawing published in his "An Essay on Wooden Bridges" (1796).

Pegram, George

314,261	Mar. 24, 1885	Pratt truss configuration. Polygonal upper chord. Top-chord segments are of equal lengths, resulting in verticals that have an increasing tilt from truss center-span to the abutment ends.
314,262	Mar. 24, 1885	Additional variations on his patent no. 314,261
409,700	Apr. 27, 1889	*Swing drawbridge. Labeled "bridge."
424,349	Mar. 25, 1890	Continuous-cantilever double-intersection Pratt truss configurations. Alternating through and deck spans.

Pennington, Cunningham
7,890 Jan. 7, 1851 Timber continuous truss. Parallel chords. Two-span undulating arches superimposed. Individual spans have additional arches and reversed arches. Web contains overlapping opposite sloping diagonals. Convoluted overkill.

Pennsylvania Truss
Not patented ca. 1875 Long-span sub-divided Pratt truss configuration with polygonal upper chord. Named for railroad company that popularized this form. Configuration occasionally referred to as a Pettit truss.

Perry, Oliver & William Allen
120,319 Oct. 24, 1871 *Tied arch. Pairs of vertical web members radiate from a series of common points along bottom chord. No diagonals.

Petersen, Richard
671,923 Apr. 9, 1901 *Bracing under bridge deck for unbalanced loads. German origin.

Pettit, Henry
136,177 Feb. 25, 1873 Deck-beam to truss chord connection detail. Labeled "bridges."

Pettit Truss
Not patented ca. 1871 Long-span **s**ubdivided Pratt truss. An alternate name used for both the Pennsylvania and Baltimore trusses. Often misspelled as "Petit." Henry Pettit was an engineer in the employ of the Pennsylvania Railroad at the time the truss configuration was developed.

Pfeifer, Charles
121,894 Dec. 12, 1871 *Tied arch. Latticed upper chord. Draped and horizontal ties. Web verticals. No diagonals.

Phillips, James – see Price & Phillips

Phillips, John
440,437 Nov. 11, 1890 Parallel trussed beams support planking for a deck. Each beam is a very shallow king-post truss configuration. Labeled "bridge."

Pierce, Jacob
141,458 Aug. 5, 1873 *Cable anchoring system for a bridge that has an inverted bowstring truss at mid-span, hung from arch-supported side trusses. Cables are anchored in the abutments and follow the contiguous curves of the arches.

Piper, John – also see Linville & Piper (Piper & Schiffler, Pittsburgh, Pa.; Keystone Bridge Co., Pittsburgh, Pa.)
33,542 Oct. 22, 1861 Bearing block detail between verticals and chords. Labeled "truss bridge."
132,410 Oct. 22, 1872 *Drawbridge detail. Turning gear.

Platt, Charles
541,213 Jun. 18, 1895 *Concrete jack-arch deck system. Labeled "bridge part."

Post, Andrew (Atlantic Bridge Works, New York, N.Y.; Post & McCord, New York, N.Y.)

81,406	Aug. 25, 1868	Tapered strut. Labeled "bridge girder & column."
81,817	Sep. 1, 1868	Method to protect timber chords from crushing force of iron struts. Double-intersecting truss configuration used as an example. Labeled "truss bridge."

Post, John W.

176,806	May 2, 1876	*Trussed beam with multiple struts. Column-supported deck-bridge. All members are tubular sections.

Post, Simeon S. (Watson Mfg. Co., Paterson, N.J.)

38,910	Jun. 16, 1863	Joint detail to control expansion. Example is a double-intersection Pratt truss configuration. Labeled "iron bridge."

Post Truss

not patented	ca. 1865	This double-intersection, Pratt-like, truss configuration with inclined verticals, known as the "Post" truss, was not patented.

Pratt, Aaron

597,590	Jan. 18, 1898	*Culvert. Fabricated with a series of arched plates. Labeled "bridge."

Pratt, Thomas – also see Pratt & Pratt

114,039	Apr. 25, 1871	Warren truss configuration. Mostly channel sections. All joint connections made with riveted gusset plates.
137,482	Apr. 1, 1873	Timber Warren truss configuration. Multi-planked members.

Pratt, Thomas & Caleb Pratt

3,523	Apr. 4, 1844	Two configurations for timber-chord trusses. One with a curved top chord and crossed rods in all panels. Second with a horizontal top chord with crossed rods in all panels and an inclined four-panel brace at its ends.

Price, Jehu & James Phillips

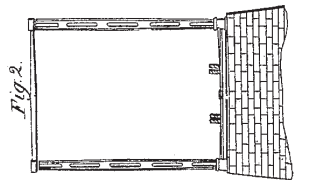
1,994	Feb. 23, 1841	Method for joining wood members using notched interlocking keys. Patent drawing shows stacked timber trusses. Labeled "truss bridge."

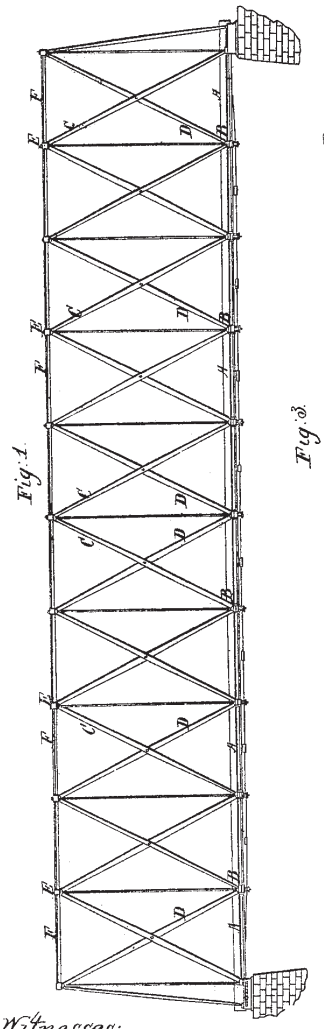
Pulliam, Luther

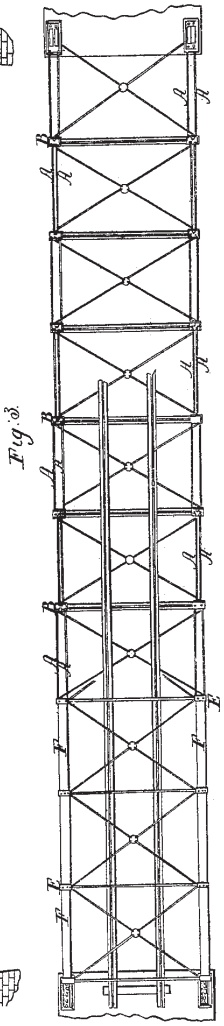
457,291	Aug. 4, 1891	*Built-up timber girder of stacked boards with staggered blocking and staggered, partial height, vertical and diagonal metal clamps.
495,005	Apr. 4, 1893	Combination of truss configurations. Stacked, rod-stayed timber bottom chords. Inclined timber top chord. Tie rods in end thirds of span.

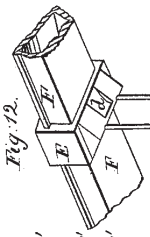
Rust & Herrmann.
Truss Bridge

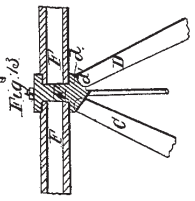
No. 81,950. Patented Sept. 8, 1868.

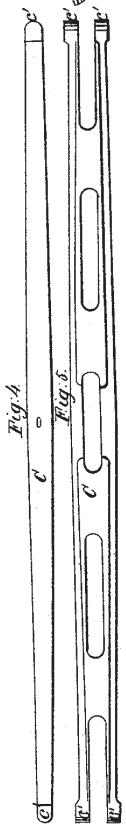


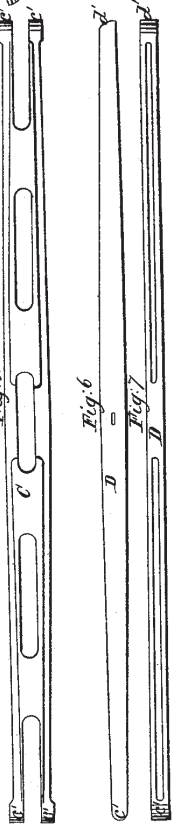


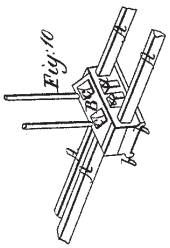


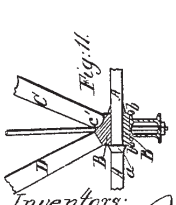












Witnesses;
W. E. Mann -
A. Gross

Inventors;
H. Rust
A. Herrmann

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R

Ramsay, Henry

381,168	Apr. 17, 1888	King-post truss. Deck truss formed with railroad rails.

Reeves, Samuel – also see Meigs & Reeves

35,582	Jun. 17, 1862	Construction of hollow, four or more segment, iron columns or struts. Known as the "Phoenix column" after the Phoenix Iron Co. (Phoenixville, Pa.), which was controlled by the Reeves family.

Reeves, William – see Hammond & Reeves

Reicherts, John

175,165	Mar. 21, 1876	*Arch. Prefabricated with cable-bound radiating staves. Labeled "bridge."

Reiling, Arnold

145,685	Dec.16, 1873	Timber King-post truss. Vertical metal rod. Timber diagonal struts.

Remington, John

3,095	May 19, 1843	*Parallel timber girders extended beyond abutment to decrease bending moment. Labeled "truss bridge."

Rezner, William – also see Glass, Schneider & Rezner (Ohio Bridge Co., Cleveland, Oh.)

128,509	Jul. 2, 1872	*Heel joint detail for securing tie-back in arched bridges. Labeled "improvement in arch-bridges."

Rice, Jesse – see Hunter & Rice

Rider, Nathaniel (Rider Iron Bridge Co., New York, N.Y.)

4,287	Nov. 26, 1845	Iron Pratt truss configuration. Cambered. All web panels have cross-bracing.

Rogers, Isaiah

2,347	Nov. 10, 1841	Timber spiral-braced cylindrical tubular bridge with interior trusses composed of horizontals and overlapping circles. Labeled "truss bridge."
15,823	Sep. 30, 1856	*Arch composed of bundled tubular sections. Labeled "truss bridge."
37,642	Feb. 10, 1863	*Arch composed of bundled tubular sections. Labeled "truss bridge."

Rogers, Robert

85,332	Dec. 29, 1868	*Detail for plate girder. Composed of plates with inverted U-shaped cutouts. Bottom chord is reinforced with a rod. Labeled "truss bridge."

Ross, Andrew

212,748	Feb. 25, 1879	*Counterweighted cables support a drawbridge at third point of span. Labeled "bridges."

Ross, Joseph

5,997	Jan. 2, 1849	*Drawbridge with swing section for opening in pile-supported spans.

Ruick, Thomas

188,678	Mar. 20, 1877	Joint block detail for connecting overlapping chord bars.

Rust, Henry & Ludwig Herrmann

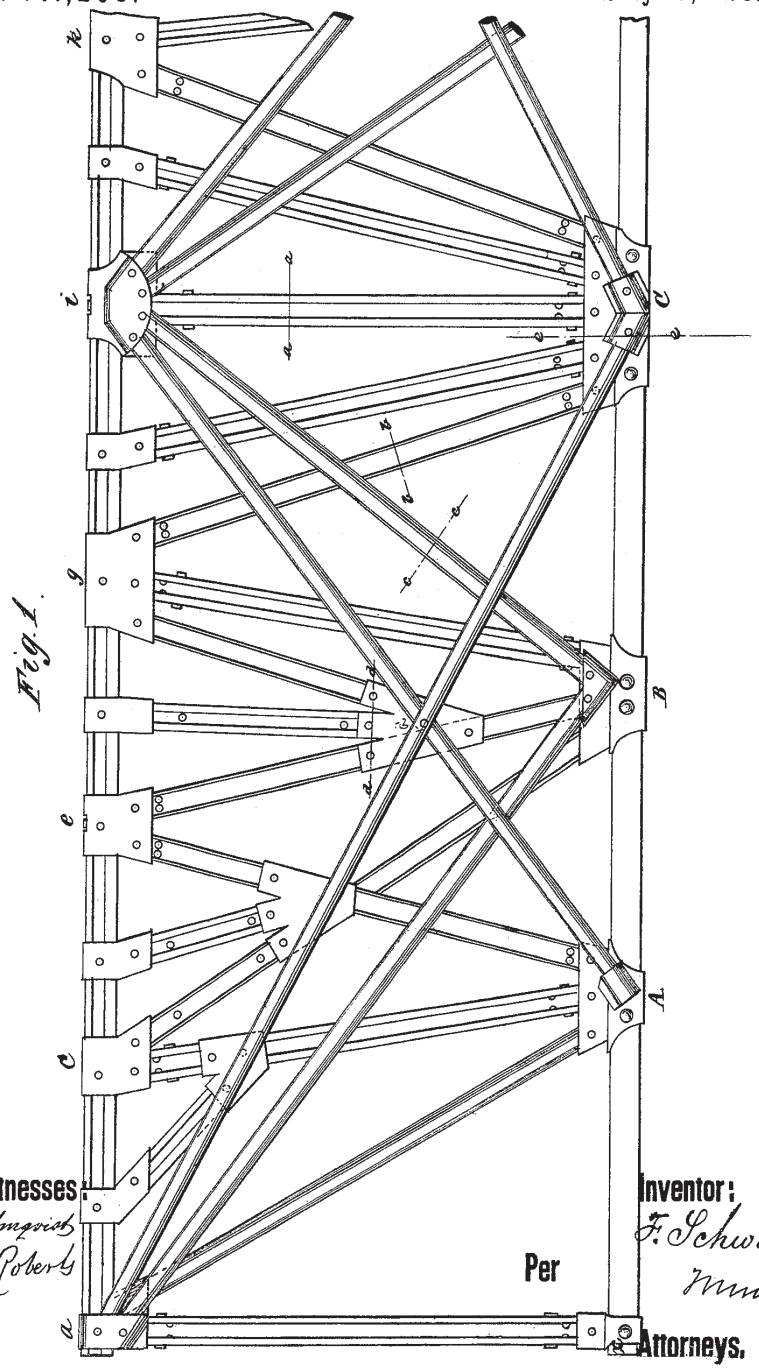
81,950	Sep. 8, 1868	Iron Howe truss configuration. End posts slightly inclined. Flexible connections.

3 Sheets--Shee

F. SCHWATKA.

Bridge Trusses.

No. 141,293. Patented July 29, 1873.



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Alex. F. Roberts

Inventor:
F. Schwatka

Per

Attorneys.

AM. PHOTO-LITHOGRAPHIC CO. N.Y. (OSBORNE'S PROCESS.)

S

Sanderson, John

77,103	Apr. 21, 1868	*Interlocking floor system. Labeled "truss bridge."

Sawyier, Ruben (Columbus Bridge Co., Columbus, Oh.)

381,584	Apr. 24, 1888	*Swing-span drawbridge. Labeled "bridge."

Schmemann, Friedrich

171,323	Nov. 6, 1875	Triple-intersecting iron lattice truss configuration, with additional diagonals in center panels. Claim made only for method of constructing compression members with tubes.
314,728	Mar. 31, 1885	Truss-like configuration composed of pipe-section arches and reversed arches intersecting at the inflection point, plus three additional contiguous arches. Imaginative, picturesque.

Schneider, George – see Glass, Schneider & Rezner

Schwatka, Frederick

141,293	Jul. 29, 1873	Suspension truss. Fink-like configuration with a cluster of radiating verticals at each bottom-chord panel point.

Schwedler Truss

No U.S. Patent	ca. 1863	European import. Parallel-chord Whipple configuration in center panels. End panels have curved-chord Pratt configurations.

Seebold, Jacob

105,497	Jul. 19, 1870	Conglomeration of forms. Web contains splayed verticals plus single and double-panel crossed diagonals. Cable stays extend from towers to mid span of bottom chord. Knee brace struts from abutments to top chord. A bit of almost everything.
107,106	Sep. 6, 1870	Howe truss configuration. Inclined timbers in end panels are supplemented with an additional brace to abutment below the iron bottom chord.
114,479	May 2, 1871	Bowstring truss. Cross-braced panels. Timber-arch chord sandwiched between iron plates.

Sellers, William

136,389	Mar. 4, 1873	Cambered Warren truss. Coupling system for tubular members. Labeled "iron-bridges."

Semmes, John

566,233	Aug. 18, 1896	Lenticular truss configuration. "Compound" truss in that its thickness increases towards mid-span along mid-height horizontal. No diagonals, therefore not a "true" truss.
584,525	Jun. 15, 1897	Timber configuration. Single mid-height chord. No top or bottom chord. Panels have two parallel diagonals that are intersected by a single crossing diagonal. Incomprehensible.
445,302	Jan. 27, 1891	*Suspension bridge with counterweighted cable anchorage. Labeled "bridge."

Sherman, Evrett

191,552	Jun. 5, 1877	Inverted king-post configuration. Timber chords and vertical.

Sherwood, Charles

363,970	May 31, 1887	Queen-post truss. Bottom chord, verticals, and crossed diagonals are rods. Connection plates have ears for connecting diagonal tie rods.

Smith, Byron – see Mills & Smith

Smith, Charles F. – also see Smith, Latrobe & Smith (Baltimore Bridge Co., Baltimore, Md.)

245,412	Aug. 9, 1881	*Pivoting "bell crank lever" used in attempt to balance lateral pressure on piers. Labeled "bridge." Overly creative.

Smith, C. Shaler – also see Smith, Latrobe & Smith; Bender, Latrobe & Smith (Smith, Latrobe & Co. & Baltimore Bridge Co., Baltimore, Md.)

93,917	Aug. 17, 1869	Chord construction. Composite section of quarter-round tubes and I-beams.

Smith, C. Shaler, Charles H. Latrobe & Frederick H. Smith (Smith, Latrobe & Co. & Baltimore Bridge Co., Baltimore, Md.)

97,975	Dec. 14, 1869	*Trestle. Inverted king-post trusses between towers.
99,017	Jan. 18, 1870	*Trestle. Inverted king-post trusses between towers. Same as patent no. 97,975, except assigned to Smith Latrobe & Co.

Smith, Fredrick H. – also see Smith, Latrobe & Smith (Smith, Latrobe & Co. & Baltimore Bridge Co., Baltimore, Md.)

60,434	Dec. 11, 1866	Suspension truss. Deck design with a diagonal pattern similar to a Bollman truss. Depth of verticals varies with least depth at center span.
75,477	Mar. 10, 1868	Howe truss configuration. Deck design with adjustable bottom chord members.
89,442	Apr. 27, 1869	Howe truss configuration. Adjustable vertical rods.
89,948	May 11, 1869	Suspension trusses. Similar to short-span Bollman truss, but least depth is at center span.
96,278	Oct. 26, 1869	Connection details for tubular truss members. Post, Fink, and double-intersection Pratt truss configurations shown as examples.
128,184	Jun. 18, 1872	*Eye-bars made by planing oversized bars.
128,449	Jun. 25, 1872	Double-intersection Pratt truss configuration. The center lines of the posts are radial, converging to a point considerably above the center of the truss.

Smith, Robert W. (Smith Bridge Co., Toledo, Oh.)

66,900	Jul. 16, 1867	Double-intersection Warren truss configuration. Timber members. Tension diagonals bolted to chords. Compression diagonals bearing against tension diagonals.
97,714	Dec. 7, 1869	Double-intersection Warren truss configuration. Timber members. Tension diagonals bolted to chords. Compression diagonals bear against tension diagonals. Center panel is V-shaped pair of struts.

Snyder, Antes

227,068	Apr. 27, 1880	*Cable-stayed suspension bridge. Labeled "bridge."

Snyder, John

190,921	May 15, 1877	*Combination of a hollow, buttressed-arch and a hollow beam, which are connected by verticals.

Snyder, Jonas

7,994	Feb. 3, 1834	*Pair of concentric timber arches combined with a truss having a double top-chord and radiating verticals.

Sohmemann, Friedrich – see Schmemann, Friedrich

314,728	Mar. 31, 1885	The name of the patentee was erroneously written and printed. June 16, 1885. Patent office entry.

Soule, H., Jr. – see Cole & Soule

Sprague, Andrew – see Patterson & Sprague

Sprague, Ira

287,974	Nov. 6, 1883	Bowstring truss. Tubular top chord. Eccentrically-crossed diagonals. Three radiating suspension rods.

Sprague, Joseph

25,852	Oct. 18, 1859	Pratt truss configuration. Crossed diagonal metal rods in all panels. Tubular compression members.

Sreeves, Charles

114,363	May 2, 1871	*Tied timber arch. Web has radiating suspension rods secured with yokes. Outriggers secured to extended floor beams.

Stanley, Edwin I.

8,337	Sep. 2, 1851	Lenticular truss configuration. Top chord, which patentee considered to be an arch, is a sandwich of iron and wood. Bottom chord is a wire cable.

Stearns, William

419,897	Jan. 21, 1890	Pratt truss configuration. Alternate verticals omitted, creating elongated panels. Full and half-panel diagonals in each panel.

