(Lower) Rollstone Street Bridge
Spanning the Nashua River on Rollstone Street
Fitchburg
Worcester County
Massachusetts

HAER No. MA-102

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PHOTOGRAPHS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
Washington, DC 20013-7127

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HISTORIC AMERICAN ENGINEERING RECORD

(LOWER) ROLLSTONE STREET BRIDGE
HAER No. MA-102

Location: Spanning the Nashua River on Rollstone Street, City of Fitchburg, Worcester County, Massachusetts
UTM: Fitchburg, Mass., Quad. 19/269660/4718250

Date of Construction: 1870

Structural Type: Wrought- and cast-iron Parker pony truss

Engineer: Unknown; design based on 1870 patent by Charles H. Parker

Fabricator/Builder: National Bridge & Iron Works, Boston, Massachusetts

Owner: City of Fitchburg, Massachusetts

Previous Use: Vehicular and pedestrian bridge

Present Use: Barricaded and abandoned, 1980

Significance: The (Lower) Rollstone Street Bridge is one of only five known surviving Parker patent trusses in the United States, and the oldest of the three located in Massachusetts. It is also one of the two oldest known metal truss bridges in the state. The design is based on Charles Parker's 1870 patent for a truss bridge that was capable of being altered in length without changing the general proportion of the truss in other respects. The bridge incorporates most of the features claimed in Parker's patent, and is a very early example of this significant bridge type, which was one of the first to allow mass-production of interchangeable parts, and illustrates the spread of iron bridge technology from railroads to highways. The bridge fabricator, National Bridge & Iron Works, was a significant New England bridge-building company in the late-nineteenth century.

Project Information: Documentation of the (Lower) Rollstone Street Bridge is part of the Massachusetts Historic Bridge Recording Project, conducted during the summer of 1990 under the co-sponsorship of HABS/HAER and the Massachusetts Department of Public Works, in cooperation with the Massachusetts Historical Commission.

Lola Bennett, HAER Historian, August 1990

Description

The (Lower) Rollstone Street Bridge is a single-span, 111-foot, pin-connected, wrought- and cast-iron Parker pony truss. The polygonal upper chord, comprised of straight built-up sections, appears as an upward curve in elevation, and rises to a height of 12'-9" above the lower chord, at the center of the truss. This upper chord, with inclined endposts, is built up of three plates and four angles. The bottom chord is comprised of two pairs of parallel bars (approximately ¾"x6"), running between the inclined endposts. The upper and lower chords of each truss are connected by a series of ten I-section, wrought-iron verticals (8"x4"), decreasing in length from the middle of the truss outward toward the ends. Each of the verticals is connected to the upper and lower chords with pins. Within each panel framed by the verticals, are crossed diagonal tension members. The diagonals angling up toward the ends of the bridge are paired, 2"-diameter rods, while the counters angling down toward the ends are single, 1¼"-diameter rods. At the upper end, the diagonals pass through the upper chord and cast-iron skewbacks, where they are secured with nuts; at the lower end, each diagonal has an eye, and is secured to the vertical member with a single bolt. The counter-diagonals, however, are threaded at both ends; the lower end passes through the casting which forms the lower panel point, and is secured against the casting with a hex nut. The original floor system has been replaced with steel floor beams (6½"x18") and a mixture of steel and timber stringers. This floor system supports a timber deck, 29' wide, that has been paved with asphalt. There is a sidewalk, with a wood plank deck and an iron railing on the east side of the bridge--the one on the west side has been removed, and the railing is now on the inside of the truss. The inclined end posts terminate at cast-iron thrust blocks resting on granite rubble abutments. At both portals, the inclined endposts support ornate cast-iron bollards, with the inscription: "National Bridge & Iron Works, Boston, Parker Patent," on their faces.(See Figure 1 and field photos.) The design of this bridge incorporates the patent's featured segmental top chord with a sloping end panel which allowed the length of the bridge to be changed to fit a given site, while all the other parts could be mass-produced. The adjustable span length was a particular advantage at sites where the bridge would replace an earlier bridge, and would need to fit the existing abutments, as was the case with the Rollstone Street Bridge. The bridge also demonstrates Parker's attempt to eliminate the use of cast iron in favor of wrought iron for both tension and compression members--although cast iron was used for the skewbacks, the eyes at either end of the verticals, and the ornamental bollards. The bridge deviates from Parker's patent somewhat in the lower chord connections, where pins were used rather than the clamp system described in the patent and found in other Parker trusses, such as the North Village Bridge at Dudley/Webster (HAER No. MA-99).

Fitchburg

Situated in the northeastern part of the County of Worcester, Massachusetts, Fitchburg was a flourishing manufacturing community in the mid- to late-nineteenth century. The most significant geographical feature is the Nashua River, which flows through the city from west to east, taking a northerly arc through the downtown area. Although in the early days, the settlement experienced numerous setbacks due to floods, the river was probably the single most important factor which contributed to the city's eventual industrial success. A description of Fitchburg from 1889 said it this way:

> Fitchburg is pre-eminently a busy and thriving city, and probably no other place of its size can boast of a greater diversity of industries. The little stream running through the town was a source of great annoyance to the early settlers. The spring floods carried away their bridges, and the river was considered a nuisance and probable bar to the growth of the town. But coming years showed the folly of these fears. Dams were constructed, the water controlled, and manufacturers on a small scale began to locate on the banks of the formerly detested stream. Thus was a seeming curse turned into an evident blessing, for from those few mills have sprung the present great manufacturing concerns located here.[1]

About forty families lived in Fitchburg when it was incoporated in 1764, and there was only one mill--a saw and grist mill--located there at that time.[2] By the year 1800, the population had increased to 1390, and shortly thereafter, a cotton factory and a paper mill were established as the town's first industries.[3] Within fifty years, "there were nearly one hundred large manufacturing concerns in town and the population had increased to 11,260."[4]

Bridging the Nashua

A map from 1830 indicates that at that date, there were at least six bridges along the length of the Nashua River in Fitchburg, four of them in the center of town.(See Figure 2.) One of these bridges, adjacent to the mill pond at the Fitchburg Woolen Mill, was on the main road leading into town from the Albany-Boston Mail Road to the south. By the late 1840s, this road, originally called the "South Road," had become known as Rollstone Street. It was named for Rollstone Hill, a rocky hill rising 300 feet, to the immediate southwest of the town center.(See Figure 3.)