Steele, J. Dutton

6,126	Feb. 20, 1849	Pratt truss configuration. Timber members. Braced with a superimposed arch, the thrust of which is contained by abutments and secured only to timber verticals.
63,666	Apr. 9, 1867	Double-intersection Warren truss configuration. Paired vertical end-posts. Labeled “isometrical bridge truss.”

Steiner, Charles

458,199	Aug. 25, 1891	Skewed pin joint for trusses.

Stephens, Ebenezer

268,309	Nov. 28, 1882	*Timber A-frame. Web contains only verticals. Bridge designed to float if water rises. Labeled “bridge.”

Stephenson, George

479,081	Jul. 19, 1892	Parallel chords slope in two end panels to meet and provide a bridge with a lenticular appearance. Pratt-design web. Cross bracing formed with two continuous cables. Tubular bottom chord has an inserted cable. Full span horizontal “thrust beam” between top and bottom chords.

Stone, Joel

484,686	Oct. 18, 1892	Five-panel suspension truss with sloped end posts. Double-intersecting diagonal suspension rods. Crossed diagonals in the second and fourth panels.

Storey, Ephraim

31,415	Feb. 12, 1861	*Braced tubular arch. Tubular verticals extend from horizontal tension rod above the arch. Crossed, diagonal ties between extended posts. Labeled "truss bridge."

Strobel, Charles

309,171	Dec. 9, 1884	Multi-span, continuous truss variations, all combining opposing catenaries and arches joined at inflection points. Lenticular in appearance.
498,993	Jun. 6, 1893	*Metal girders supporting lateral timber deck. Labeled "bridge."
498,994	Jun. 6, 1893	*Metal girders supporting lateral timber deck. Labeled "bridge."

Sullivan, Mark, Jacob Kessler & Josiah Foster

224,491	Feb. 10, 1880	Variety of timber chord king-post and queen-post truss configurations. All with verticals composed of two rods. No diagonals in queen-posts, including a three vertical version. Labeled "wooden truss-bridge."

Swartz, Abram

18,253	Sep. 22, 1857	Bowstring truss. Tension rods extend from short towers at each end to underside of lateral needle-beam at mid-span.

Swartz, Daniel

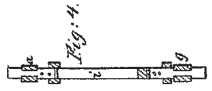
346,873	Aug. 3, 1886	*Metal abutment frame support for short-span trussed beams.

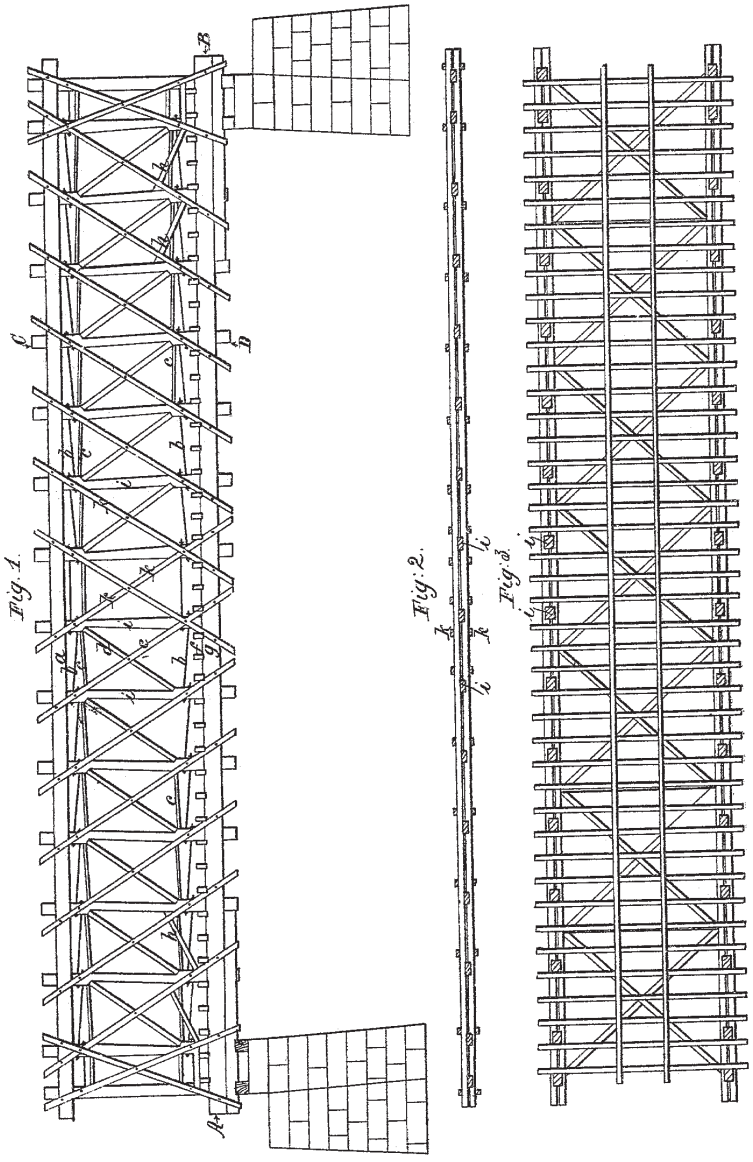
Sylvester, Frank – see Morse & Sylvester

G. W. Thayer.

Truss Bridge.

No. 4,004. Patented Apr. 16, 1845.





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T

Thacher, Edwin

242,396	May 31, 1881	Suspension truss. Multi-panel diagonals from top of end posts. Radiating diagonals from top of center post.
310,747	Jan. 13, 1885	Methods for subdividing panels of suspension truss as described in patent no. 242,396.
570,239	Oct. 27, 1896	*Masonry arch with steel framework in spandrel. Labeled "bridge."

Thayer, George

4,004	Apr. 16, 1845	Timber parallel-chord truss. Tie rods alongside of bottom and top chords. Verticals and tension diagonals extend beyond chords.
10,765	Apr. 11, 1854	Overlapping iron arches extend above top chord. Verticals from arch crowns to bottom chord.

Thomas, Emilien

456,501	Jul. 21, 1891	Kit of tubular parts for bridges and piers. Pratt truss configuration featured with alternate verticals deleted. Labeled "bridge."

Thomas, William

129,374	Jul. 16, 1872	*A bridge that rises and falls with stream water level. Labeled "improvement in bridges."

Thompson, James

81,960	Sep. 8, 1868	Howe truss. Curved chords composed of varying numbers of wrought-iron bars.

Tomlinson, Joseph

349,468	Sep. 21, 1886	Continuous cantilevered truss bridge. Top chord eye-bars are tiered. Labeled "bridge." British origin.

Town, Ithiel

3,169x	Jan. 28, 1820	Timber lattice truss. Seven intersections. Verticals only at ends. Chords sandwich the lattice web members.
8,743x	Apr. 3, 1835	Timber double-lattice truss. No verticals shown. Additional horizontals just below top chord and above bottom chord. Top and bottom chords sandwich the lattice web.

Tracy, Joseph

121,556	Dec. 5, 1871	Uniquely configured, dimpled, secondary "stiffening" truss secured above a Warren truss configuration.

Trowbridge, William

94,529	Sep. 7, 1869	*Cable-stayed sliding drawbridge.

Truesdell, Lucius E.

15,048	Jun. 3, 1856	Timber lattice truss with a repeated St. Andrew-cross pattern. No horizontal top chord.
21,388	Aug. 31, 1858	Iron lattice truss. Full and half height verticals. Full span horizontals in addition to diagonals. Clamped connections.
24,068	May 17, 1859	Iron lattice truss. Full and half height verticals. Full span horizontals in addition to diagonals. Clamped connections. Minor variation on patent no. 21,388.

Truesdell, Lucius E. (cont'd)

78,403	May 26, 1868	Connection detail for interlocking clamped corrugated bars. Labeled "truss bridge."
104,902	Jun. 28, 1870	Pratt truss configuration. All panels are cross-braced. Counters in end panels are secured directly to the masonry abutment. Corrugated blocks used to secure ties to chord.
105,868	Jul. 26, 1870	Clamp detail. Labeled "truss bridge."

Trumbull, Earl

2,164	Jul. 10, 1841	Howe truss configuration. Cambered all-iron variation. A series of cast-iron panels, each consisting of crossed diagonals between half-round posts. Wrought-iron verticals are inserted in hollow formed by the abutting half posts. Wrought-iron catenary from top of end posts to bottom of mid-span post. Wrought–iron ties along top of bottom chord. Arguably not a truss.

R. B. VARDELL.
Bridge.

No. 221,632. Patented Nov. 11, 1879.

Fig. 1.

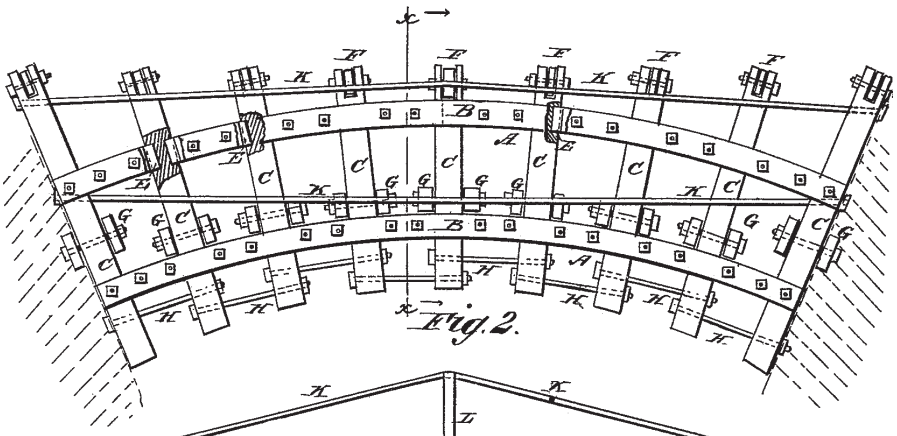


Fig. 2.

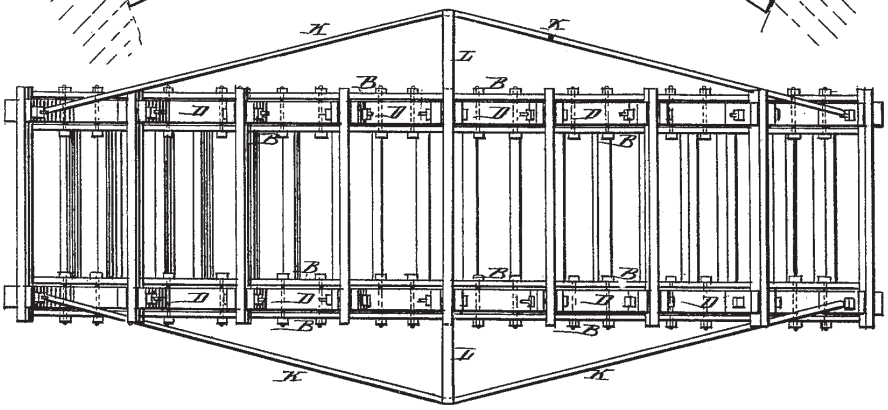
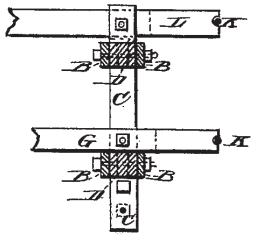


Fig. 3.



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V

Valentine, Elijah – see Bradway & Valentine

Valleley, James

166,042	Jul. 27, 1875	*Tied arch. Warren-type trussing for arch. Radial web members. Labeled "metallic truss bridge."

Van Duzer, David

25,537	Sep. 20, 1859	*Stone arch with rods along extrados and intrados. Labeled "bridge."

Vardell, Robert

221,632	Nov. 11, 1879	*Buttressed arched chords. Augmented with horizontal ties. Radiating verticals in web.

Von Bayer, Hector

245,034	Aug. 2, 1881	*Cable stays from towers at each end of bridge. Labeled "reacting truss."

I. H. Wheeler,

Truss Bridge.

No. 107,576. Patented Sept. 20, 1870.

Fig. 1.

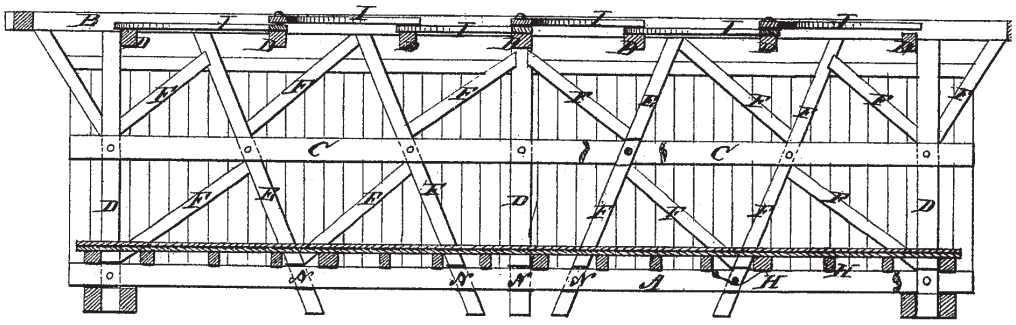


Fig. 2.

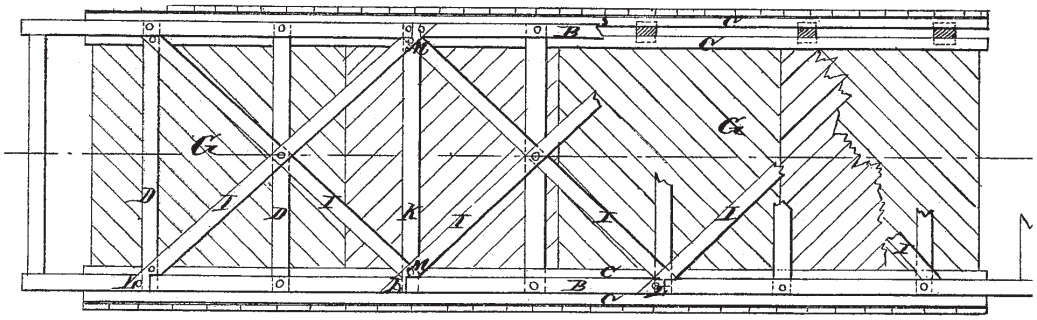
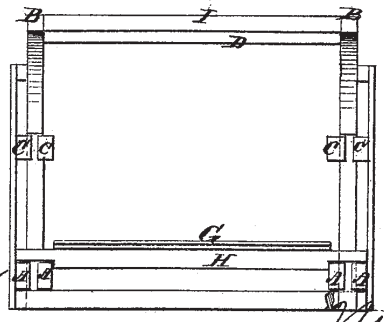


Fig. 3



Witnesses:

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Inventor:

I. H. Wheeler

Per Munn & Co

Attorneys.

W

Waddell, John A. L. – also see Waddell & Hedrick

529,220	Nov. 13, 1894	Steel A-frame truss. Quarter-span verticals. Howe roof-truss configuration used as a bridge.

Waddell, John A. L. & Ira Hedrick

605,153	Jun. 7, 1898	*Suspension bridge. Side bracing in lieu of stiffening truss.
737,679	Sep. 1, 1903	*Suspension bridge tower. Permits future change from one to two track width. Labeled “iron railway bridge.”

Waddell, Montgomery

621,466	Mar. 21, 1899	*Bascule drawbridge. Labeled “bridge.”
637,050	Nov. 14, 1899	*Bascule drawbridge. Labeled “bridge.”
660,827	Oct. 30, 1900	*Bascule drawbridge. Labeled “bridge.”

Walker, Willis

651,281	Jun. 5, 1900	Deck construction detail. Floor beam connection to lower chord. Labeled 'bridge.”

Wall, Jonathan – also see Wall & Wall (Wall & Co., Hamilton, Oh.)

164,349	Jun. 8, 1875	Configuration for parallel-chord truss or top chord of bowstring truss. Crossed-braced Howe-design panels with third concentric chord at mid-height. Labeled “bridge truss.”
241,763	May 17, 1881	Half-hip Pratt truss configuration. Pin has an eccentric shaft to permit adjustment.

Wall, Jonathan & Zimri Wall (Wall & Co., Hamilton, Oh.)

148,010	Feb. 24, 1874	Bowstring truss. Web verticals and diagonals extend into the trussed top chord.

Walter, George

124,400	Mar. 5, 1872	*Turntable for swing-span drawbridges.

Warner, Charles

130,959	Aug. 27, 1872	Timber A-Frame truss with vertical metal rods. Ends of timber members sit in oil-filled shoes for preservation.

Warren Truss

No U.S. patent	1848	Parallel chord truss with a web configuration of contiguous triangles. Developed in Italy, Belgium and France prior to 1848. Eventually imported to America from Great Britain where it was patented by James Warren and Willoughby Monzani in 1848. No U.S. patent secured by Warren and Monzani.

Webb, Stephen & Lewis Hagg

438,511	Oct. 14, 1890	Stacked Warren-design web configurations composed of bent pieces of old rails. Full and half-height, vertical, metal rods. No horizontal chords. Intriguing contraption.

Wegner, Gustav

297,479	Apr. 22, 1884	*Truss-stiffened suspension bridge. German origin.

Weimer, Peter

118,566	Aug. 29, 1871	Bowstring truss. Lattice web.

Weiss, Julius

509,781	Nov. 28, 1893	Unique combination of Warren truss configurations is one of several shown using patented adjustable members. Labeled "elements for building bridges."

Werner, Emmerich

311,624	Feb. 3, 1885	*Three-hinged arch. Segments composed of two lenticular trusses. Deck supported above on struts.
329,249	Oct. 27, 1885	*Three-hinged arch. Segments composed of two lenticular trusses. Deck truss supported below at mid-span.

Wernwag, Lewis

5,760X	Dec. 22, 1829	Cambered timber truss with rectangular panels having iron tension diagonals and end-post tie-downs.

Wheeler, Cyrus

149,965	Apr. 21, 1874	*Hollow four-piece oval girder.
231,383	Aug. 17, 1880	Warren truss configuration. Inclined end-posts. End panels have vertical member.

Wheeler, Isaac

107,576	Sep. 20, 1870	Timber truss with a mid-height third chord. Tension diagonals extend from top to bottom chord. Staggered compression diagonals butt against middle and ends of tension diagonals. Verticals at ends and at mid-span.

Whipple, Squire

2,064	Apr. 24, 1841	Iron bowstring truss. Crossed-braced rods between double-rod verticals. Distinctive cast-iron arch-chords are splayed, their width increasing toward their ends.
134,338	Dec. 24, 1872	*Lift drawbridge. Truss configuration is a "Whipple" double-intersection trapezoidal truss.

Whipple truss

Not patented	ca. 1846	Squire Whipple's, double-intersecting Pratt type truss. Also known as his "trapezoidal truss." Cast-iron top chord and vertical web members. Inclined end posts.

Whipple-Murphy truss

Not patented	ca.1863	See Murphy-Whipple truss.

White, Ammi

8,713	Feb. 3, 1852	*Suspension bridge. Timber towers and stiffing truss.

White, George

108,663	Oct. 25, 1876	*Latticed tube. Labeled "truss bridge."

White, Timothy

66,433	Jul. 2, 1867	Built-up hollow sections for truss chords and diagonals. Howe truss configuration shown as an example. Labeled "truss bridge."
77,502	Mar. 10, 1868	Iron clamp for timber chords.
87,741	Mar. 9, 1869	Quarter-circle convex bars used to form struts. Howe truss configuration shown as an example. Labeled "truss bridge."

Wible, Elias

250,027	Nov. 22, 1881	*Cable-stayed swing-span drawbridge.

Wilbur, Lebbeus

587,540	Aug. 3, 1897	*Girder bridge for overpasses.

Wilden, George

399,105	Mar. 5, 1889	*Trussed suspension bridge. Cross-braced panels between cable and bottom chord.

Wilkinson, George

4756X	May 15, 1827	*Timber, sliding drawbridge.

Williams, Edgar

213,154	Mar. 11, 1879	Howe-truss configuration. Inclined end posts. Joint block connection detail permits staggered arrangement of metal rods in the lower chord. Labeled "construction of bridges."

Wilson, Solon

314,900	Mar. 31, 1885	Web panels have inverted-V pattern of struts. Bottom chord is supplemented by a pair of metal rods, the top chord by a single rod. Lateral rods, cross-bracing and diagonal wires below bridge floor. Overly redundant. Patentee called it an "under-brace truss bridge." Patent labeled "suspension bridge."

Wilton, Henry

1,192	Jun. 24, 1839	Timber, arch-braced, double-lattice truss. Vertical metal rods. Truss extends beyond abutment for counterbalancing.

Winters, John

158,347	Dec. 29, 1874	Lateral bracing detail for pony trusses. Labeled "truss-bridges."

Wise, William

447,222	Feb. 24, 1891	*Laterally cambered bridge deck proposal. Labeled "bridge."

Witty, Richard

9,172X	Oct. 14, 1835	*Trussed beam. Timber girder and belly rod. Labeled "construction of bridges."

Woodruff, Eugene

655,291	Aug. 7, 1900	Tubular joint detail to permit slight variation in truss length. Pratt truss configuration shown.