In 1849 the town paid $1050 to the firm of Stone & Harris of Springfield, for a new bridge on Rollstone Street.[5] This bridge, described as a "wooden truss bridge," in a later annual report[6], managed to survive the flood of 1850, but was seriously damaged in the flood of 1869. The Fitchburg Sentinel reported:

> One of the most severe rain storms occurred on Monday last, that has taken place since Noah's time. The consequence was a sudden and unprecedented rise of water in the rivers and brooks through all the Eastern States. ...The streets and roads in this town were badly washed, and in many places rendered impassable. All, or nearly all the bridges on roads leading to the neighboring towns were more or less damaged, and some of them entirely ruined. All the factories, mills and shops on the river were impaired to a greater or less extent.[7]

Rollstone Street Bridge

Shortly after the flood, the Rollstone Street Bridge was declared unsafe, and propped up to keep it open. The town selectmen began making arrangements for its reconstruction. At the same time, they decided to widen Rollstone Street, which necessitated building new abutments and retaining walls. This work was done by the local firm of A. Frost and Company, for the sum of $5,047.61.[8] Plans and estimates for the bridge were received from several companies, and the contract was awarded to National Bridge and Iron Works of Boston. The selectmen, being pleased with the plans for the bridge, "and further believing iron to be preferable to any wooden structure," decided to erect another similar bridge on River Road, near the Pulp Mill.[9] The newspaper reported:

> We understand that both of these bridges are to be built of iron. The former will be a single span iron structure of about 100 feet span and 40 feet in width. The cost of the iron work will be about $7000. The bridge near the pulp mill is to be of similar character, having a span, however, some ten feet less in length. This style of bridge seems much better adapted to resist the floods than those built of wood or stone."[10]

The Rollstone Street Bridge was erected during the fall of 1870, at a total cost of $15,161.33. Of this amount, Blodgett & Gurry, proprietors of National Bridge and Iron Works, received $7,500 for an "iron bridge."[11] In the annual report for that year, the selectmen said:

> We have no hesitation in saying we consider the work given us is of the first order, combining all the essential requisites of a bridge, and we believe cannot fail eventually to satisfy all our people.[12](See Figure 4.)

A few years later, in 1879, the south abutment had to be repaired. The abutments were actually resting on top of the woodwork of the Fitchburg Woolen Mill dam, and when the wood decayed, the abutment settled and cracked. Repairs were made by digging below the level of the dam, and bracing up the abutment with stone.[13] Apparently, that was the biggest problem encountered with the bridge during its expected lifespan. Every few years, the bridge received minor maintenance, in the form of new paint and new planking on the deck.

Between 1909 and 1910, the city built a steel bridge, next to and slightly above, the old Parker truss bridge on Rollstone Street, as part of a grade crossing elimination project.(See Figures 5 and 6.) The lower bridge is now dwarfed and partially hidden by the upper bridge, which also carries all of the traffic, since the lower bridge was closed to vehicular traffic in 1980. The pond and mill buildings are gone now, and in their place is the city's Department of Public Works yard at the east end of the bridge. In recent years, there has been much discussion regarding the importance of a bridge at that point to provide easy access to the yard. The upper deck of the bridge was rebuilt in 1981, but the bridge was still determined unstable for the heavy DPW trucks. In 1985, the city contracted for a replacement structure, but work was halted in 1987, when the state stepped in and announced that the project could not be funded with federal money until the Section 106 review process was completed.[14] The project is currently on hold while the city and state study the alternatives and come to some agreement on the matter.

C.H. Parker and the National Bridge & Iron Works

Charles Henry Parker was born in Ashburnham, Massachusetts in 1842. As a young man, Parker chose a career in mechanical engineering, and entered the employ of J.B. Parker & Company, as a designer of machinery for textile and shoe manufacturers. A few years later, he began working with motive power applications, under the employ of J.R. Robinson in Boston. He also did some experimental work for the Shaw Hot Air Engine Company.

In 1867 Parker established the "Solid Lever Bridge Company" of Boston, specializing in the construction of "iron-truss cantilevers with web members arranged as in the Warren truss," although it is unclear as to whether any of these bridges were actually built.[15] Within a short time, this company was succeeded by the National Bridge & Iron Works, under the proprietorship of William A. Blodgett, formerly of the Blodgett & White Metal and Steel Company, and Cadwalader Curry, of the Metallic Compression Casting Company. Charles Parker was employed as a consulting engineer. According to its advertisements, National Bridge & Iron Works, contracted for "Building and Erecting Wrought-Iron Railway and Highway Bridges and Roof Trusses."(See Figure 7.) This firm was just one of the many companies which grew out of the iron bridge technology pioneered by the railroads--companies which saw the potential of applying these same technologies to vehicular bridges.

In 1870 Parker patented a wrought iron truss bridge, "with a curved top member and straight bottom member, and sloping ends that shall be capable of being altered in length within certain limits, without changing the general proportions of the truss in other respects."[16](See Appendix A.) In other words, the end panels could be lengthened or shortened, while the remaining parts could be mass-produced from the same patterns. This feature had particular relevance at sites where the span length was pre-determined by existing abutments, as in the case of the Rollstone Street Bridge. Another important feature of Parker's patent was the extensive use of wrought iron for both tension and compression members. In early iron bridge designs, cast iron tension members had historically been the weakest elements. Wrought iron, which was known to be a much stronger material in tension, was also much more expensive to produce. Parker's attempt to eliminate cast iron from the large structural members, while using it for the non-structural members, such as the skew backs, the eyes at either end of the verticals, and the ornamental bollards, demonstrates that this was a transitional period in bridge technology, where the emphasis was placed on achieving a balance between cost-effectiveness, strength, and aesthetics.

Parker's patent turned out to be a veritable gold mine for National Bridge & Iron Works. As with most early bridge-building companies, National Bridge & Iron Works chose to work with a standard design which could be easily mass-produced and erected. Plnned connections helped make this possible, and

Parker's design for mass-produced members even more so. "A successful company like National Bridge & Iron owed its superiority to the fact that its designs reduced the costs of production and hence the selling price."[17] Advertising literature indicates that Parker's truss design was in production for some time prior to his receiving a patent for it. The company used Parker's design quite extensively, although few of these bridges have survived to the present. The (Lower) Rollstone Street Bridge is one of only five known surviving Parker patent truss in the United States.(See HAER Nos. MA-99, VT-3, and VT-13.)

National Bridge & Iron Works was a significant New England bridge-building company in the late nineteenth century. Among their most important engineering contracts were: the bridges over the Merrimack at Lowell, Haverhill and Tyngsboro, the iron roof of the train house of the Boston & Providence depot, the Boston & Lowell depot, the Museum of Fine Arts, the Boston Post Office and Treasury Building, and the iron work of the Providence City Hall. The company was also engaged in the erection of oil refineries, pipe lines, mill roofs and blast-furnace works.[18]

National Bridge & Iron Works lasted only seven years, and during that time, underwent numerous changes in its internal structure and management. In 1873 Blodgett left the company, and was succeeded by Parker as proprietor. The following year, Curry left the company, and was succeeded by Carey B. Dopp of New York. In 1874 the company was listed in directories as C.H. Parker & Co., trading as National Bridge & Iron Works. During Parker's tenure at National Bridge, over 150 bridges are said to have been produced,[19] but it is uncertain how many of these were Parker's design, and how many conformed to his patent. National Bridge & Iron Works folded in 1876, and was succeeded, in 1877, by Boston Bridge Works, under the direction of D.H. Andrews.(See HAER Report MA-92.) Parker went on to head the firm of Parker, Field & Mitchell, which was involved in the iron industries. He later worked for the Charles River Iron Works, of Cambridgeport, "designing, constructing, and erecting mining machinery, hoisting engines, and power plants."[20] Most of his later work seems to have been principally concerned with the production of machinery and manufacturing plants. Charles Henry Parker died August 31, 1897, at the age of 55.

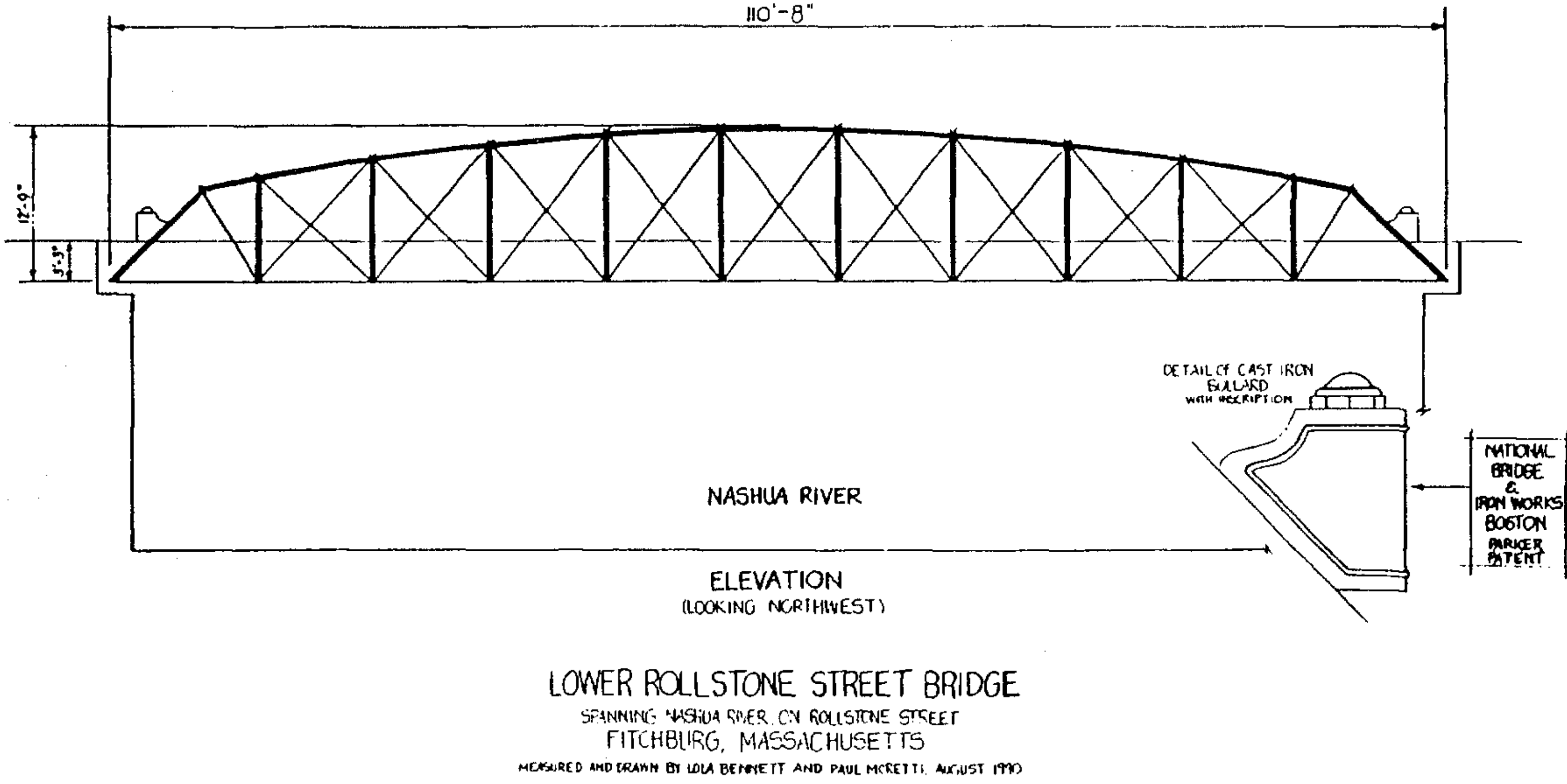


Figure 1. Elevation of Rollstone Street Bridge.