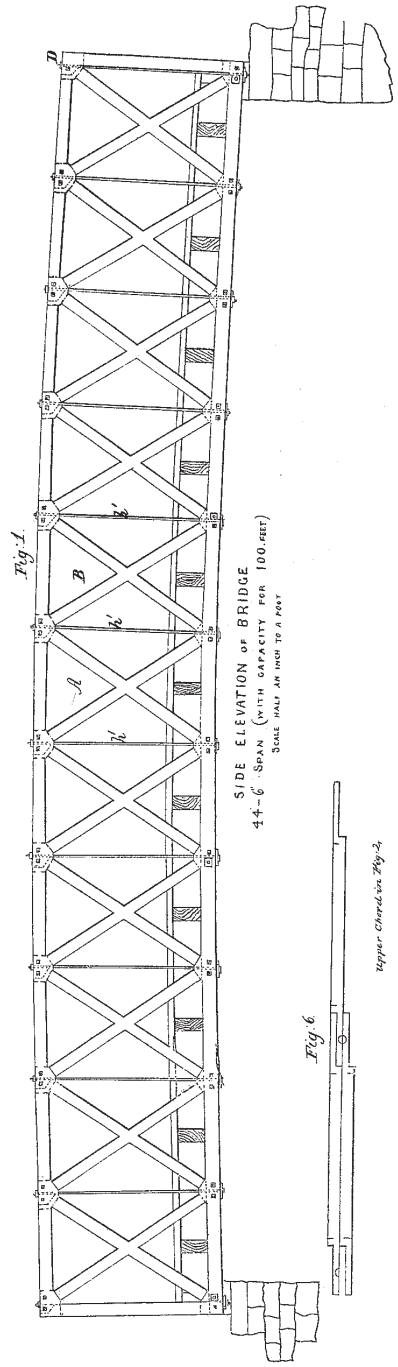
Woodruff, Jacob & Joshua Butterworth

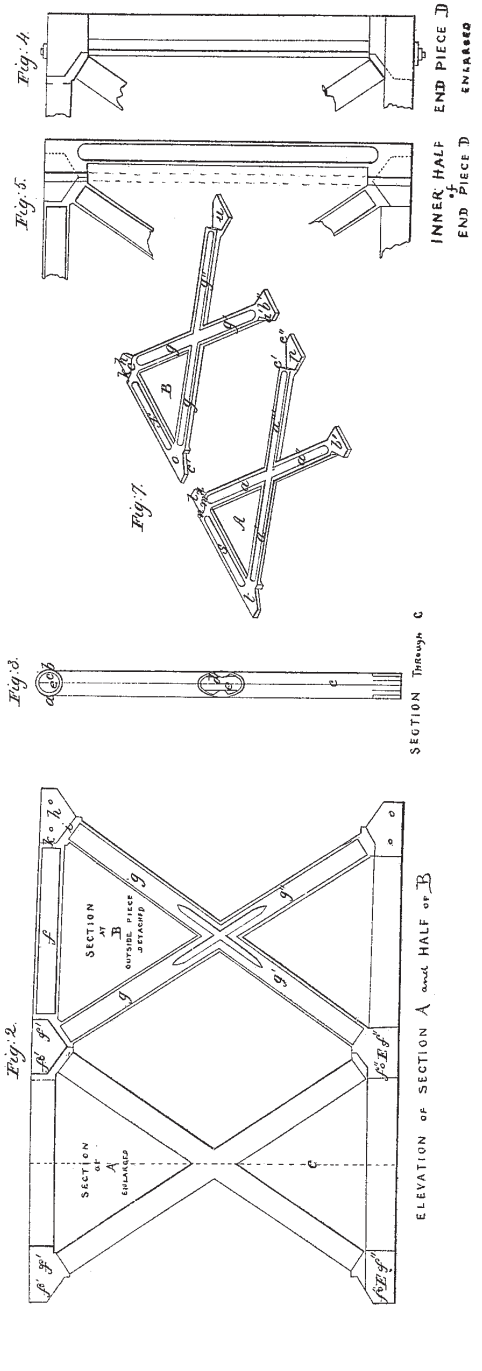
10,527	Feb. 14, 1854	*Bridge can be lowered into water to permit ship passage. Called "sinking-drop bridge."

Zerk & Heming.
Truss Bridge.

No. 3,019.
No. 34,023.

Patented Dec. 24, 1861.





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Y-Z

Yandell, John & Joseph Johnson

11,818	Oct. 17, 1854	Combination of suspension and truss forms, more suspension bridge than truss. Details for top and bottom wire chords of Pratt-like configuration anchored to abutments. Main suspension cable from towers to mid-span. Called "wire tress [sic] suspension bridge" in patent specifications. Labeled "iron truss bridge."

Yerk, James & George Heming – also see Zerk & Heming

34,023	Dec. 24, 1861	Iron Howe truss configuration. Cast-iron truss web members fabricated with longitudinally-bisected tubes. Each web section casting consists of a crossbrace and a segment of the upper chord. Patent is misfiled under Zerk & Heming in the patent records.

Young, Edward

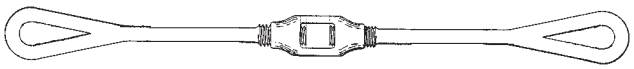
95,402	Sep. 28, 1869	*Methods for supporting suspension spans with two cantilevers. Originally patented in England.

Zellweger, John

125,244	Apr. 2, 1872	*Framed arch. Labeled "improvement in bridges."
145,545	Oct. 20, 1873	*Design details for vertical web struts composed of several members connected by helix strapping. Labeled "bridge columns."

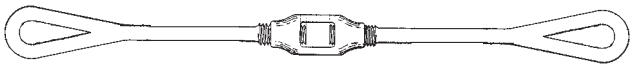
Zerk & Heming – see Yerk & Heming

Zerk is a patent office misprint of James Yerk's name. The Yerk & Heming patent is officially filed under Zerk & Heming.



Part II

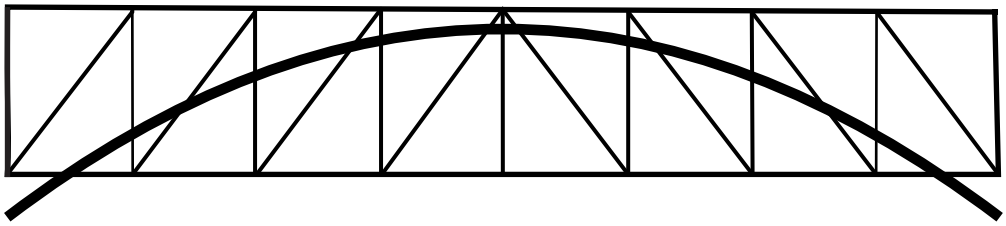
Patent Chronology
Ordered by Truss Configuration



Arch-Braced Trusses

Early timber trusses were often combined with a stiffening arch. It was a common belief that the truss carried the live load and the arch the dead load. In actuality the arch and truss were intertwined; the true proportioning of loads ultimately depended on the joinery in addition to the geometry.

Patent entries noted below with a # symbol are not true arch-braced trusses. They have been listed because their silhouette contains elements that may create the impression that they are arch-braced trusses.



PATENT CHRONOLOGY

Burr 1817: Single compression diagonal in all panels. Timber arch springs from abutments below the bottom chord.

 # Snyder, Jonas 1834: Pair of concentric, buttress-contained arches combined with two parallel chords and radiating verticals. No diagonals. More of a braced-arch than an arch-braced truss.

Wilton 1839: Timber lattice web with evenly spaced vertical rods. Arch springs from abutments below bottom chord.

Howe 1840: All-timber truss. Tension verticals. V-pattern of diagonals in each panel. Superimposed full-span arch.

Gay 1846: All timber. Curved chords. Crossed diagonals intersect the chords at different panel points than the verticals.

Howe 1846: Timber except for vertical rods. Arch springs from abutments below bottom chord. Crossed-diagonals in all panels.

Steele 1849: Timber arch springs from abutments below bottom chord. Arch secured only to verticals. Crossed-diagonals in all panels.

 # McCallum 1851: All timber. Radiating struts from abutment. Crossed diagonals in web panels extend from bottom chord to underside of arch.

Pennington 1851: Upright and reversed arches. Overlapping diagonals. No verticals.

Long, S. H. 1858: Inverted arch. Multitude of varied-slope web members.

Eikenberry 1859: Pair of concentric arches. Multi-intersecting compression diagonals.

Ham 1859: Three full-span arches brace an arched-chord truss.

 # McGuffie 1861: Iron bowstring with verticals extending to a horizontal top member.

 # McGuffie, 1862 Mar.: Iron bowstring with slightly radiating verticals extending to a horizontal top member.

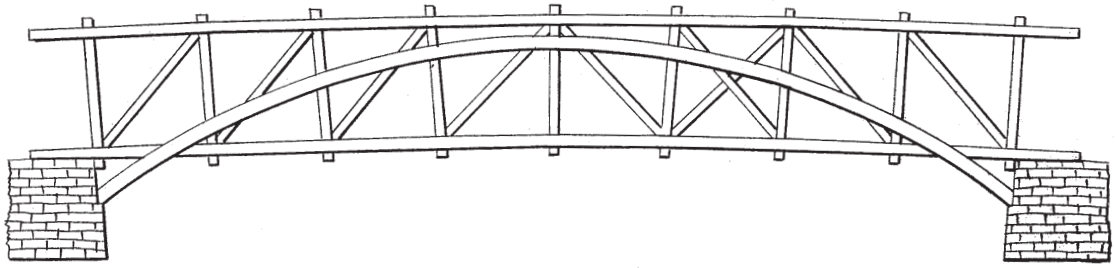
 # McGuffie, 1862 May: Timber bowstring with verticals extending to a horizontal top member.

DuBois 1862: Lift drawbridge. Design shows superimposed arch secured to verticals.

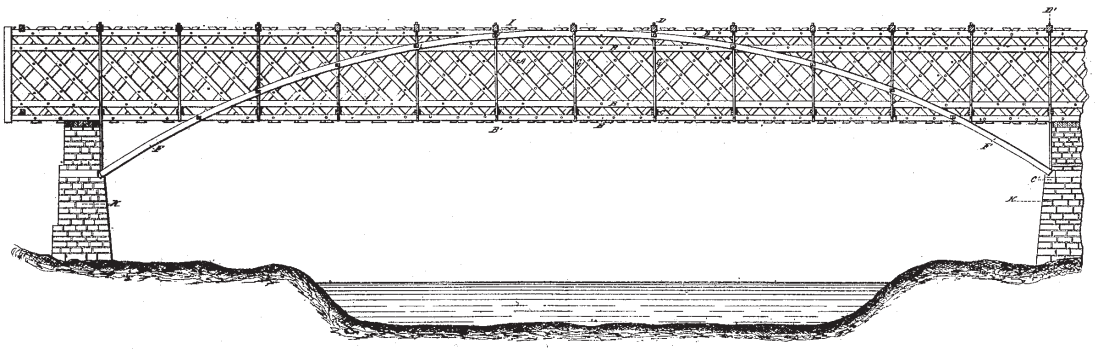
Boles 1865: Web of overlapping U-shaped bars and vertical rods.

 # Snyder, John 1877: Hollow metal arch and a pair of hollow beams connected by verticals.

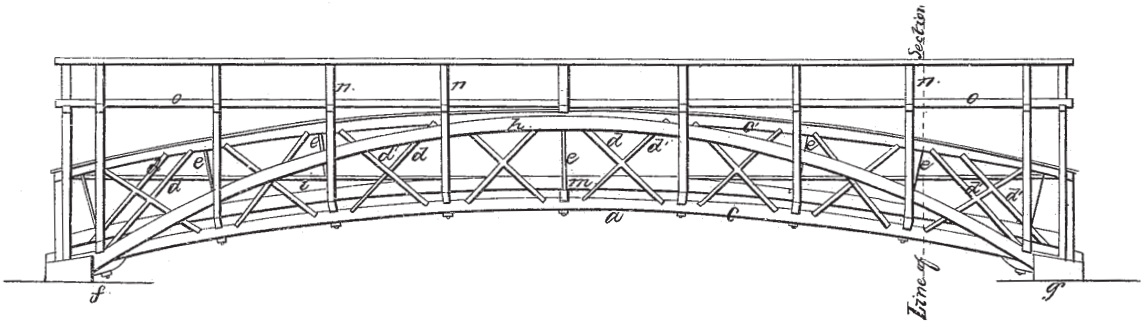
 # Brenner 1881: Arched bottom chord.



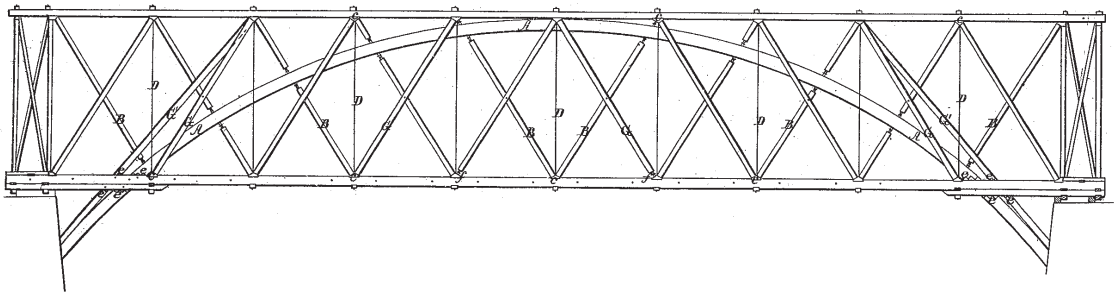
Theodore Burr, Patent No. 2769x (1817)



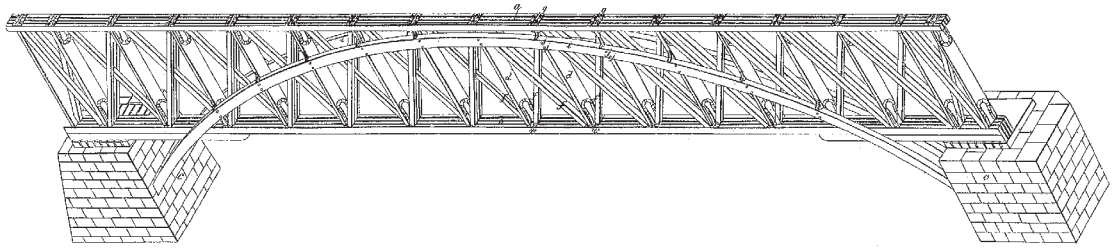
Henry Wilton, Patent No. 1,192 (1839)



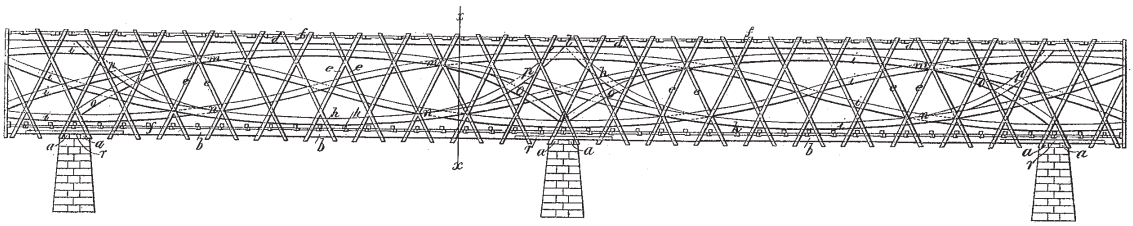
Lowman Gay, Patent No. 4,837 (1846)



William Howe, Patent No. 4,726 (1846)

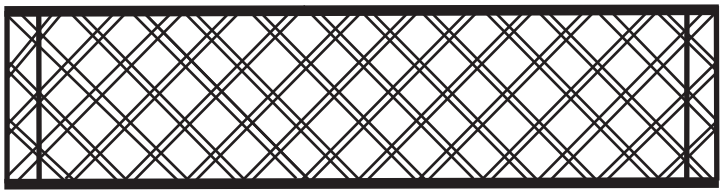


J. Dutton Steele, Patent No. 6,126 (1849)

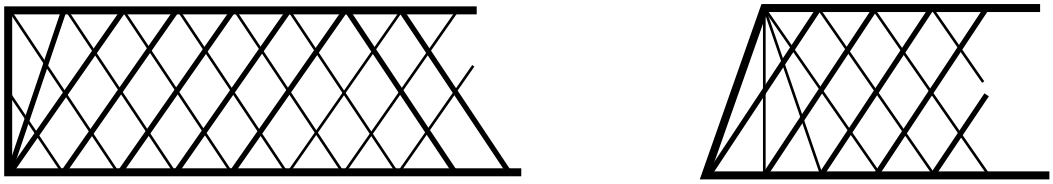


Cunningham Pennington, Patent No. 7,890 (1851)

Lattice Configurations



Typical timber lattice configuration.



Common metal lattice configurations.

PATENT CHRONOLOGY

Town 1820: Timber. Seven intersections. Verticals at ends only. Chords sandwich the lattice web.

Town 1835: Timber. Double layer of lattice members. Second pair of chords just above and below top and bottom chords. No verticals called for, but usually built with end verticals.

Wilton 1839: Timber lattice and chords. Arch-braced. Iron verticals spaced at same dimension as truss height. Truss extends beyond abutments.

Cottrell 1841: Timber. Quadruple-intersecting diagonals.

Price & Phillips 1841: Timber. Additional mid-height chord. Interlocking notched joints.

Truesdell 1856: Timber. Weave of horizontal, vertical, and diagonal members.

Carroll 1859: Iron. Not patented. Common railroad truss configuration.

Truesdell 1859: Iron. Subdivided double-intersection lattice web. Three additional horizontals. Diagonals clamped at intersections.

Avery, J. P. 1861: Inclined timber trusses form a hollow triangular tube. Third horizontal chord. Vertical rods.

Kendall 1862: Three chords. Alternate compression and tension verticals. Double-intersecting diagonals. Timber except for alternate vertical rods.

Briggs 1863: Timber. Compression diagonals omitted in middle third of span.

Kremser 1866: Lenticular shape. Iron members. Mid-height chord.

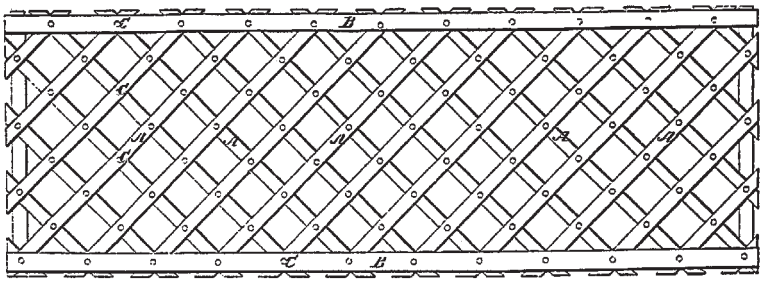
Manley 1867: Iron. Double-intersecting configuration with mid-height chord.

Weimer 1871: Bowstring truss with lattice web.

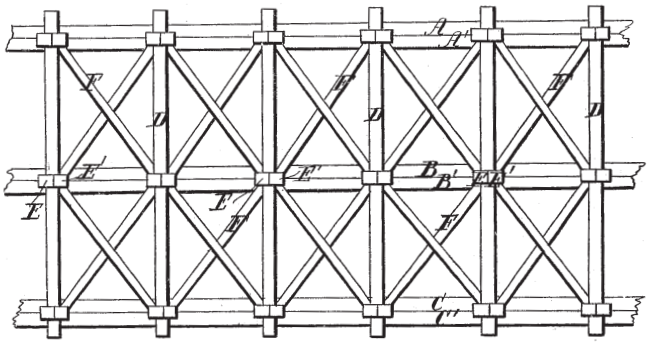
Schmemann 1875: Triple-intersection lattice with additional diagonals in middle third of span. Pipe sections.

Litell 1882: Timber. Quadruple-intersecting diagonals. Three intermediate-height chords. Verticals only at ends.

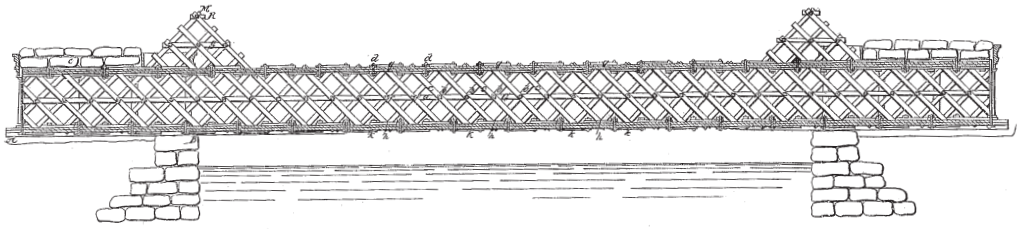
Haynes 1887: Multi-tiered, four-directional lattice-arch. Wire diagonals.