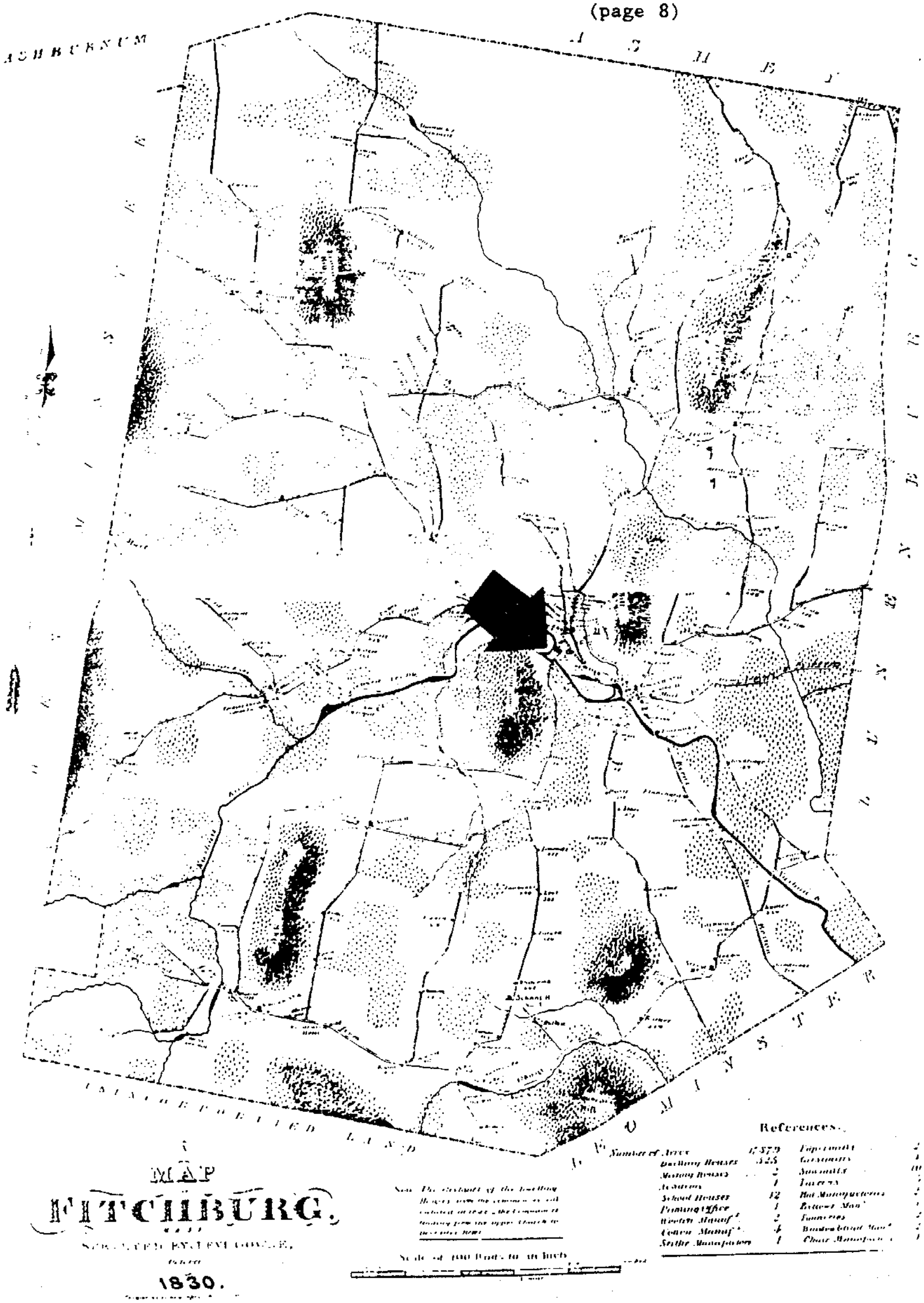


Figure 2. Map of Fitchburg, 1830, showing location of earlier bridge.