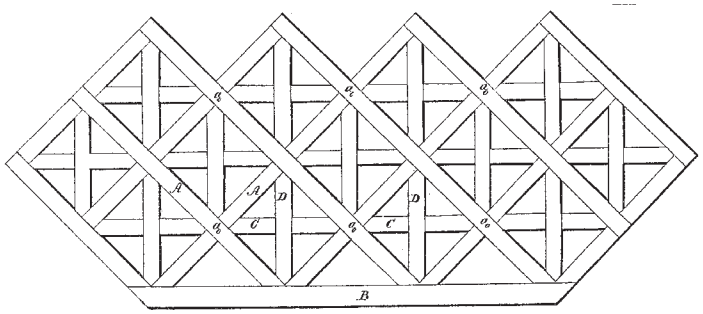
Ithiel Town, Patent No. 3,169x (1820)



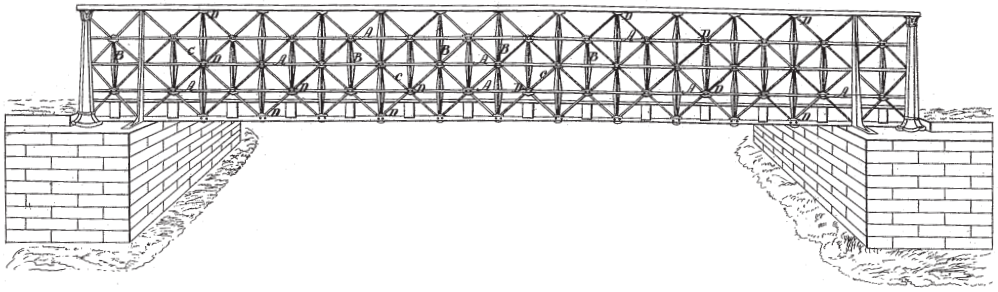
Jehu Price & James Phillips, Patent No. 1,994 (1841)



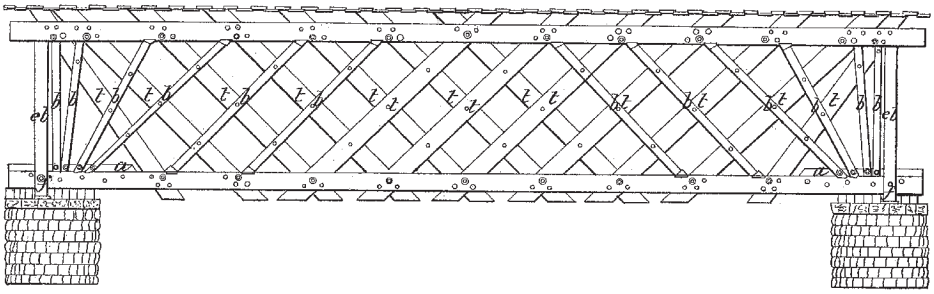
Albert Cottrell, Patent No. 2,334 (1841)



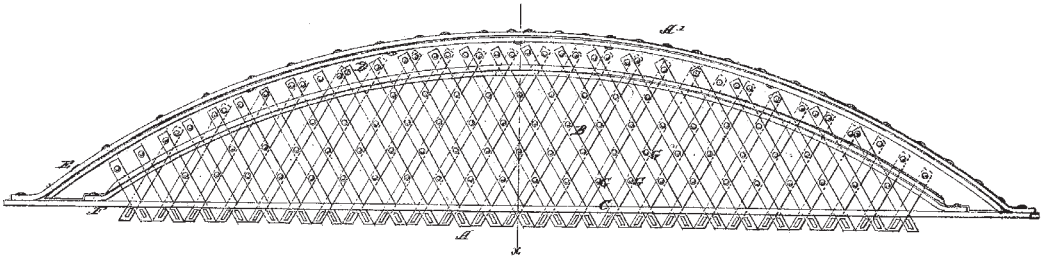
Lucius E. Truesdell, Patent No. 15,048 (1856)



Lucius E. Truesdell, Patent No. 24,068 (1859)



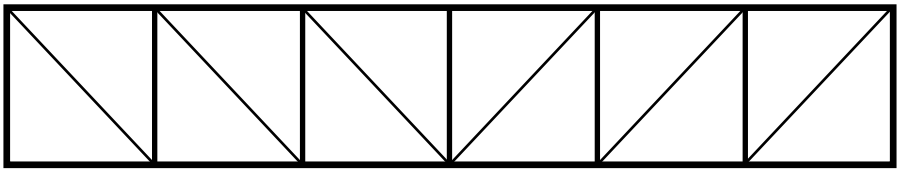
John Briggs, Patent No. 38,653 (1863)



Peter Weimer, Patent No. 118,566 (1871)

Pratt Configurations

Vertical web members are in compression and diagonals in tension. The basic difference between these Pratt configurations is the cross-sectional shape of the various members of the truss and/or the way they are joined together.



Wernwag 1829: Timber arched-truss configuration with single, iron diagonals in the panels in addition to cross-bracing timber diagonals.

Pratt & Pratt 1844: Timber chords and verticals with crossed iron diagonals. Four-panel-long strut at ends. A second configuration with a curved top chord and without the multi-panel strut is also shown.

Rider 1845: Cast-iron compression and wrought-iron tension members. Diagonals are bars not rods.

Sprague, J. 1859: Iron pipe used for compression members, rods for tension members.

Jacobs 1860: Timber except for crossed diagonals of continuous strapping.

Canda 1869: Verticals and top-chord segments are tapered.

Adams 1870: Swivel stirrups under posts. Lower chord is spliced with clevis and pin.

Brundage 1870: Crossed diagonals in all panels. Tapered verticals. Convoluted joints.

Truesdell 1870: Counter diagonal in end panel is anchored directly into masonry abutment.

Canda 1871: Crossed diagonals. Tapered verticals.

Morgan 1871: Wire rope used for bottom chord and cross-bracing in panels.

Adler 1872: Hollow compression top chord.

Bonnell 1872: Sloped end post. Joint variation.

Bogardus 1874: Pratt-like capacity, but also functions as Howe and as a double-intersection Warren.

Hammond & Abbott 1874 (Patent No. 150,151): Top chord composed of channels. Star iron verticals.

Hammond & Abbott 1874 (Patent No. 150,152): Top chord composed of channels and tees. I-beam verticals.

Hammond & Abbott 1874 (Patent No. 150,153): Top chord composed of plate and channels. I-beam verticals.

Truesdell 1879: Iron. Crimped connections.

Wall 1881: Half-hip variation. No hanger at juncture of sloped end and top chord.

Godman, 1882 Aug.: Metal-covered timber top chord. Wrought-iron rods for lower chord, diagonals, and mid-height horizontal ties. Cast-iron verticals.

Godman, 1882 Nov.: Timber top chord. Wrought-iron bottom chord and diagonals. I-beam verticals.

Irelan 1882: Method to post-stress bottom chord. Single diagonal in panels.

Mitchell 1887: Pratt configured end panels. King-post center panel.

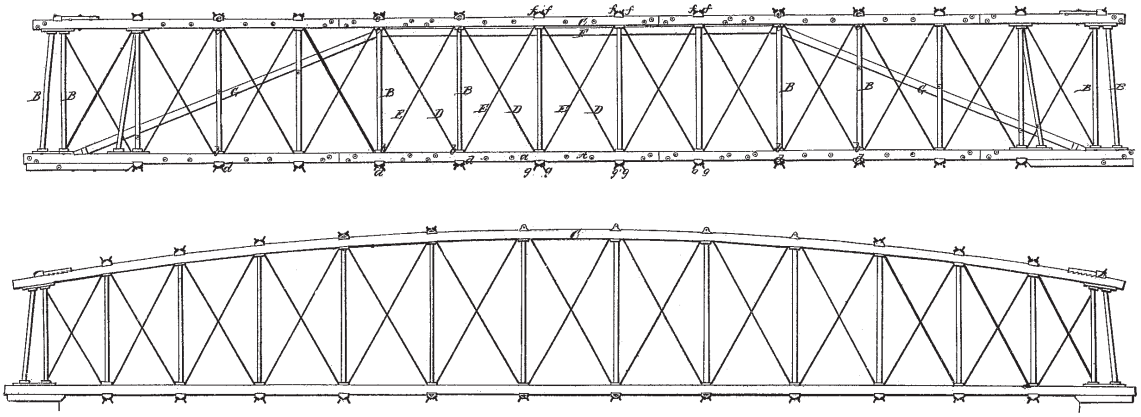
Godman 1886: Subdivided panels. Mid-height horizontal ties.

Green 1891: Segmented tubular chords. Cross-braced panels.

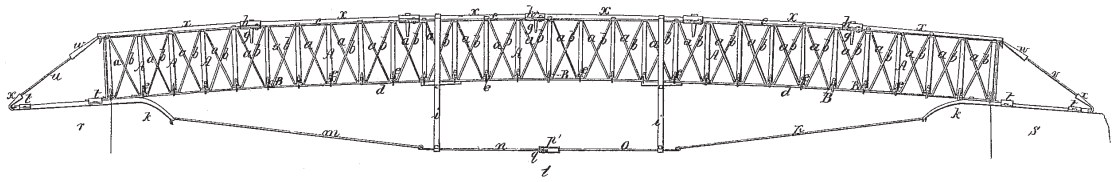
Stephenson 1892: Web cross-bracing is a continuous cable. Tubular lower chord with inserted cable.

Gray 1893: Tubular top chord and verticals.

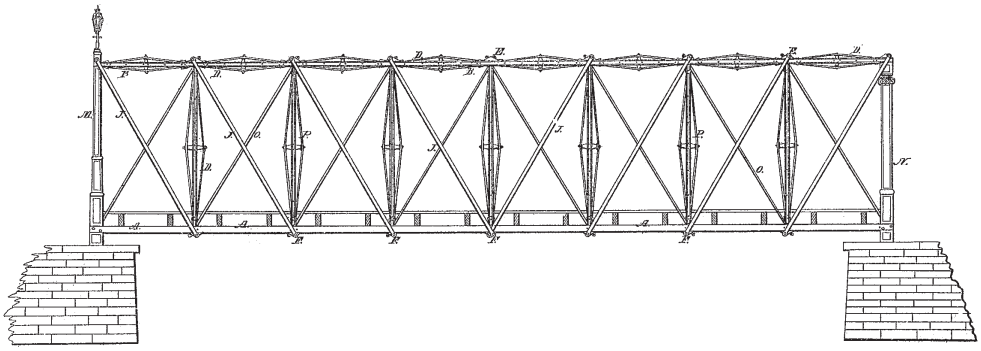
Carr, W. 1895: Metal-covered timber top cord. Slightly inclined end posts.



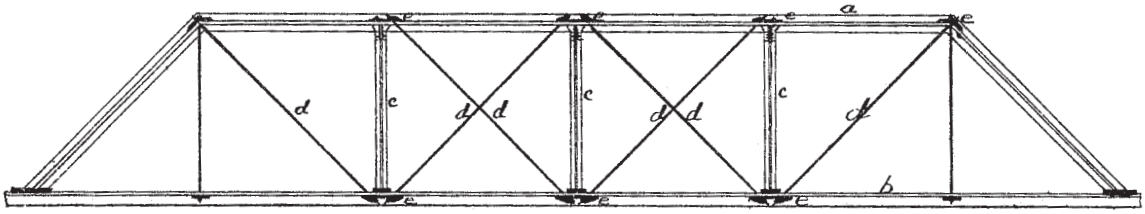
Thomas & Caleb Pratt, Patent No. 3,523 (1844)
[Two alternate truss configurations]



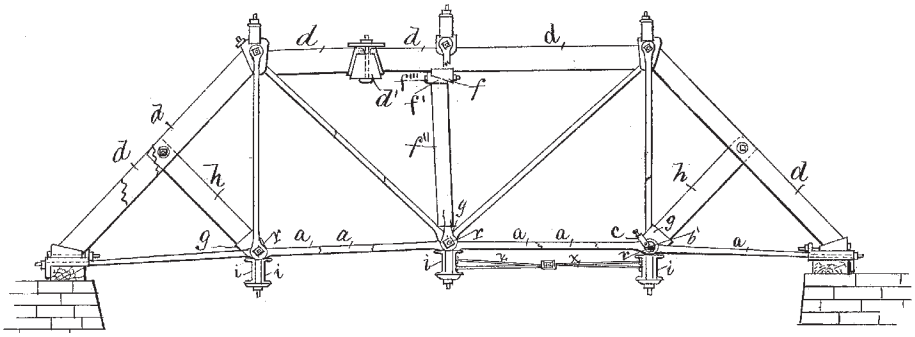
Nathaniel Rider, Patent No. 4,287 (1845)



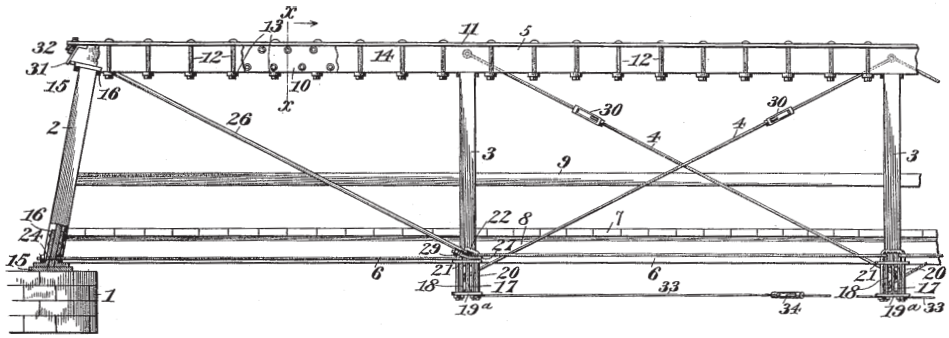
F. E. Canda, Patent No. 88,446 (1869)



William F. Bonnell, Patent No. 130,561 (1872)



William Irelan, Patent No. 254,978 (1882)

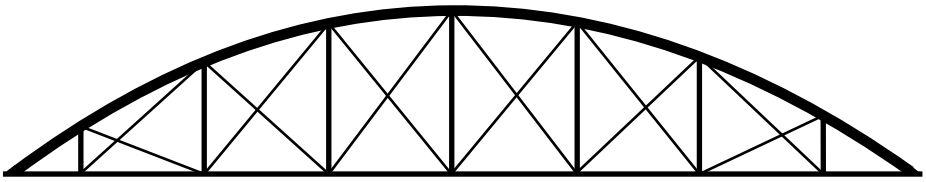


William Carr, Patent No. 539,506 (1895)

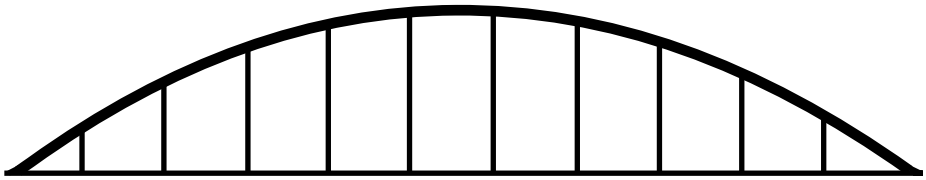
Bowstring Configurations

Not all bowstring configurations are trusses. Tied arches and other non-truss configurations are indicated with a # symbol.

Bowstring truss: A bowstring truss is a truss with an arched upper compression chord and a horizontal tension bottom chord that connects the ends of the arched chord. Diagonal members in the truss web help prevent the arched chord from deforming under moving loads placed on the bridge deck, which is hung from the arch. Some bowstring configurations are "inverted" with a horizontal top chord in conjunction with a curved tension chord.



Tied arch: A tied arch contains horizontal thrust by a tension member that connects the ends of the arch. The bridge deck is supported beneath the arch only by vertical hangers. Any tendency for the arch to deform due to a moving load on the bridge must be solely resisted by the rigidity of the arch.



PATENT CHRONOLOGY

Long, G. W. 1830: All-timber, Howe-type web with a single diagonal in each panel.

Whipple 1841: Iron. Ends of top chord are splayed. Paired verticals. Crossed diagonals.

 # Lanergan 1850: Three overlapping bowstring arches. Labeled "truss."

Guiou 1856: Iron. Web of radial posts, plus full, half, and quarter-span V-pattern braces.

Avery, G. S. 1857: Layered top chord. Web of crossed diagonal struts and rod ties.

 # Meigs & Reeves 1857: Radiating ties originating from common mid-span location.

 # Moseley 1857: Web of very closely spaced radiating hangers perpendicular to the arch. Labeled "truss."

Swartz 1857: Supplemental tension rods extend from short towers to mid span.

 # Ham 1859: Curved-chord Howe with single diagonal in panels. Three superimposed full-span arches.

 # Montgomery, R. 1859: Timber arch. Three verticals, no diagonals in web. Labeled 'truss."

 # Frees & King 1861: Radiating verticals. Labeled "truss."

McGuffie 1861: Tubular arch. Verticals extend above to a horizontal member which is laterally braced.

Junkins 1861: Timber upper chord and crossed diagonals. Timber bottom chord in conjunction with a rod. Radiating vertical rods.

McGuffie, 1862 Feb.: Inverted bowstring. Roadway hung below.

McGuffie, 1862 Mar.: Verticals extend above arch to a horizontal member which is laterally braced.

McGuffie, 1862 May: Timber. Radiating verticals extend above to a horizontal member which is laterally braced. Crossed rods in panels.

 # Hammond & Reeves 1864: Web verticals and radiating members perpendicular to the arch originate from adjacent points along bottom tie. Labeled "truss."

 # Gilbert 1866: Pair of circular segment, parallel iron-plates form an arch. Labeled "truss."

Hammond 1866: Radial verticals. Cross-braced panels.

Herthel 1866: Parabolic top chord. Crossed diagonal rods and vertical struts.

King, Z. 1866: Hollow top chord tapered to narrower depth and diameter at mid-span.

 # Moseley 1866: Circular-segment arch composed of three parallel plates. Labeled "truss."

 # Davenport 1867: Latticed arch chord. Radial rods in web.

 # Glass, Schneider & Rezner: 1867: Tubular oval arch. Radiating plus two diagonal web stays.

Herthel 1867: Tubular arch chord. Vertical struts, crossed rods in panels.

Morrison 1867: I-beam arch chord, strong axis set horizontally. Vertical struts, crossed ties.

Bender 1868: Inverted bowstring. Roadway hung below.

Davenport 1868: Latticed arch. One-third span tenson diagonals supplement horizontal tie. Cross-braced radial web ties.

 # Liscom 1868: Bowstring truss anchored to corbelled timber supports that extend to mid-span.

Hammond & Reeves 1869: Cross-bracing intersects at a ring. Verticals from ring to top chord.

 # Henszey 1869: Arch composed of Phoenix-column sections. Web contains only verticals.

Herthel 1869: Double-intersecting web diagonals. Tapered posts.

Kelly 1869: Wire-rope bottom chord. Radial verticals and crossed diagonals.

Laird, J. 1869 (Patent No. 94,321): Radial verticals. Diagonal cross-bracing. Trussed arch-chord.

Laird, J. 1869 (Patent No. 94,322): Radial verticals. Diagonal cross-bracing.

Parker, C. 1869: Suspension truss superimposed on bowstring.

Hammond & Abbott 1870 (Patent No. 102,392): Tubular arch top-chord. Web diagonals and radiating verticals attach to flanges of top-chord sections.

Hammond & Abbott 1870 (Patent No. 102,393): Tubular arch top-chord. Web diagonals and radiating verticals penetrate the top chord.

 # McCurdy 1870 (Patent No. 104,867): Bottom tie is a wire cable. Web contains only verticals.

McCurdy 1870 (Patent No. 104,868): Web has a single vertical at mid-span, no diagonals. Also could be considered a curved-king-post truss.

 # Miller, M. 1870: Multi-plate arch-chord. Web of radiating pipe sections.

Moseley 1870 (Patent No. 103,765): Vertical suspenders. Use of diagonals "when necessary" would make it a truss.

Moseley 1870 (Patent No. 106, 855): Diagonal tie from mid-point of bottom chord to quarter-span on arch chord. Vertical ties. Use of cross bracing option between ties would make it a truss.

Kirkups 1871: Verticals and diagonals meet chord at alternate panel points.

 # Kittinger 1871: Branched web verticals form a pattern of skinny inverted Vs. No diagonals in web.

 # Perry & Allen 1871: Splayed verticals. No web diagonals.

Seebold 1871: Vertical posts. Crossed rods in all panels.

 # Sreeves 1871: Timber arch. Radial web ties perpendicular to arch. No diagonals.

Weimer 1871: Multi-intersecting lattice web.

 # Adler 1872: Variety of hollow arch-chords formed with plates, channels, and angles.

Davis, B. 1873: Verticals and radiating struts from mid-span of lower chord.

 # Evans 1873: Wire tie sheathed in a segmented tube within a second tube. Verticals only.

Hammond, Adler & Abbott 1873: Chord and web sections proposals for a variety of bowstring truss configurations.

 # Bannister 1873: Multi-planked undulating top chord. Web contains only verticals.

Cooper, W. 1873: Tubular arch chord. Crossed diagonals and vertical are rods.

Davis 1873: Verticals plus radiating struts from mid-span of lower chord.

 # Evans 1873: Web contains only verticals. Horizontal wire tie is sheathed.

Johnson, P. 1873: Twin tubular arch chord. Cross-braced panels.

Bausman 1874: Inverted bowstring. Cross-braced panels.

Laird, W. 1874: Tubular arch chord. Radial verticals. Crossed diagonals.

Black 1875: Inverted bowstring truss. Roadbed suspended from arch chord.

Farnsworth 1875: Web verticals do not intersect the chords at same point as diagonals.

 # Valleley 1875: Trussed arch. Web members are radial ties.

Wall, J. & Z. 1875: Web verticals and diagonals extend through trussed chord.

Avery & Bartholomew 1877: Bent railroad-rail top chord. Crossed diagonals.

Colby 1877: Continuous railroad-rail top-chord bent at panel points. Crossed diagonals.

Hoover 1879: Verticals and double-intersecting diagonals. Inverted double-intersecting V-pattern strut at mid-span.

Jarvis 1879: Tubular arch chord. Double and triple-intersecting diagonals. Bollman-type web.

Jayne 1879: Timber arch chord. Vertical rods threaded through wood verticals. Crossed diagonals.

Groves 1881: Metal-protected timber arch chord. Iron verticals and diagonals. Additional diagonal struts from bottom of vertical at mid-span.

Maish 1882: Twin-pipe arched chord. Crossed diagonals rods. Pair of rods used for bottom chord and verticals.

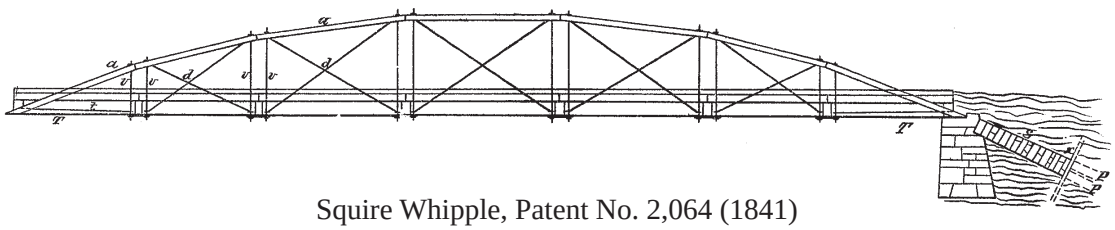
Sprague, I. 1883: Tubular arch chord. Radial verticals. Eccentrically crossed diagonals.

Dibble 1884: Web contains V-shaped pattern of rods between vertical struts.

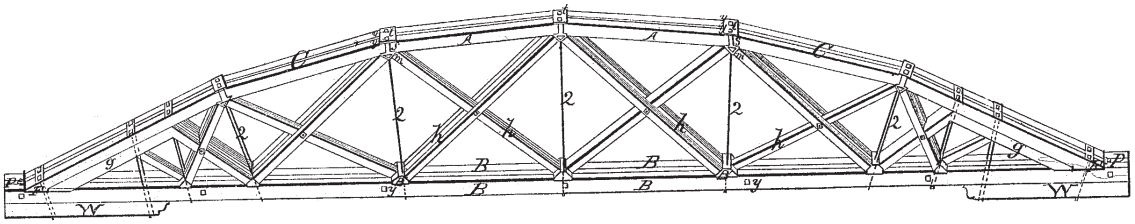
 # Mitchell. J. 1890: Web contains only verticals.

Greiner 1895: Proposed variations include an inverted bowstring superimposed on both a Pratt and a Howe parallel-chord truss configuration.

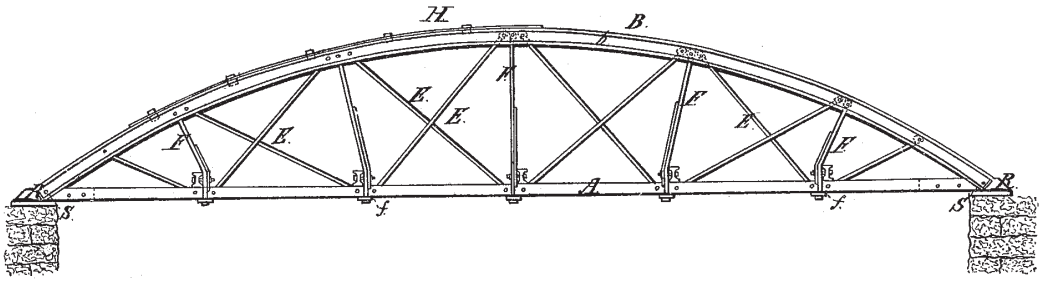
Horton 1897: Web of radiating struts. Crossed and inverted V-shaped pattern of members in each panel.



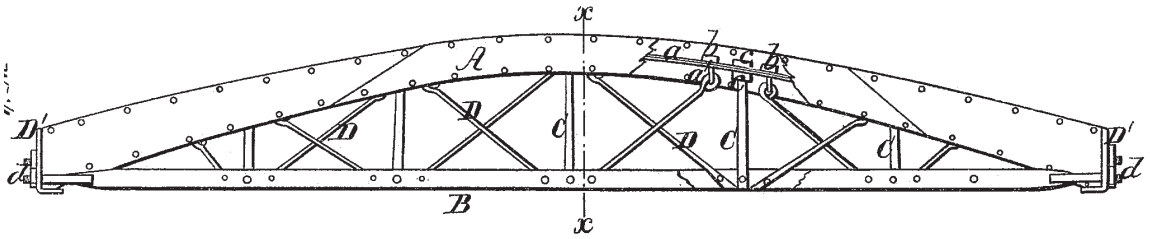
Squire Whipple, Patent No. 2,064 (1841)



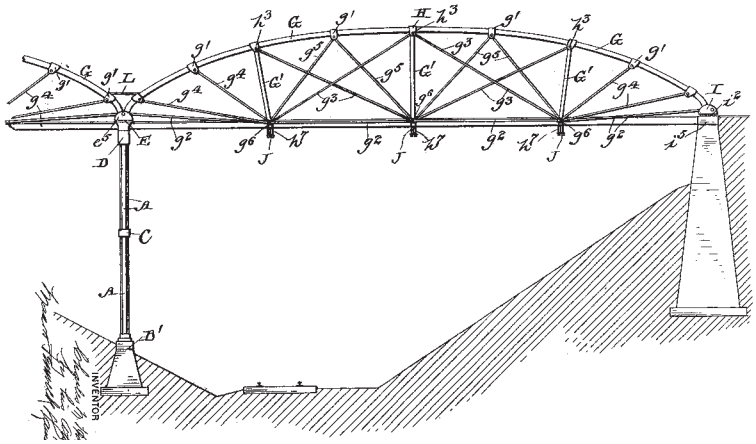
John Junkins, Patent No. 32,480 (1861)



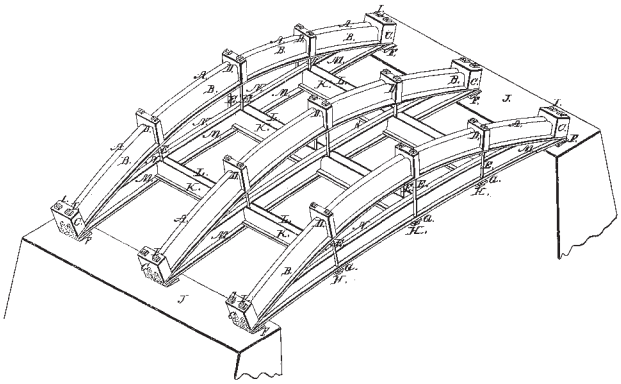
David Hammond, Patent No. 56,043 (1866)



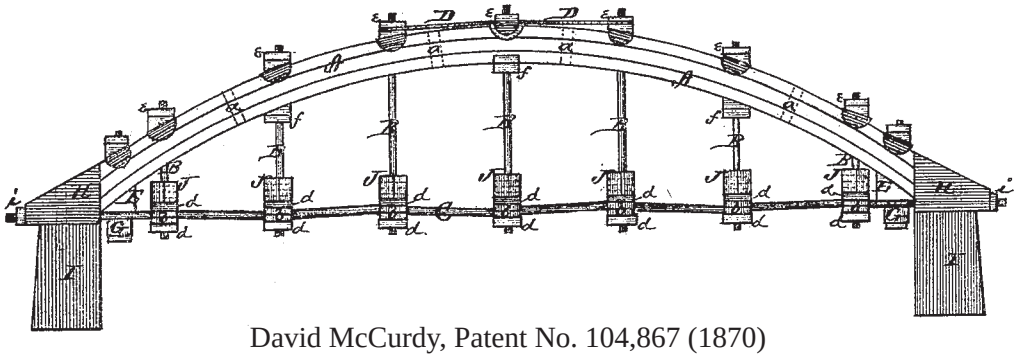
Zenas King, Patent No. 58,266 (1866)



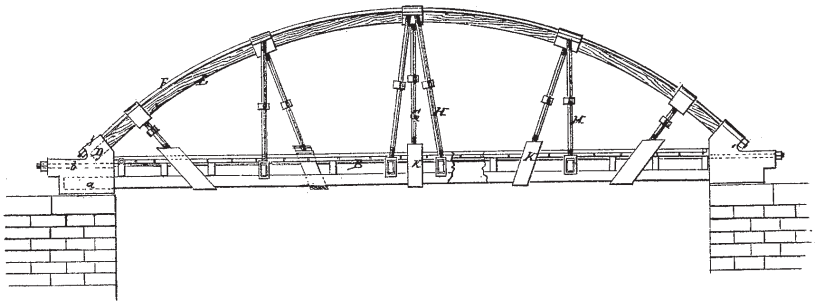
Charles Horton, Patent No. 595,629 (1897)



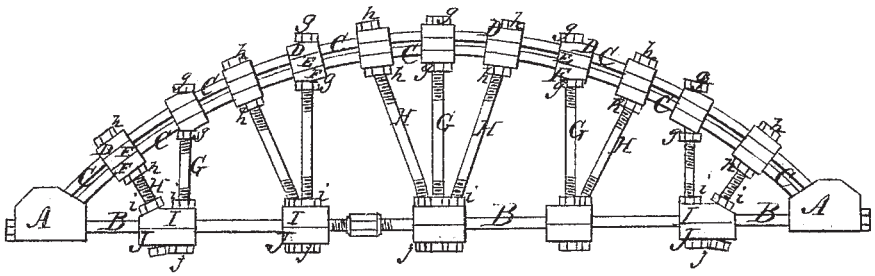
Richard Montgomery, Patent No. 25,210 (1859)



David McCurdy, Patent No. 104,867 (1870)



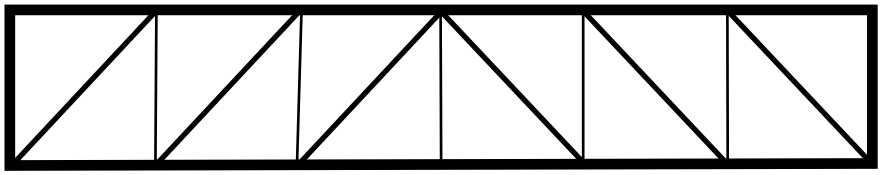
Charles Sreeves, Patent No. 114,363 (1871)



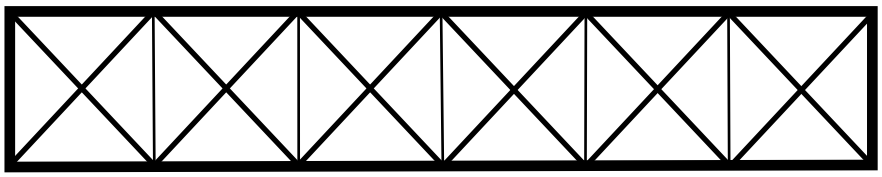
Oliver Perry & William Allen, Patent No. 120,319 (1871)

Howe Configurations

A Howe truss is characterized by rectangular panels with tension verticals and compression diagonals. The most commonly built variations of the Howe truss used timber for their upper chords and crossed diagonals, and wrought-iron for their lower chords and verticals. Although technically a "combination" truss due to the use of two materials, truss literature often refers to these examples as timber trusses, no doubt due to the earlier all-timber examples.



Howe truss - compression diagonals & tension verticals.



Howe truss with counters

PATENT CHRONOLOGY

Long, G. 1830: Timber. Polygonal top chord. Single compression diagonal in each panel.

Long, S. 1830, 1836, 1839: All of Steven Long's patented trusses have timber chords and web members. Due to the joinery system they have tension verticals and compression diagonals. They have no iron members.

Howe 1840, July: Timber. Pattern of V-shaped bracing in each panel. Full-span arch.

Howe 1840, Aug.: Crossed, double-intersecting, compression diagonals. All-timber except for vertical rods.

Osborn 1845: First all-metal Howe truss configuration. Not patented.

Hassard 1846: Timber. Multi-panel struts at ends.

Harbach 1846: Iron pipe used for all members except for vertical rods.

Childs 1846: Timber except for counter rods.

Fink 1857: Timber. All panels have crossed diagonals plus ties from diagonal intersections to lower chord.

Briggs 1858: Timber chords. Rubber pad "springs" in compression joints.

Ham 1859: Curved, iron, top chord, with three additional full-span arches.

Jones 1860: Diagonals are pipes. Verticals are rods. Sloped end posts.

Heath 1862: Forked diagonals. Screw sockets used for lower-chord connections.

Jones 1863: Iron. Similar to the 1860 patent. Diagonals are stiffened.

Blackman & Blackman 1864: Timber with crossed-braced diagonals. Vertical rods. Post-tensioning rope below bottom chord.

Cole & Soule 1866: Threaded iron-rod bottom chord. Timber compression members.

Corey 1867: Timber diagonals notched into chords between vertical rods.

White, T. B. 1867: Iron. Built-up hollow sections for chords and diagonals.

Rust & Herrmann 1868: Iron. Inclined end posts.

Thompson 1868: Iron. Curved top chord. Crossed diagonals. Multi-bar chords.

White, T. B. 1869: Iron. Four piece, concave, quarter-arc, diagonal struts and end posts.

Ensign: 1869: Chords are trussed beams. Diagonals and verticals are not to same points on chords.

Cartter 1870: Timber top chord and web bracing. Lower chord of interlocking iron plates.

McDowell 1870: Timber chords and splayed crossed diagonals. Vertical rods. Double-sloped top chord in end panels.

Burke 1871: Steep-pitched diagonals. Rod verticals and reversed, sloped diagonals.

Cartter 1872: Timber top chord and crossed diagonals. Wrought-iron bottom chord and verticals. Special shoe connects bottom chord, end post, vertical rod, and timber diagonal.

Anderson 1873: Bottom-chord bars lapped and secured by threaded lateral rods and nuts.

Bower 1873: Single timber diagonal in all panels. Vertical rods. Cambered chords.

Bogardus 1874: Curved-chord truss with Howe, Pratt and double Warren characteristics. Pipe used for compression diagonal contains a tension rod. Panel lengths increase toward mid-span, which permits diagonals to be parallel.

Densmore 1877: Timber top-chord. Number of bars in bottom chord increase toward mid-span.

Irelan 1877: Timber. Sloping roof-truss type chord. Mid-height struts parallel to top chord.

Gorrill 1880: Center panels of timber top chord have a sub-chord.

Fritz 1884: Timber chord and crossed diagonals. Paired vertical rods. Multi-rod bottom chord.

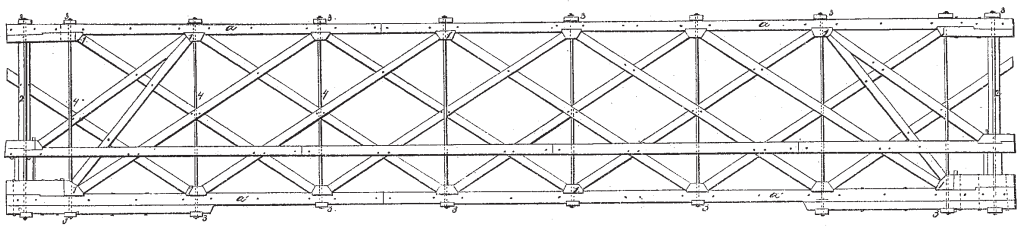
Carr & Carr 1885: Timber top chord and diagonals. Bottom chord and verticals are rods.

Buckley 1887: Timber chords, plus wire cables underneath bottom chord.

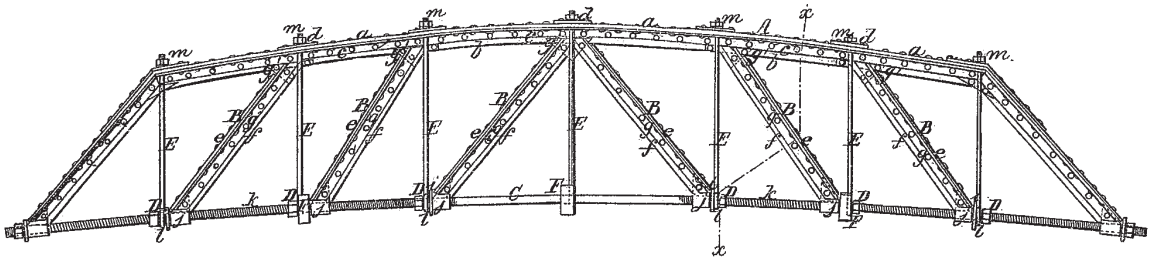
Lane 1890: Chords and diagonals are used rails. Verticals are rods.

Weiss 1893: Lengths of all members are adjustable.

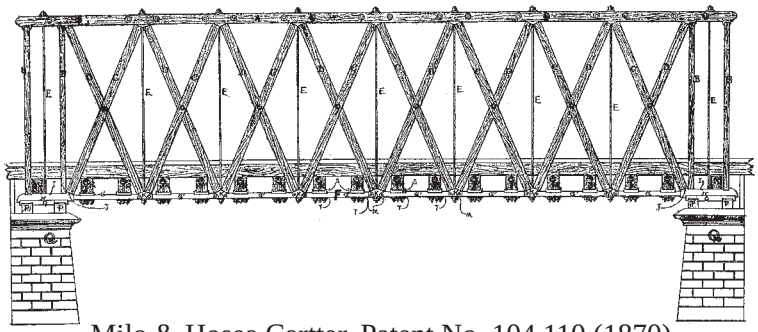
Greiner 1894: Truss members are used rails. Single diagonal in panels.



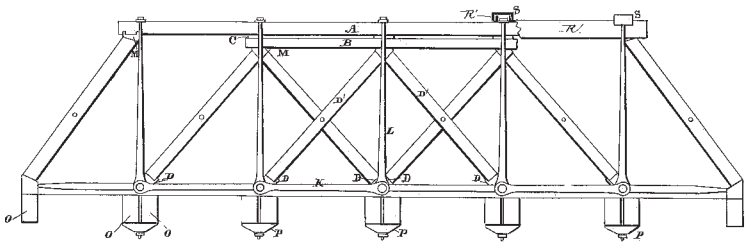
William Howe, Patent No. 1,711 (1840)



George Heath, Patent No. 35,374 (1862)



Milo & Hosea Cartter, Patent No. 104,110 (1870)



Richard Gorrill, Patent No. 224,677 (1880)

Trusses with Multi-Panel Diagonal Struts

Haupt 1839: Tripl- intersecting compression struts and half-span diagonal struts.

Long 1839: Optional configuration included a version with multi-diagonal struts.

Howe 1840: Double-intersecting diagonals. Vertical rods.

Pratt & Pratt 1844: Timber chords and verticals with crossed iron diagonals. Four-panel-long strut at ends.

Hassard 1846: Multi-panel struts radiating from abutment. Cross-braced center panels. Single compressive strut in end panels.

McCallum 1851: Two radiating diagonal struts at each abutment.

Gridley 1852: Half-span diagonal braces. Compression diagonals below brace, cross-bracing above. Iron verticals at half-panel points.

McCallum 1857: Single diagonal strut at each abutment.

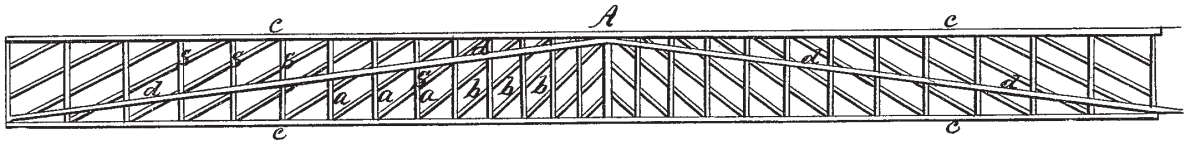
Eikenberry 1861: Half-span struts from abutments. Triple-intersecting struts in web.

Davis, B. 1873: Bowstring configuration. Radiating struts from center of timber bottom chord. Combination of timber and iron verticals.

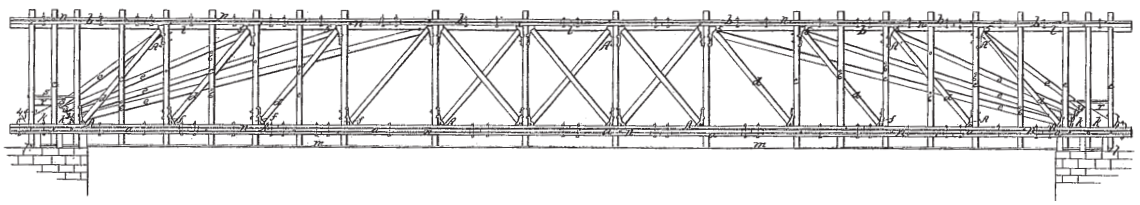
Cooley 1878: Half-span diagonals brace with struts between brace and top chord. Single-panel diagonal in end panels. Vertical rods alongside timber verticals.

Holt 1879: Timber. Sloped top chord. Radiating verticals. Paired diagonals extend across three panels from abutment to top chord.