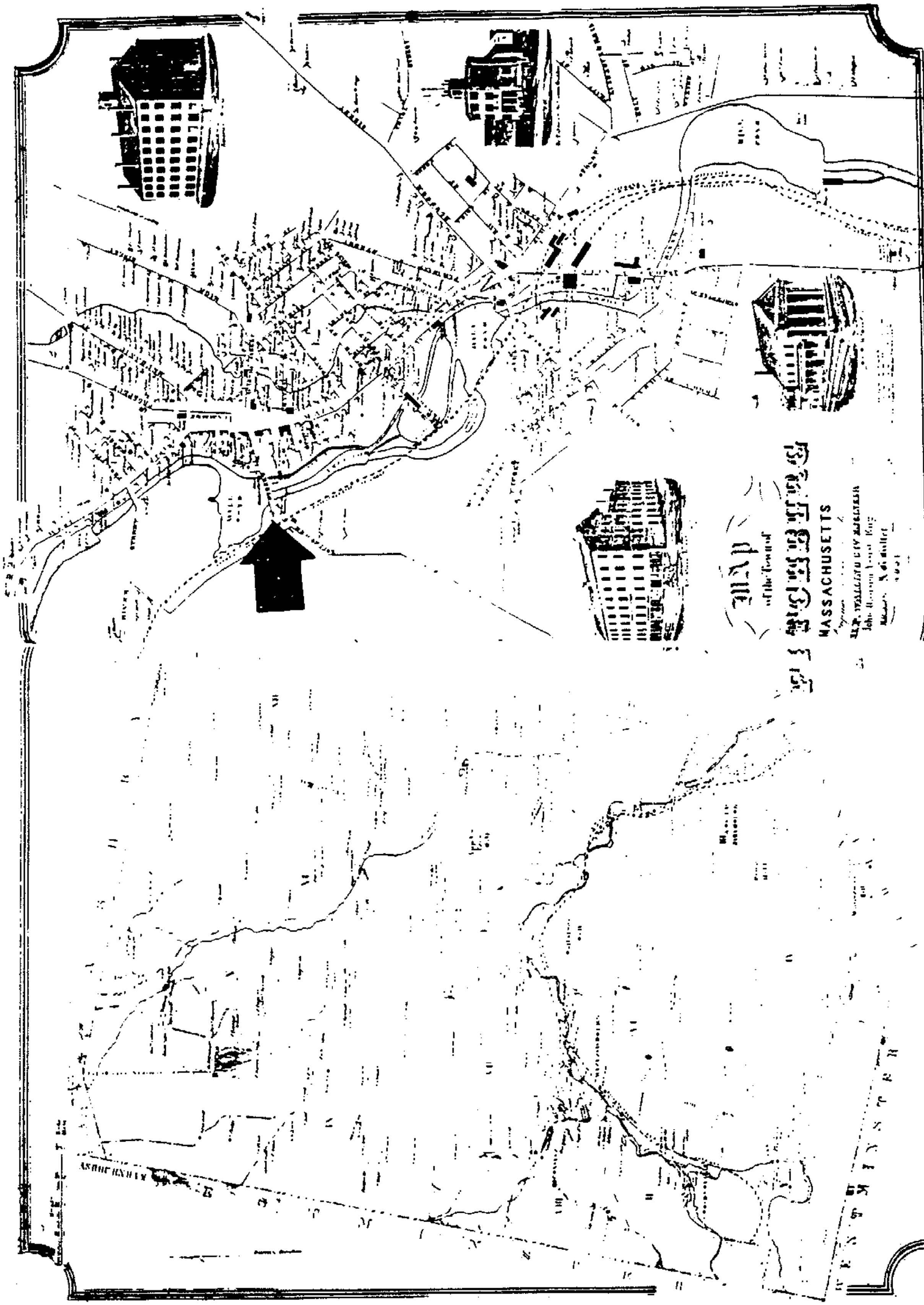


Figure 3. Map of Fitchburg, 1854, showing location of earlier bridge.

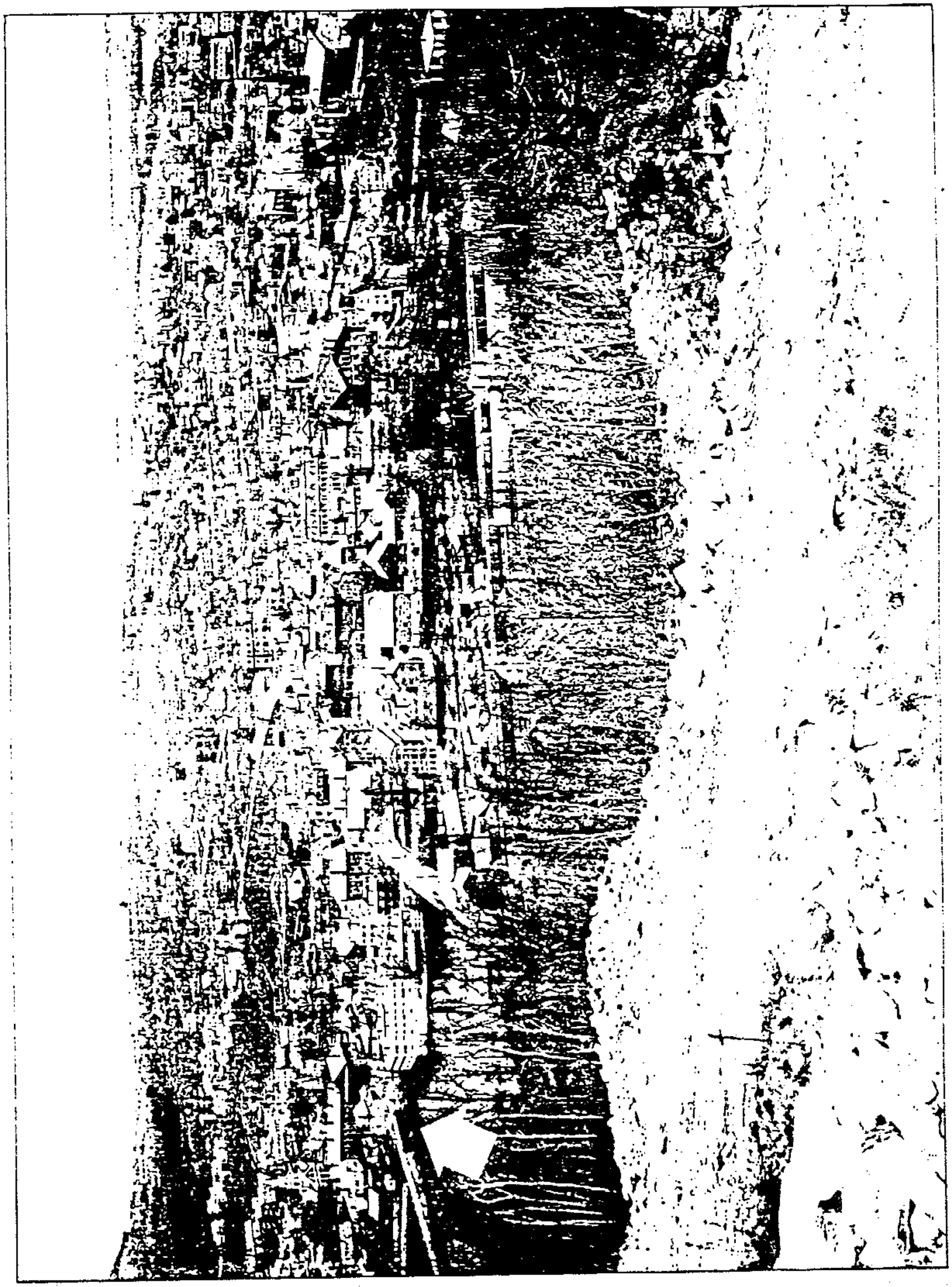


Figure 4.
View of Fitchburg from Rollstone Hill, showing Rollstone Street Bridge, 1888.
(*Picturesque Fitchburg*, 1888.)

Figure 5. Lower Rollstone Street Bridge, ca. early 1920s.
(Fitchburg Historical Society Collection.)