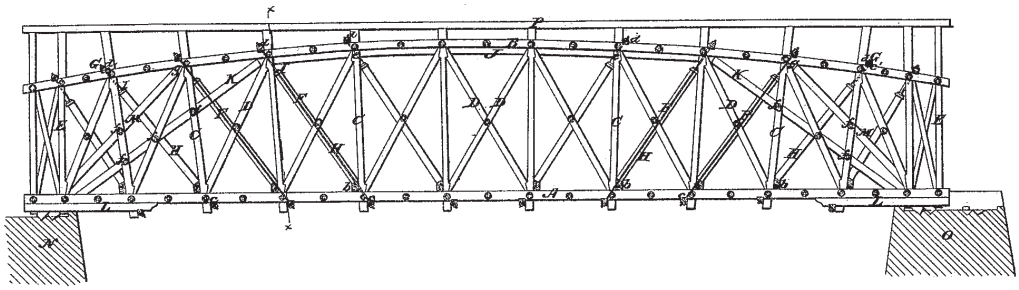
Jones, J. H. 1885: Timber. Multi-layered web of inclined verticals and multi-panel diagonals.



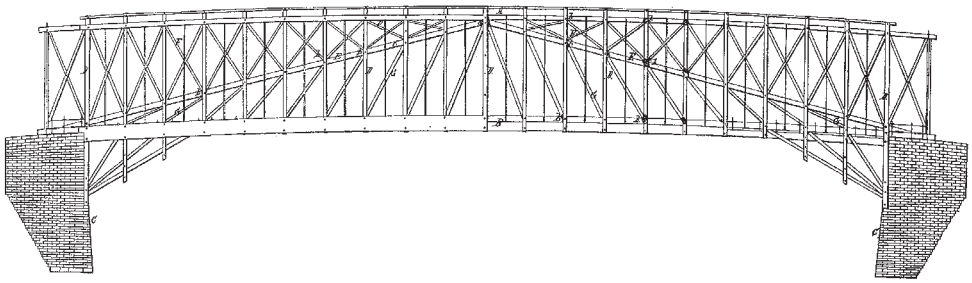
Herman Haupt, Patent No. 1,445 (1839)



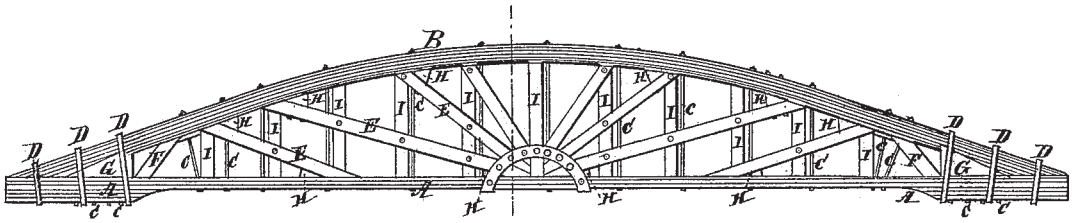
Thomas Hassard, Patent No. 4,359 (1846)



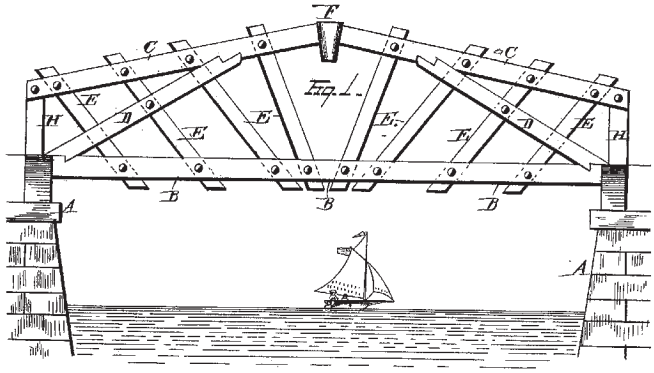
Daniel C. McCallum, Patent No. 8,224 (1851)



J. B. Gridley, Patent No. 9,093 (1852)



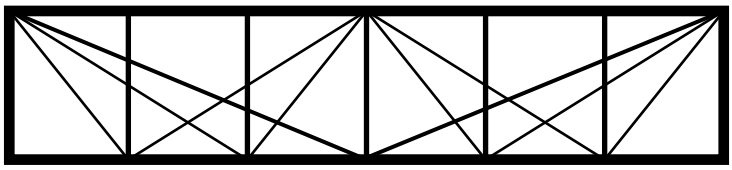
Benjamin Davis, Patent No. 143,125 (1873)



Samuel Holt, Patent No. 215,223 (1879)

Suspension Trusses

Parallel chord trusses with additional diagonal tension members that either directly support the bottom chord or the lower end of vertical compression members.



PATENT CHRONOLOGY

Trumbull 1841: Tie-rods from top of end posts to center of bottom chord.

Bollman 1852: Diagonals radiate from top of end posts to bottom of all verticals.

Champion 1854: Radiating rods. Cantilevered truss.

Fink 1854: Multiple pairs of diagonals support the bottom of verticals.

Smith, F. 1866: Bollman-type configuration with struts to common long diagonal. Least depth is at mid-span.

Smith, F. , 1869 May: Short-span, Fink-type configuration with least depth at mid-span.

Smith, F., 1869 Oct.: Overlapping Fink-like configurations.

Kellogg 1870: Pratt-type configuration with an additional diagonal in each panel.

Diedrichs 1872: Verticals are connected to at least one buttress by paired ties.

Schwatka 1873: Radiating clusters of verticals along lower chord's panel-points. Diagonal ties from cluster bases.

Hammond, Morse & Adler 1876: Counter ties to mid-point of adjacent posts.

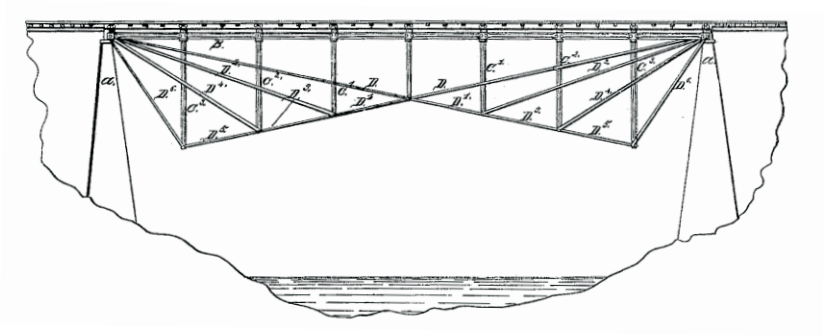
Houts 1879: Timber parallel chord truss with Bollman-like web.

Thacher 1881: Multiple diagonals from top of end posts and center post.

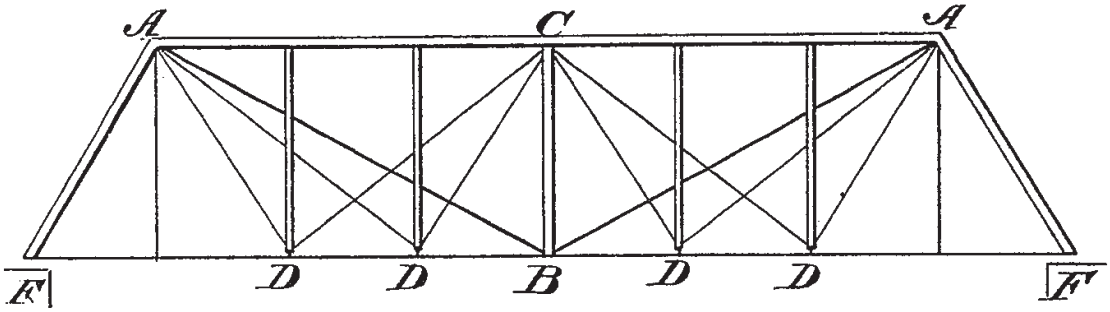
Thacher 1885: Methods to subdivide panels in his 1881 patent configuration**.**

Stearns 1890: Pratt configuration with alternate verticals omitted. Elongated panels.

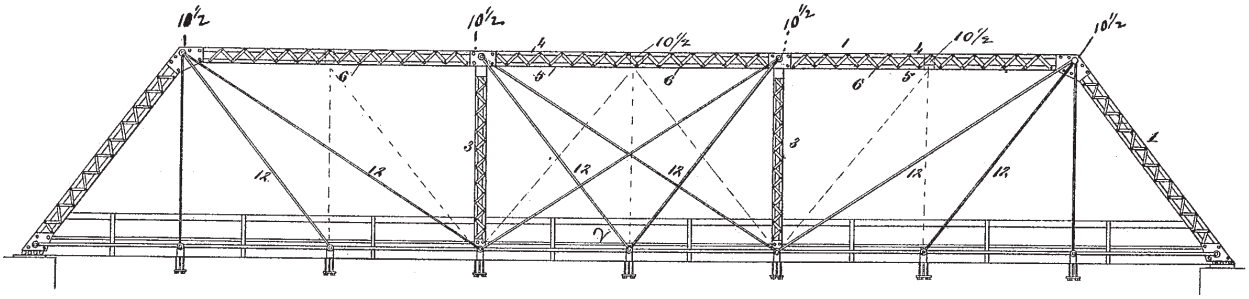
Stone 1892: Double- panel length diagonal from end posts. No diagonals in center panel.



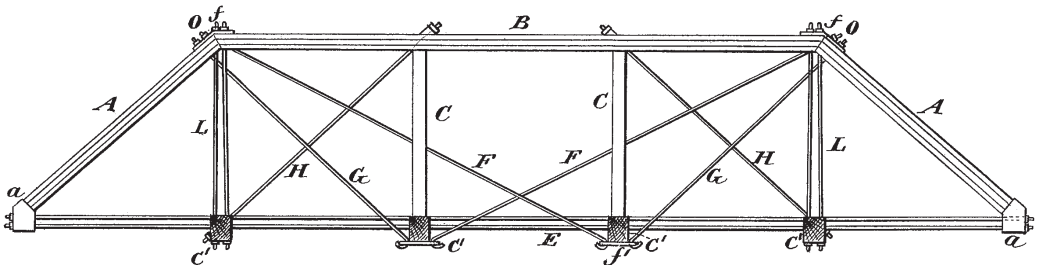
Frederick H. Smith, Patent No. 60,434 (1866)



Edwin Thacher, Patent No. 242,396 (1881)



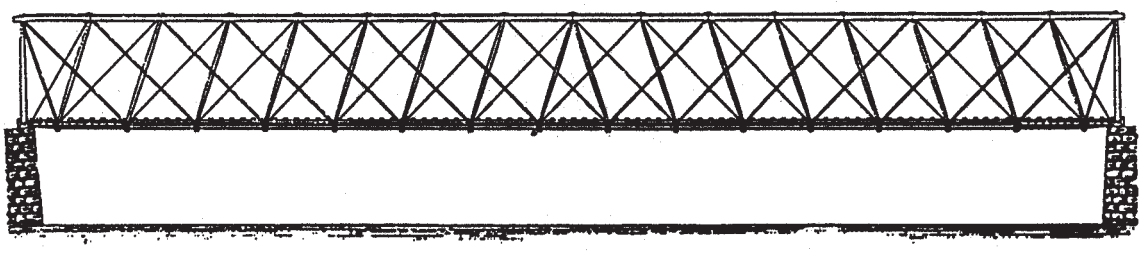
William Stearns, Patent No. 419,897 (1890)



Joel Stone, Patent No. 484,686 (1892)

Trusses with Inclined Verticals

The "Post" truss was an oft-used configuration for long-span railroad bridges from the 1860s to 1870s. It was named after engineer Simeon Post, who popularized the form with inclined verticals, but did not patent it.



PATENT CHRONOLOGY

Long, S. H. 1847: True verticals with additional tilted verticals in end thirds of span.

Long, S. H. 1858: Same as 1847 configuration with addition of a reversed arch.

Post, S. ca.1863: A double-intersecting Pratt configuration with verticals that are inclined a half-panel length. Although popular for a period of about 35 years, this configuration was not patented.

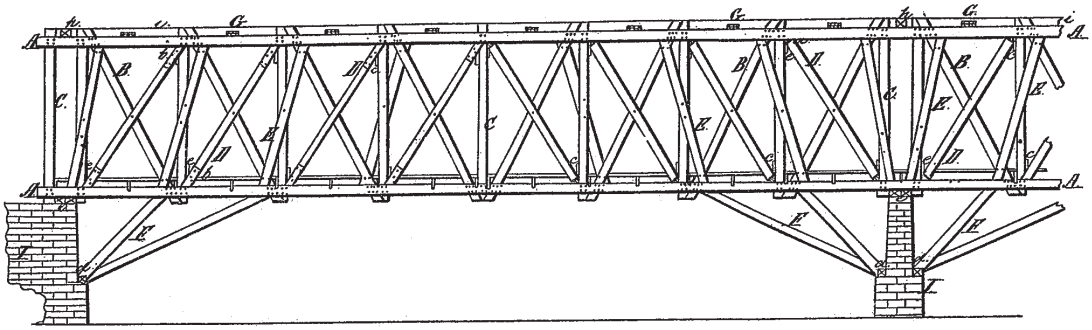
Foreman 1868: Timber chords and inclined verticals. Double-intersecting diagonal rods.

Smith, F. 1869: Drawing shows a "Post truss" configuration, however the patent's focus is the connections not the configuration.

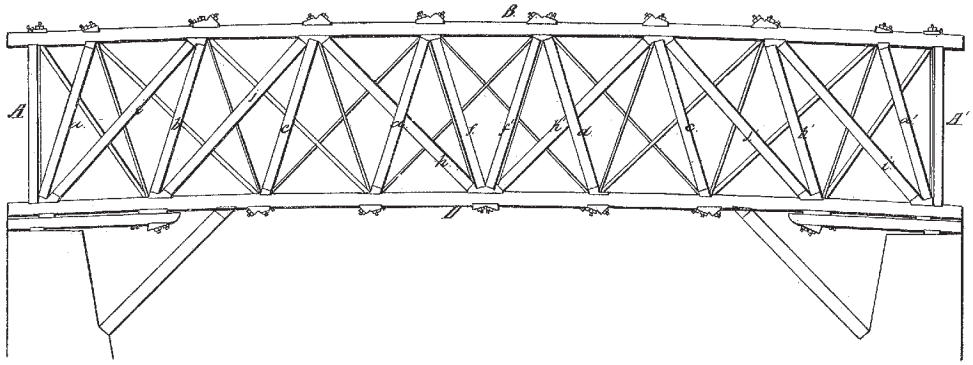
Smith, F. 1872: Double-intersecting Pratt configuration. The centerlines of the verticals converge to a point considerably above the center of the truss.

Jones, J. H. 1885: Timber. Multi-layered web of inclined verticals, cross-braced panels, and multi-panel struts. Top and bottom chord panel points are offset by a half panel.

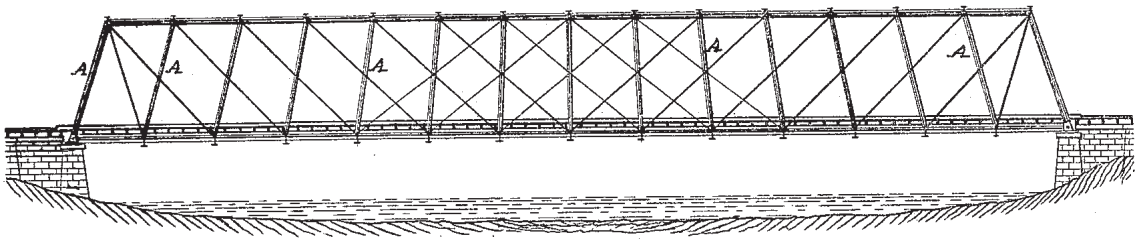
Pegram 1885: Polygonal top-chord Pratt variation. All segments of the top chord are of the same length, resulting in a progressive tilting of the verticals.



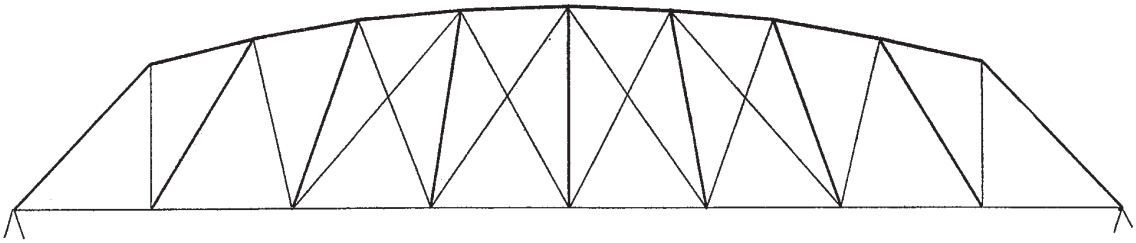
Stephen H. Long, Patent No. 5,366 (1847)



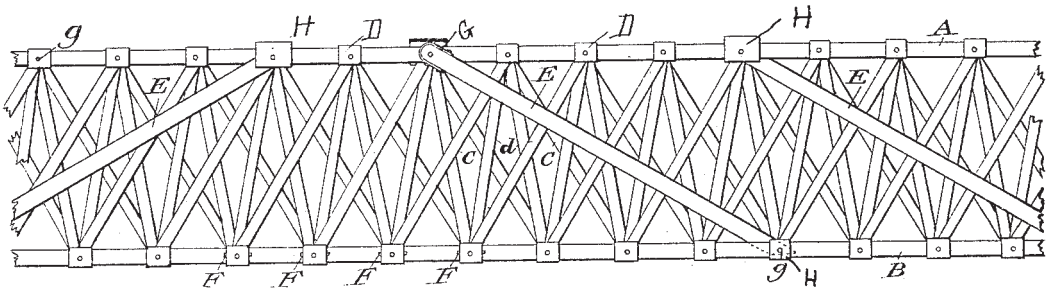
John Foreman, Patent No. 78,797 (1868)



Frederick H. Smith, Patent No. 128,449 (1872)



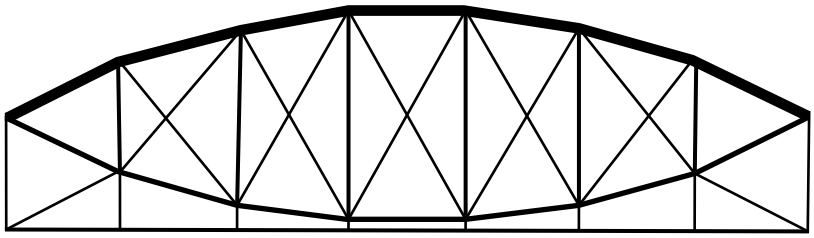
George Pegram, Patent No. 314,262 (1885)



John Jones, Patent No. 318,626 (1885)

Lenticular Configurations

Lenticular trusses have both top and bottom chords curved over their entire length. This form is most efficient when the panel points lie along a parabolic curve. Configurations that do not contain diagonals in their webs are not capable of true truss action and are indicated with a # symbol.



PATENT CHRONOLOGY

Barnes, J. 1849: Chords follow an elliptical or oval curve. Deck located at mid-height.

Stanley 1851: Timber top chord. Wire-cable bottom chord.

Harvey & Osborn 1856: Timber top chord. Wire suspension bottom chord.

Kremser 1866: Lattice web. Mid-height bridge deck.

Dieckman 1871: Mid-height horizontal tie. Secondary set of webbing between it and the bottom chord.

 # Harding 1872: Vertical tension rods connect opposing trussed arches.

Conklin 1876: Chords formed with straight segments. Three additional full-span horizontal chords.

Douglas 1878: Top and bottom chords composed of three straight segments.

Strobel 1884: Series of continuous lenticular trusses joined at inflection point.

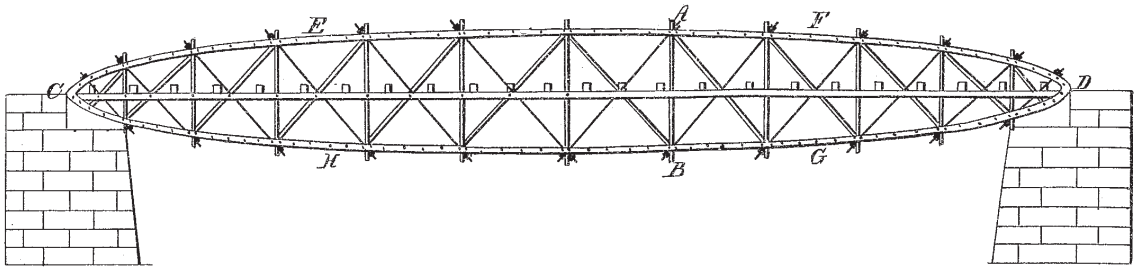
Douglas 1885: Chord segments between panel points are straight. Panel points all lie on a parabolic curve. Wind struts in end panels.

Werner, Feb. 1885: Two lenticular trusses form segments of a three-hinged arch that supports the bridge deck above.

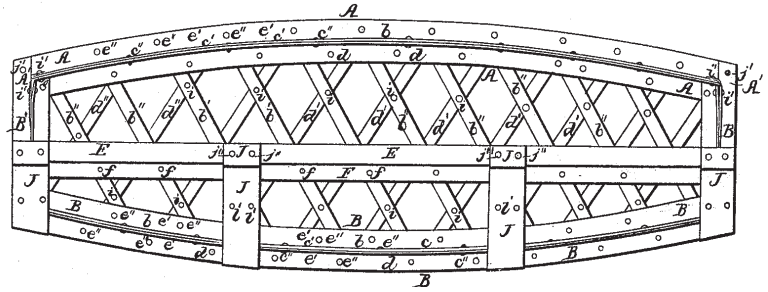
Werner, Oct. 1885: Two lenticular trusses form segments of a three-hinged arch. A hanger from the apex supports the mid-span of the bridge deck below.