Rollstone Bridge Repairs To Be Finished In September

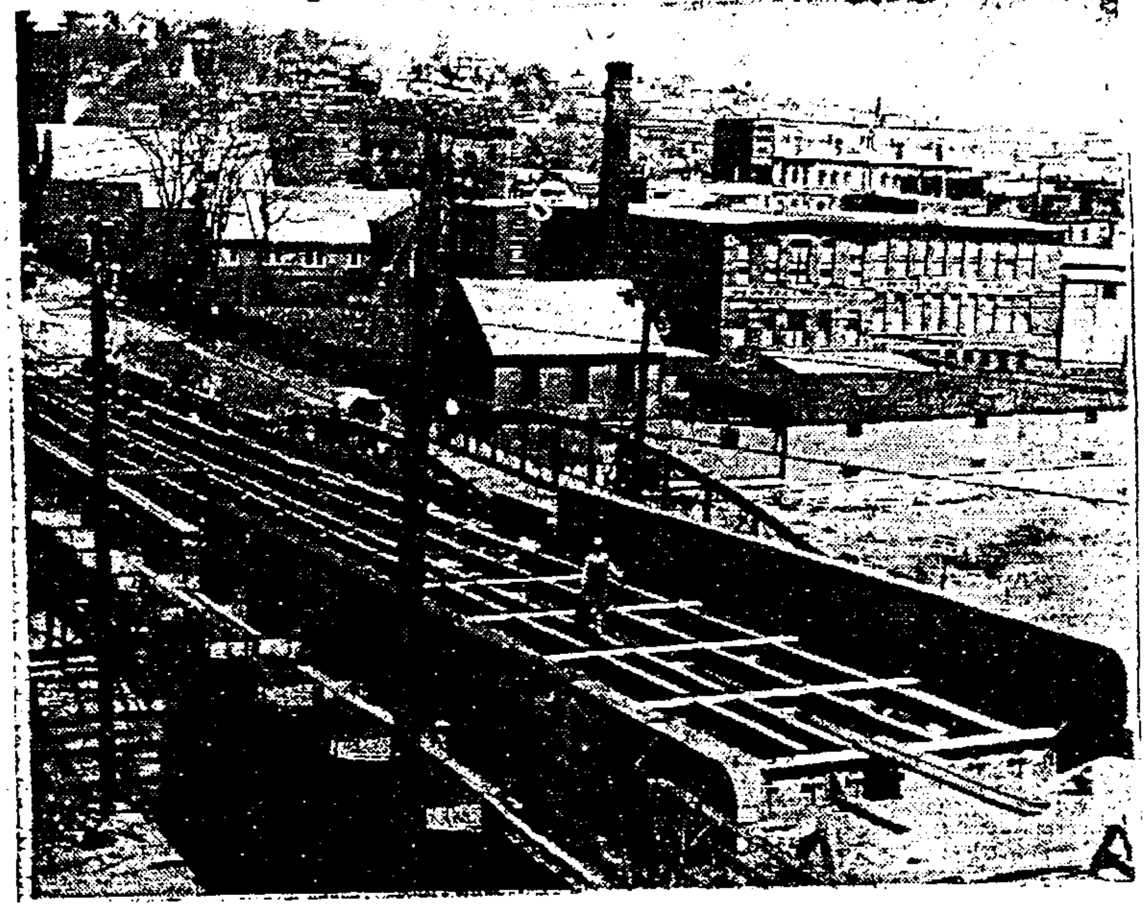


Figure 6. Upper Rollstone Street Bridge, 1950.
(Fitchburg Sentinel and Enterprise.)

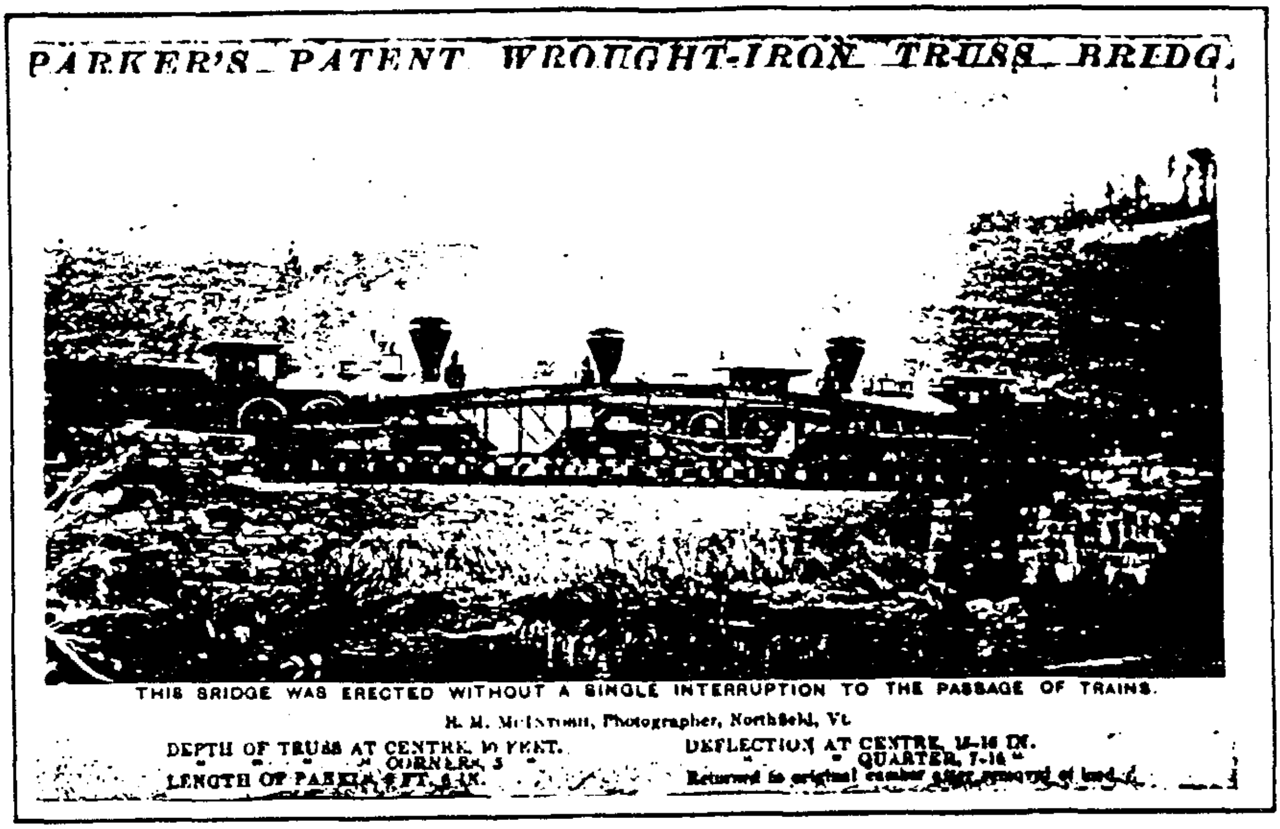


Figure 7. Advertisement for National Bridge and Iron works.