 # Pulliam 1893: Trussed timber girder with lenticular appearance.

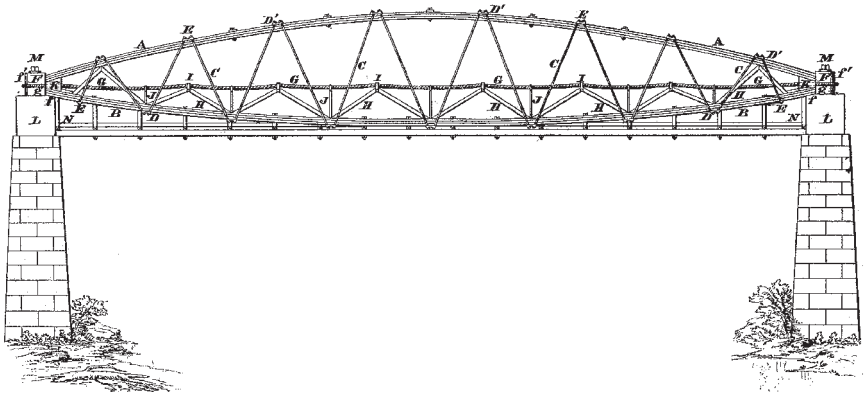
 # Semmes 1896: Width as well as depth increases towards mid-span. Web contains only verticals. Not a true truss.



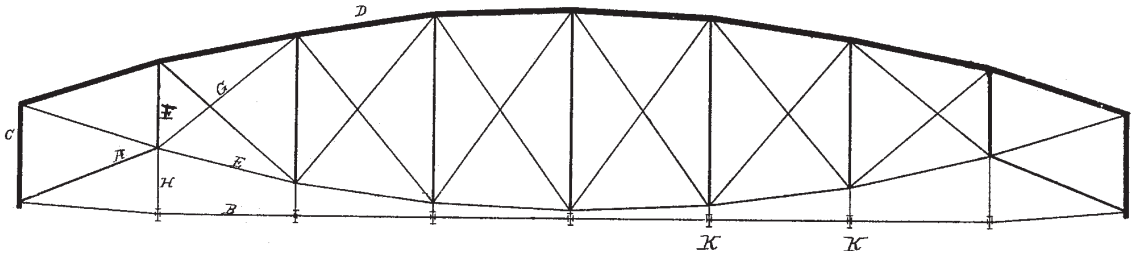
James Barnes, Patent No. 6,230 (1849)



Marten Kremser, Patent No. 52,860 (1866)



Ferdinand Dieckman, Patent No. 113,030 (1871)



William Douglas, Patent No. 315,259 (1885)

Indefinable and One-of-a-kind Fanciful Truss Proposals

Unique proposals that are whimsical, picturesque fantasies, or downright silly.

PATENT CHRONOLOGY

Pennington 1851: Web of overlapping crossed diagonals. Undulating and reversed super-imposed arches.

Bradway & Valentine 1852: Timber web diagonals alternate slope direction in adjacent panels. V-shaped pattern of overlapping two-panel-wide rods. Vertical rods are paired.

Yandell & Johnson 1854: Both top and bottom chords are wires. Additional suspension cable to mid-span.

Huygens 1856: Crossed, superimposed compensating arches.

Durden 1858: Tied arch. Stiffening truss with tension top chord.

Eikenberry 1869: Combination of arches and multi-intersecting chordless truss.

Fisher, J. P. 1860: Series of iron arches. Wire rope ties and network of web bracing.

Eikenberry 1861: Combination of half-span struts and multi-intersecting chordless truss.

Boles 1863: Web of overlapping rings and verticals, backed by a full-span arch.

Batchelder 1865: Spider-web network of rods and junction nodes.

Boles 1865 (Patent No. 47,920): Web of overlapping U-shaped braces, plus a variety of full-span arches and ties.

Boles 1865 (Patent No. 48,013): Web of overlapping U- and V-shaped braces, plus full-span arch.

Montgomery 1868: Curved top chord. Panels contain an asymmetrical pattern of timber diagonals.

Campbell 1870: Compensating cables interconnect levered arched braces. Counterweights, tower-top pulleys, suspension supports, and friction drums.

Seebold 1870: Cable stays. Knee-brace struts. Three systems of web members.

Hastings 1872: Bowstring configuration with "compensating counter arch."

Schwatka 1873: Fink-like suspension truss system with clusters of splayed verticals along lower chord panel points.

Lawrence 1881: Combination of forms. Continuous wire alongside diagonals. Verticals omitted in end panels. Trussed bottom chord. Extra posts at ends.

Stephens 1882: A-frame floats on water surface during floods.

Schmemann 1885: Upright and reversed intersecting pipe arches. Additional one-third span arches.

Loomis 1892: Web of intersecting circles, plus suspension cable.

Eddy 1893: Suspension cable with superimposed bowstring with a cable top-chord.

Subgroup of Indefinable Trusses with a Missing or Discontinuous Top Chord

Lanergan 1850: Three overlapping tied arches with radial verticals.

Thayer 1854: Multiple overlapping and interlocking timber arches.

Truesdell 1856: Lattice with inlaid cross-bracing having a St. Andrew's cross pattern.

Bruce 1862: Overlapping king-post design. Cambered bottom chord.

Tracy 1871: Warren truss, with a stiffening truss, which dips down at mid-span, secured above the upper chord.

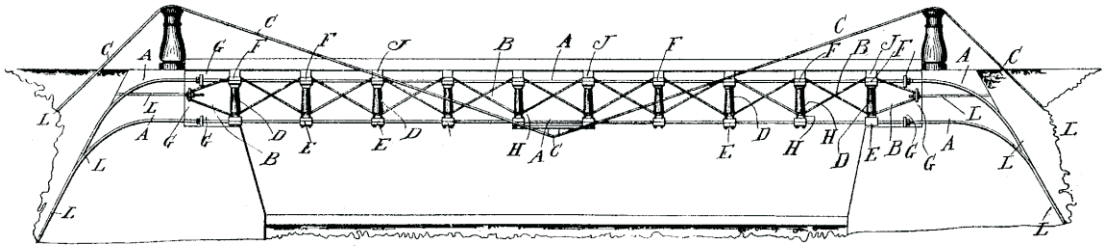
Kersten 1884: Undulating bottom chord. Series of contiguous inverted king-posts.

Marks 1886: Crossed timber diagonals. Verticals and bottom chord are rods.

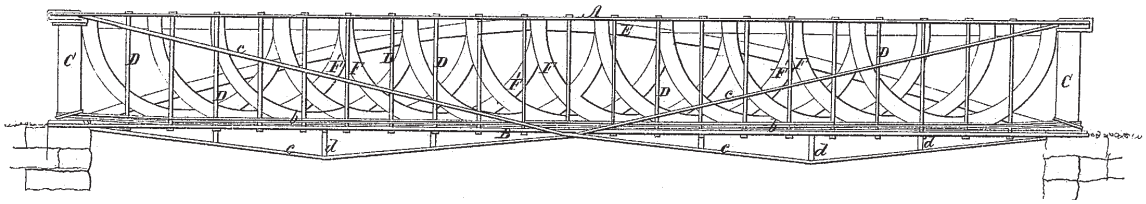
Knudson 1887: Series of overlapping king-posts. Balance scale for weighing traffic.

Webb & Haag 1890: Stacked Warren web configurations. Made from bent railroad rails.

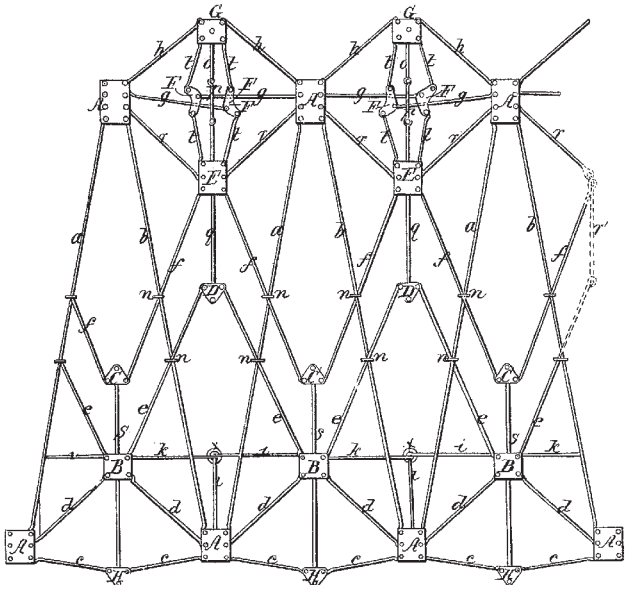
Semmes 1897: Cambered bottom chord. Single mid-height chord. Non-symmetrical pattern of timber diagonals. Vertical rods.



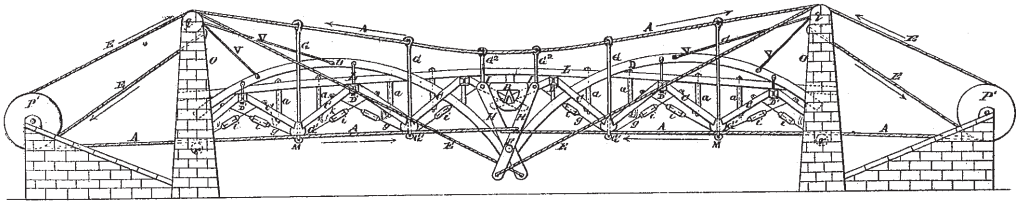
John Yandell and Joseph Johnson, Patent No. 11,818 (1854)



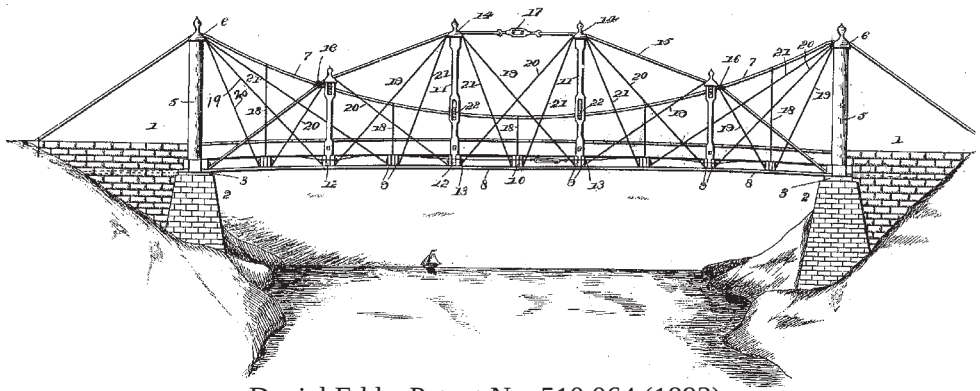
John Boles, Jr., Patent No. 47,920 (1865)



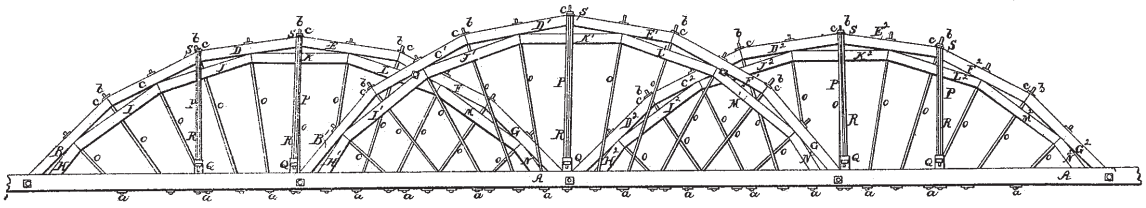
William Batchelder, Patent No. 48,643 (1865)



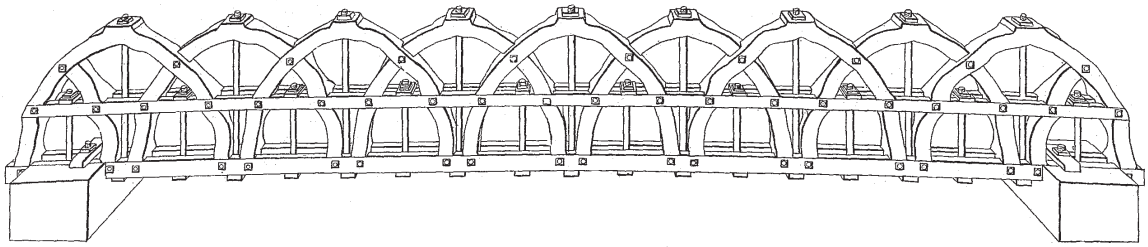
Alexander Campbell, Patent No. 110,546 (1870)



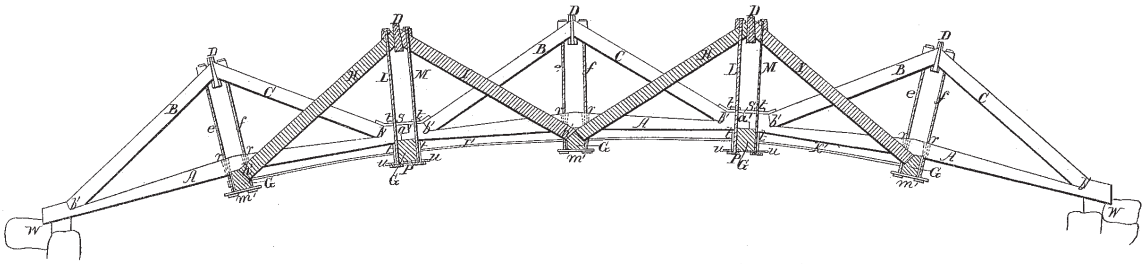
Daniel Eddy, Patent No. 510,064 (1893)



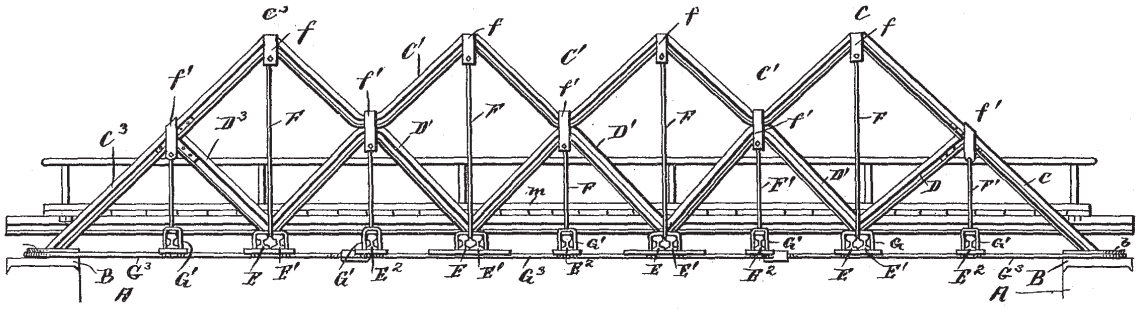
Henry Lanergan, Patent No. 7,305 (1850)



George Thayer, Patent No. 10,765 (1854)



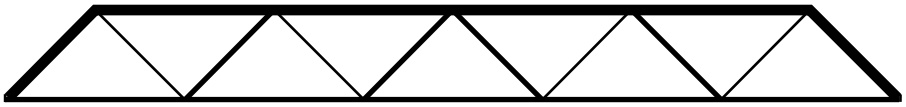
George Bruce, Patent No. 34,102 (1862)



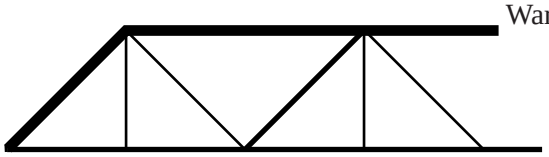
Stephen Webb & Lewis Hagg, Patent No. 438,511 (1890)

Warren Configurations

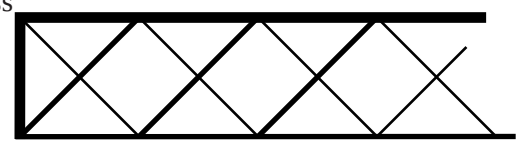
Warren trusses are characterized by a web configuration composed of contiguous triangles. Stresses in the alternating sloped diagonals alternate between compression and tension. Warren configurations fall into four broad sub-categories: (1) simple Warren, i.e., web of alternating sloped members forming triangular patterns; (2) double-intersecting Warren, i.e., web composed of two overlapping sets of sloping diagonals; (3) Warrens with verticals, i.e., verticals extend from apex of triangles to either or both chords; (4) subdivided Warrens where the basic triangular pattern is subdivided (developed in the twentieth century and therefore not included).



Warren truss



Warren truss with verticals



Double-intersection Warren truss

PATENT CHRONOLOGY

Brown 1857: Timber. Double-intersecting Warren, with center-span vertical tie rod.

Briggs, A. 1858: Timber members except for the tension diagonals in the web, which are rods.

Fink 1867: Simple Warren with verticals. Timber top chord. Vertical rods. Top chord and diagonals are timber. Bottom chord and first diagonal are wrought-iron bars. Patent re-issued in 1870 and 1881.

Smith, R. W. 1867: Timber. Double-intersecting pattern. Extra web strut at ends. Pair of cross braced-verticals at mid-span.

Steele 1867: Double-intersecting Warren. Verticals only at ends.

McKay 1869: Timber. Double-intersecting Warren. Double verticals at ends.

Smith, R. W. 1869: Timber. Double-intersecting pattern. Extra web strut at ends. V-shaped pattern of struts at mid-span.

McKay 1871: All timber. Double-intersecting Warren. Double verticals at ends.

Pratt 1871: Simple Warren. Channel sections for chords and web members. Fish-plate connected joints.

Partridge 1872: All timber. Double-intersecting Warren. Tension diagonals slope at 60 degrees, compression diagonals at 45.

Pratt 1873: Simple Warren. Timber. Three-piece chords and two-piece web members.

Sellers 1873: Equalateral triangles. No web verticals. Tubular members.

Bogardus 1874: Curved-chord double-intersecting Warren with verticals. Diagonal pipe struts have inserted rods. Panel lengths increase toward mid-span permitting parallel diagonals.

Hemberle 1874: No web verticals. Curved ends.

Hammond 1876: A pair of T-shaped flanges connected by a web of lattice bars arranged in a pattern of repetitive triangles. More likely to be used as a girder than a truss.

Wheeler, C. W. 1880: Inclined end posts. The wider triangles used for the end panels are subdivided by vertical ties.

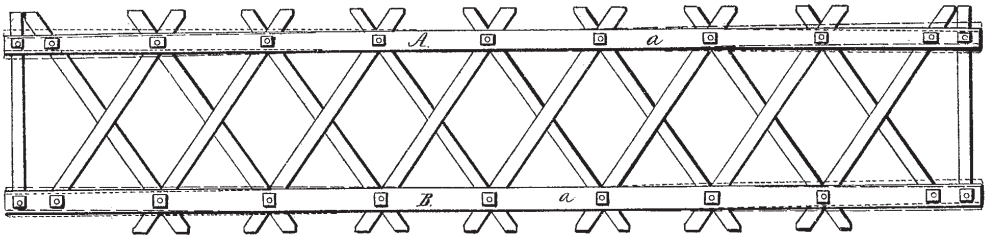
Fink 1881: Sub-divided. Verticals at apexes and midway between apexes.

Brochocki 1888: Kit of parts for assembling Warren trusses. Originally a French patent.

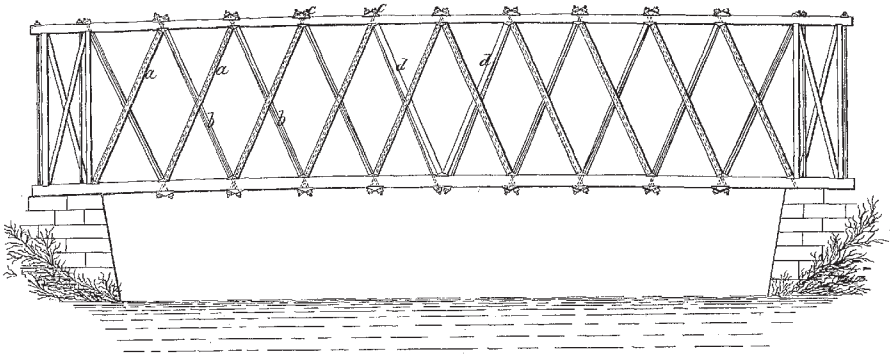
Duval 1888: Double-intersecting Warren with verticals at alternate panel points.

Morse & Sylvester 1897: Diagonals intersect slightly below top chord. Configuration proposed for a draw-bridge.