National Bridge and Iron Works,

BLODGETT & CURRY. PROPRIETORS.

NO. 15 STATE STREET, BOSTON, MASS.

Contractors for Building and Erecting Wrought-Iron Railway and Highway Bridges and Roof Trusses.

CHAS. H. PARKER, *Consulting Engineer.* A. W. PARKER, *Supt. of Works.*

THE PARKER TRUSS WROUGHT-IRON RAILWAY BRIDGE, shown on the opposite side of this Card, was built and erected for the Vermont Central Railway Co., within four weeks after the burning of a wooden structure. It is situated on the main line, near Montpelier, Vt. It is 104 ft. 6 in. long, and is made to our standard for a single track, having an ultimate strength of six tons to the lineal foot of span, besides six times its own weight. The Bridge was tested Dec. 2, 1870, as shown, in the presence and under the direction of Hon. J. Gregory Smith, President, G. Merrill, Esq., General Superintendent, and other Railway officials, with three freight engines, showing results stated underneath.

United States Patent Office.

CHARLES H. PARKER, OF BOSTON, MASSACHUSETTS.

Letters Patent No. 100,185, dated February 22, 1870.

IMPROVED BRIDGE.

The Schedule referred to in these Letters Patent and making part of the same.

To whom it may concern:

Be it known that I, CHARLES H. PARKER, civil engineer, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in the Construction of Bridges; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing, in which—

Figure 1 is a side elevation of a bridge embodying my invention.

Figures 2, 3, 4, and 5 are views representing in detail the construction and arrangement of the compression member.

Figures 6, 7, and 8 are like views of the skew-back or thrust-block.

Figure 9 is a view on an enlarged scale of the upper portion of one of the end panels of the structure.

The improvements in the construction of bridges which I desire to secure by Letters Patent are as follows:

First. The first portion of my invention relates to the construction of the end panels or bays of a truss.

In order to make a truss with a curved top member and straight bottom member, and sloping ends that shall be capable of being altered in length within certain limits, without changing the general proportions of the truss in other respects, I have designed the end panels, or in the following manner:

The truss is composed of a curved top member, a straight bottom member, and vertical posts or compression members A, with the usual system of longitudinal diagonal rods or braces.

With the vertical post at each end of the truss I combine the fractional length of the top member and a sloping end, as seen in the drawing, the curved top member being made some fractional length of the end panel or bay, as shown at G, figs. 1 and 9, and the balance of the length of this panel or bay being composed of the sloping end N, which is riveted or otherwise secured to the curved top member G and to its point of support at its other end in any suitable manner. The advantages of this plan are, that in practice if I wish to lengthen or shorten a given length of span within certain limits, I have only to shorten or lengthen the fractional top member of the end bays or panels, or increase or decrease the slope of the ends, without in any way altering or disturbing the patterns or dimensions or proportions of the vertical posts, or of that part of the truss between the end panels; and I am thus enabled in practice to make all patterns, measurements, and plans answer for different lengths of spans within certain limits.

Secondly. The second part of my invention relates to an improvement in the construction of a wrought-iron compression member, capable also of acting with equal efficiency as a tension member. The body of this member is formed of an I section-beam, A, either rolled or built up of plates and angles.

The ends of the I-beam A are cut to receive the cast-iron eyes B B, having shoulders c, which are fitted to and so as to rest on the ends of the flanges of the I-beam and projecting lips D D, which fit on each side of the web of the I-beam.

To join the eye to and virtually make it a part of the I-beam, I employ a strap of wrought iron, E, which passes around the outside and is recessed into the casting B at I, extending down over the lips D D to the web of the I-beam A, to which it is securely riveted.

The strap recessed into the casting, in connection with the projecting lips D D, prevents any moving of the casting from position.

The hole through the castings for a pin or rivet forms the means of connection of this member with the top and bottom members of a truss.

To form a connection with the bottom chord of a truss and the diagonals of the the web, a further modification, shown in figs. 2, 3, and 4, is introduced into the lower eye. This consists in casting into the eye a slot, S, and cutting into the encircling strap E a similar slot, and then placing in this slot the eyes of the diagonals, so that by the common bolt all are held in place. By this construction I make a member which is effective in resisting both compression and tension, and is also capable of resisting effectually any lateral motion.

Thirdly. The third portion of my invention relates to an improved block or skew-back, which is used in the end panels or bays. The general form of this block is shown in figs. 6, 7, and 8. Along each side and around the rod H is a recess, K, to receive the bar L, which passes completely around the thrust-block, and terminates at the ends in eyes or any equivalent fastenings for fastening to the chord-bars of the bridge.

To form the connection with the sloping end N of the arch or top member G, the block projects into said end. The thrust of this top member is received by a shoulder, O, cast upon the block and the upper edges of the encircling strap L.

To give additional lateral stiffness, and to more thoroughly join to the block the top member of arch, I introduce the plates P P recessed into the block, and under the encircling strap L and under the side plates of the arch or top member, the whole being fastened together by bolts or rivets R R, or any equivalent, passing through the encircling strap L, the plates P, into the block, and through the side plates of the arch,

APPENDIX A. Charles Parker's Patent, 1870.

top member G, the plate P, and into the block; d also with bolts X, or any equivalent fastening, rough the top plate of the arch or top member into e block, thus binding the whole together securely. e advantages of this are, that the thrusts and pulls the respective top and bottom members of a truss e resisted by the block, which receives from these o members only strains of compression through the edium of the encircling strap L; and the bolts, riv- s, or any equivalent used to fasten said members to e block, are not called upon to resist the direct rains from the said top and bottom members.

What I claim as new, and desire to secure by etters Patent, is—

1. A truss having its vertical posts or compression embers fractional lengths of the curved top member, d sloping ends combined in the end panels or bays, bstantially in the manner and for the purpose speci- d.