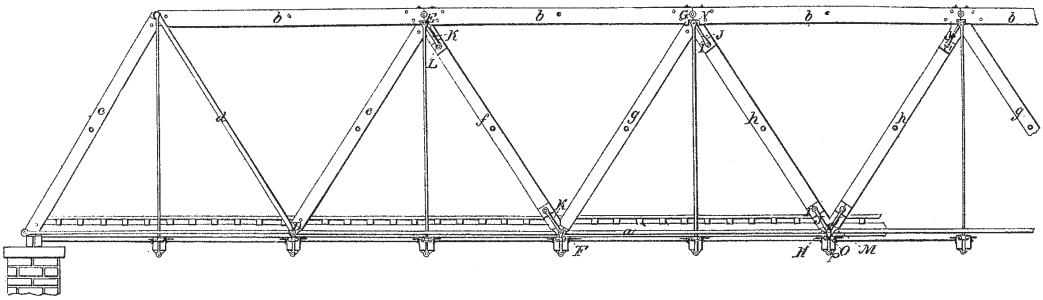
Davidson 1898: Double-intersecting Warren. Third chord at mid-height. Channel sections for chords and web members. Riveted fishplate joints.



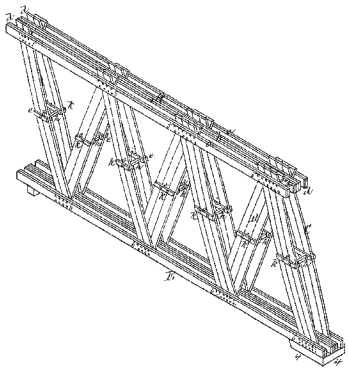
Josiah Brown, Patent No. 17,722 (1857)



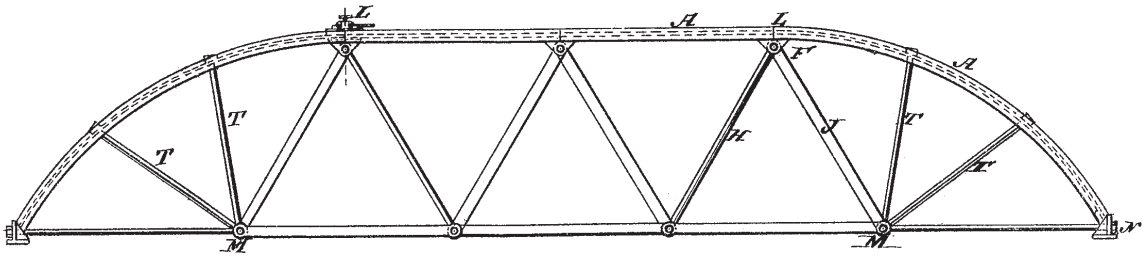
J. Dutton Steele, Patent No. 63,666 (1867)



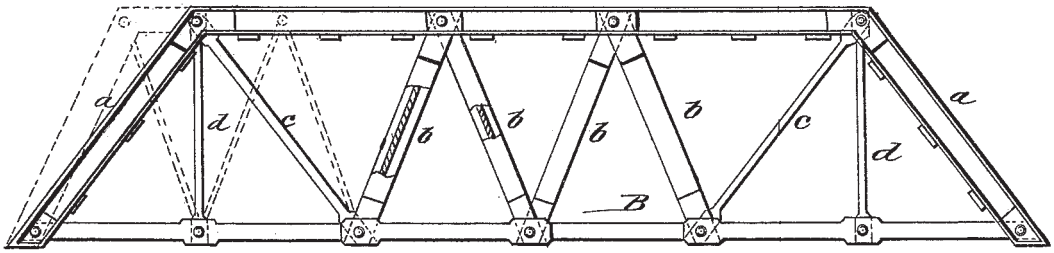
Albert Fink, Patent No. 63,714 (1867)



Thomas Pratt, Patent No. 137,482 (1873)



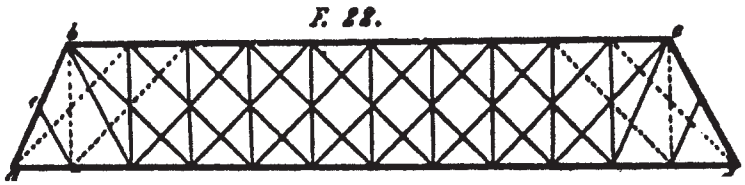
Edward Hemberle, Patent No. 152,489 (1874)



Cyrus Wheeler, Patent No. 231,383 (1880)

Pratt Family of Trusses with Multi-intersecting Diagonals

Pratt-type configurations where tension diagonals cross two or more verticals.



Whipple's double-intersecting truss, an extensively used configuration, was never patented. This drawing is from Whipple's *A Work on Bridge Building, 1847*.

PATENT CHRONOLOGY

Lowthorp 1857: Segmented upper chord. Vertical post connection designed to permit "vibrations."

Murphy 1861: Detail for the use of eye-bars and pins.

Linville 1862: Connection detail for double-intersecting trusses.

Kendall 1862: Alternating tension and compression verticals. Additional chord at mid-height. Lattice effect.

Murphy-Whipple 1863: Not patented. Double-intersecting Pratt configuration. Wrought iron used for tension members and cast iron for compression members. Pin-connected joints.

Whipple-Murphy 1863: Alternate name for Murphy-Whipple.

Linville & Piper 1865: Detail for improving double-intersecting truss connections.

Smith, F. H. 1869: Patent is for a joint detail. A double-intersecting truss configuration is shown to demonstrate the application of the detail.

Herthel 1870: Double-intersecting diagonals pass through verticals. No counters. Vertical end posts.

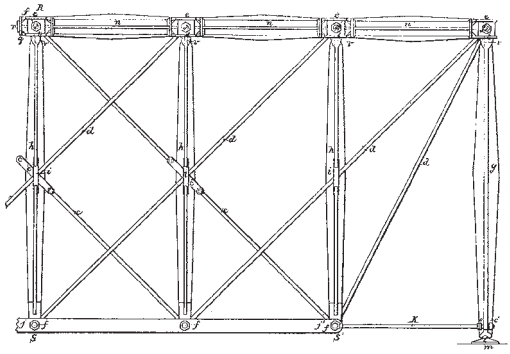
Smith, F.H. 1872: Double-intersecting diagonals. Verticals and end posts are inclined; their center lines converge to a point high above the centerline of the span.

Whipple 1872: Patent for a vertical-lift drawbridge features his unpatented double-intersecting truss configuration.

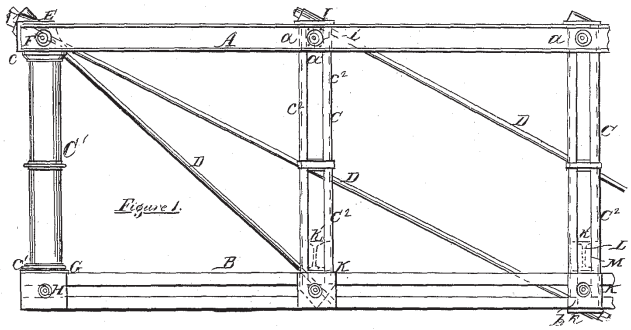
Clark, Bonzano & Griffen 1873: Diagonals intersect four panels.

Hammond, Morse, & Abbott 1876: Pratt single-diagonal configuration with double-intersecting counter-diagonals.

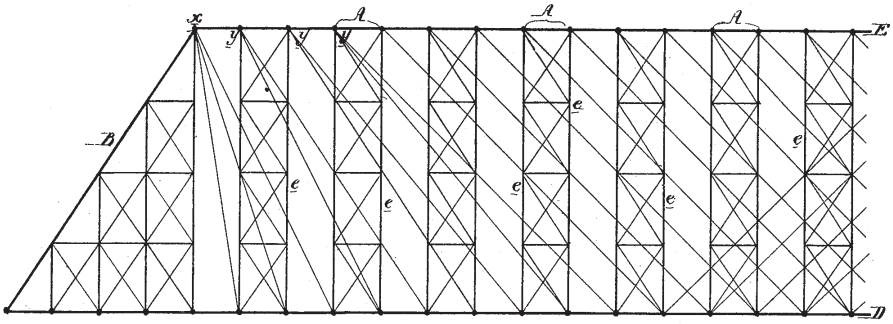
Davies 1877: Double-intersecting tension diagonals. Double end posts. Double compression diagonal in end panels.



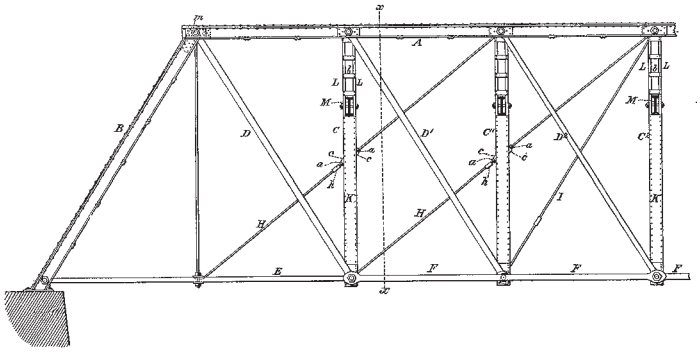
Francis C. Lowthorp, Patent No. 18,548 (1857)



George Herthel, Jr., Patent No. 98,866 (1870)



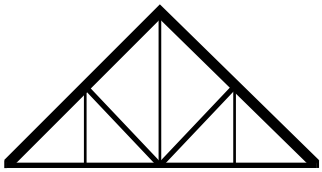
Thomas Clark, Alphonse Bonzano & John Griffen, Patent No. 140,471 (1873)



David Hammond, Henry Morse & Job Abbott, Patent No. 184,520 (1876)

A-Frame

A sloped top chord variation of the Howe truss. A common roof truss configuration occasionally used as a bridge truss. Diagonals are compression members and verticals are tension members.

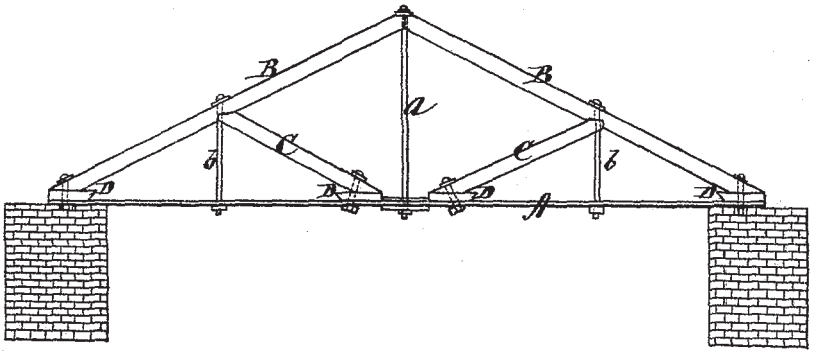


PATENT CHRONOLOGY

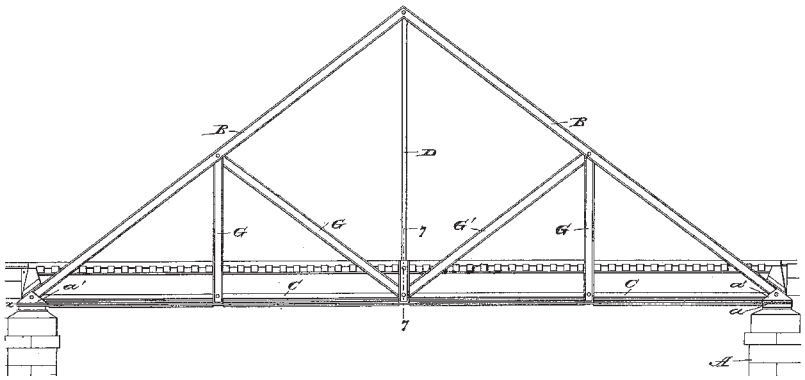
Baker 1869: Timber except for vertical rods. Top chord extends past bottom chord to masonry buttress.

Warner 1872: Timber top chord and diagonals. Iron bottom chord and vertical hangers.

Waddell 1894: Steel.



Charles Warner, Patent No. 130,959 (1872)



J. A. L. Waddell, Patent No. 529,220 (1894)

King-Post Configurations

The term "king-post" is often a misnomer, as in most situations the vertical is not a post, but a tension member. When inverted, the vertical is a true post because it is in compression. Some historians have referred to Howe configurations having only one diagonal in each panel as "multiple king-posts."

PATENT CHRONOLOGY

McCurdy 1870: Curved top chord.

Reiling 1873: Timber with tension iron vertical. Diagonal timber struts.

McDonald 1876: Timber king-post superimposed on a Vierendeel configuration with three horizontal chords.

Coultas 1877: Inverted king-post configuration with compression post and tension diagonals.

Sherman 1877: Inverted king-post configuration with compression post and tension diagonals.

Sullivan, Kessler & Foster 1880: Timber chords. Vertical is a double rod.

Ramsey 1888: Inverted. Deck bridge. Chord members are rails.

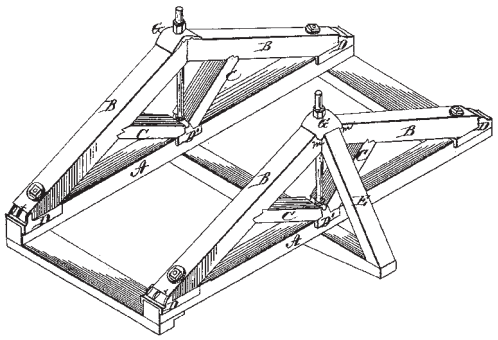
McGiffin 1890: Timber with rod vertical.

McPherson 1882: Timber. Vertical rod. Wire-rope lower chord.

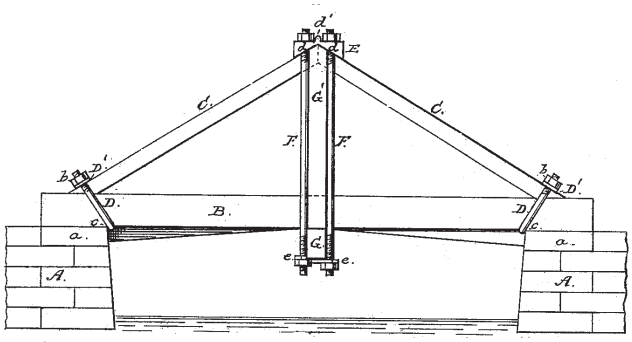
Paisley 1889: Parallel-chord, two-panel Howe. Tubular chords. Vertical rod. Has the appearance of a king-post within a rectangular configuration.

Fenn 1894: Vertical rod is kinked to bypass bottom chord and connect directly to floor beams.

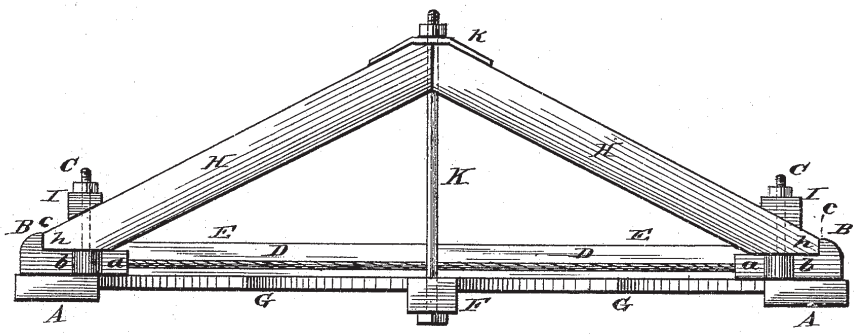
Davis 1897: Inverted. Deck truss. Top chord is a wide-flange beam with the lower flange peeled off to form the bottom chord.



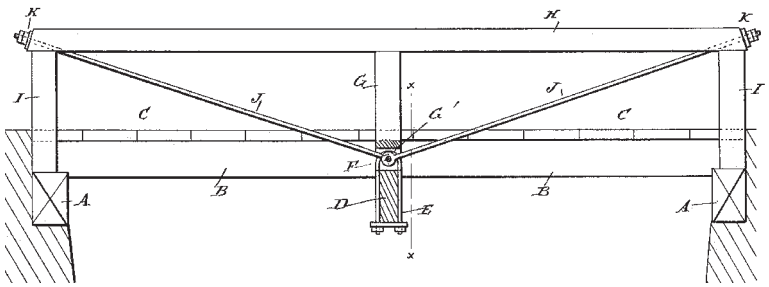
Arnold Reiling, Patent No. 145,685 (1873)



Mark Sullivan, Jacob Kessler & Josiah Foster, Patent No. 224,491 (1880)



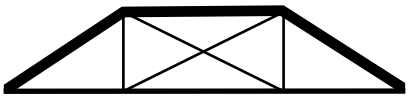
John McPherson, Patent No. 252,487 (1882)



George Coultas, Patent No. 365,970 (1887)

Queen-Post Configurations

Queen-post trusses have tension verticals and crossed diagonals. Inverted queen-post configurations have compression verticals and tension diagonals.



PATENT CHRONOLOGY

Palmer 1876: Timber top chord. Cable bottom chord. No diagonals in center panel.

Mullin 1877: Timber top and bottom chords and crossed diagonals. Vertical rods.

Borneman 1879: Timber top chord and vertical compression posts. Crossed diagonal rods.

Sullivan, Kessler & Foster 1880: Timber chords. Verticals are paired rods. No diagonals. Also, four panel (three verticals) variation without diagonals.

Sherwood 1887: Timber top chord. Bottom chord, verticals, and crossed diagonals are rods.

Ferguson 1891: Top and bottom chords, and crossed diagonals are timber. Verticals are rods. Diagonal timber strut in end panels.

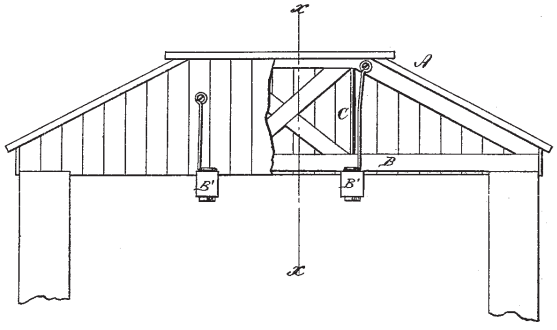
Hardesty 1892: Timber top chord. Compression posts are metal tubes. Lower chord and crossed diagonals are rods.

Ball 1893: Top chord is a pipe. Bottom chord, verticals, and crossed diagonals are rods.

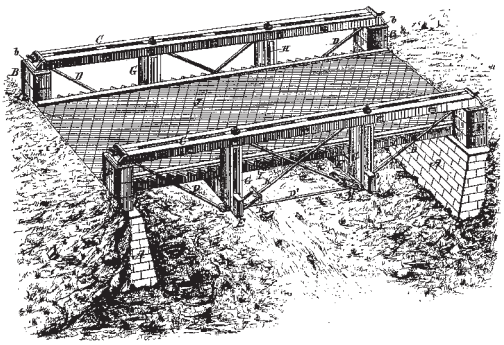
Avery, C. 1895: Top chord composed of pipes. Bottom chord, verticals, and crossed diagonals are rods.

Brelsford 1895: Timber top chord. Bottom chord, verticals, and diagonals are rods.

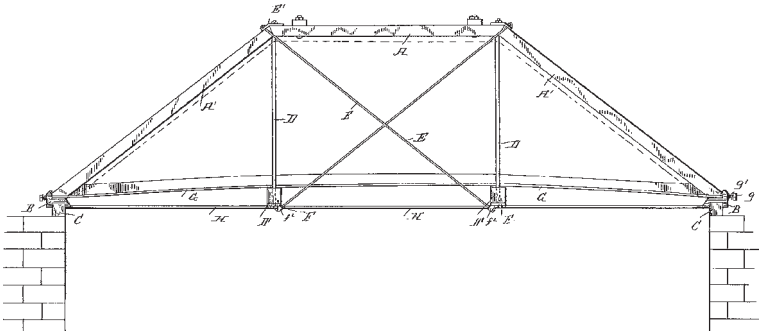
Brelsford 1899: Tubular top chord. Channel-iron verticals. Bottom chord and crossed diagonals are rods.



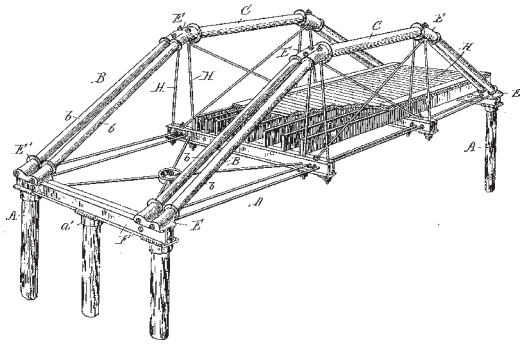
Thomas Mullin, Patent No. 192,450 (1877)



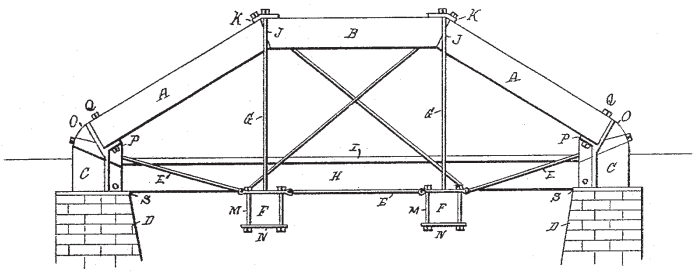
August Borneman, Patent No. 219,846 (1879)



Charles Sherwood, Patent No. 363,970 (1887)



Colby Avery, Patent No. 536,680 (1895)



William Brelsford, Patent No. 531,768 (1895)