2. A compression member of a truss, constructed the manner and for the purposes specified.

3. The cast-iron eye or end of the compression ember of a truss, constructed with lips to fit the web of the beam, shoulders to fit upon the flanges of the beam, and a recess to receive the encircling strap E, in the manner and for the purposes specified.

4. The thrust-block or skewback constructed in the manner and for the purposes specified.

5. The encircling bar or strap L, used in connection with the thrust-block, so as to bind the abutments of the bridge, and at the same time to partially receive the thrust of the top member of the truss, in the manner and for the purposes specified.

6. The plate P, used in the manner and for the purposes specified.

7. The combination of the top and bottom members of a truss with the thrust-block, its encircling bar or strap, and the stiffening-plate P, under the arrangement shown and described.

In testimony whereof, I have signed my name to this specification before two subscribing witnesses.

CHAS. H. PARKER.

Witnesses:

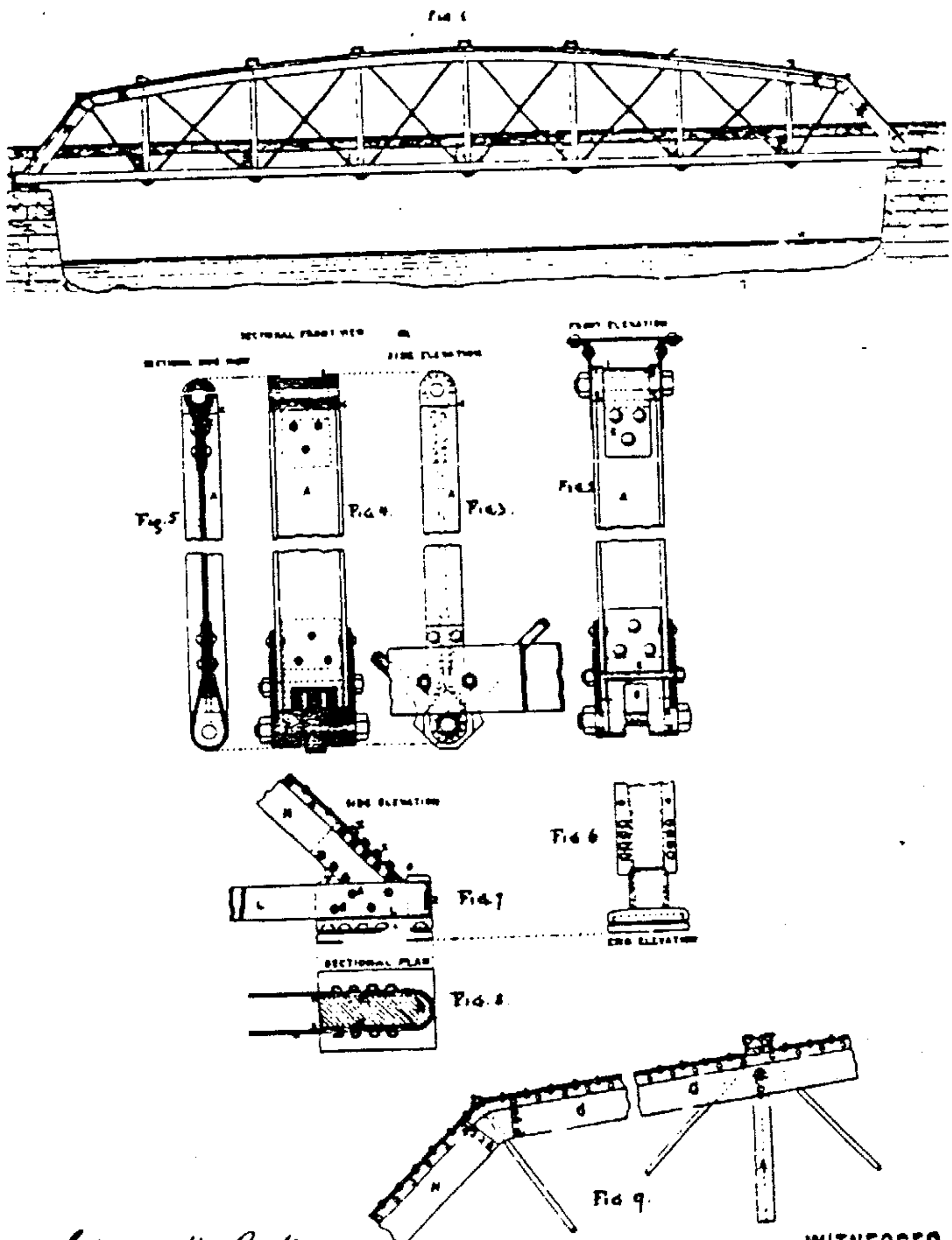
THOMAS G. BANKS,

CADWALLADER CURRY.

C. H. Parker.

Truss Bridge.

No. 100,185. Patented Feb. 22 1870



Charles H. Parker
by his attorney
C. A. Pollok

WITNESSES.

ENDNOTES

1. D. Hamilton Hurd, History of Worcester County, Massachusetts, vol 2. (Philadelphia, 1889), p.209.

2. Ibid, p.212.

3. Ibid, p.220.

4. Ibid, p.227.

5. Town of Fitchburg Annual Reports, 1849. (Stone & Harris was the predecessor of R.F. Hawkins Iron Works in Springfield. See HAER reports MA-96, MA-97, MA-108, MA-117, and MA-118, for more information on this company.)

6. Annual Reports, 1871.

7. The Fitchburg Sentinel, Fitchburg, Mass, October 9, 1869.

8. Annual Reports, 1871, p.15.

9. Ibid, pp.4-5.

10. The Fitchburg Sentinel, August 6, 1870.

11. Annual Reports, 1871, p.15.

12. Ibid, p.5.

13. Ibid, 1879, p.106.

14. According to Steve Roper, Massachusetts Department of Public Works Historic Bridge Specialist.

15. Carl W. Condit, American Building Art: The Nineteenth Century (New York, 1960), p.144.

16. Charles H. Parker, "U.S. Patent No. 100,185."

17. Dennis M. Zembala, Elm Street Bridge (Woodstock, Vermont, 1977), p.5.

18. "Charles H. Parker," memorial notice, Journal of the American Society of Mechanical Engineers, 1897, p.966.

19. Condit.

20. Ibid.

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