Mystic River Drawbridge No. 7
Spanning Mystic River at the Massachusetts Bay
Transportation Authority Rail Line (formerly
Boston & Maine Eastern Route) Right-of-Way
Somerville
~~Suffolk County~~ MIDDLESEX COUNTY
Everett
Middlesex County
Massachusetts

HAER No. MA-88

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
Mid-Atlantic Regional Office
National Park Service
U.S. Department of the Interior
Philadelphia, Pennsylvania 19106

HISTORIC AMERICAN ENGINEERING RECORD

Mystic River Drawbridge No. 7

HAER No. MA-88

Location:	Spanning Mystic River on the right-of-way of the Massachusetts Bay Transportation Authority rail line (formerly the Boston & Maine Eastern Route) at the town line between Somerville (south), ~~Suffolk County~~ Middlesex County, and Everett (north), Middlesex County, Massachusetts
	UTM: 19.329250.4695250 Quad: Boston North, Massachusetts (1979)
Date of Construction:	1893-1894. 1933 - Tower rebuilt. 1955 - Easterly girder built, replacing 1977 truss. 1917 - Westerly truss built. 1988-1989 - Replaced.
Present Owner:	Massachusetts Bay Transportation Authority Ten Park Plaza Boston, Massachusetts 02116
Present Use:	Single-track, movable span railroad bridge. Horizontal draw accommodates limited marine traffic.
Significance:	Drawbridge No. 7 is apparently the last horizontally folding railroad bridge in the eastern United States. Its technology is representative of the earliest patented movable span bridge in the country (patented by Joseph Ross of Ipswich, Massachusetts, in 1849). The horizontally folding draw was a common railroad bridge type in the Greater Boston area since the 1840s. All except Drawbridge No. 7 have been removed and/or replaced.
Project Information:	Mary Elizabeth McCahon Abba G. Lichtenstein, P.E. Paul Blair, P.E. Gerard J. Grippo, P.E. Massachusetts office of A. G. Lichtenstein & Associates as subconsultants to McGinley Hart & Associates, Boston, MA

The project was undertaken by the Massachusetts Bay Transportation Authority (MBTA) as part of its compliance with Section 106 of the National Historic Preservation Act of 1966, as amended. Drawbridge No. 7 has been replaced by a modern, concrete high-rise railroad bridge, erected in 1988-1989.

I. Historic Context

A. Summary Statement

The Mystic River Bridge-Draw No. 7, originally constructed in 1893-94 as a three-track railroad bridge across the Mystic River at the town line between Somerville and Everett, Massachusetts, is the sole remaining example of the horizontally folding drawbridge once common in the greater Boston area. It replaced bridges of nearly identical technology built at the crossing since 1850. One of a series of eight such bridges (all named for the sequential order from the eastern side of the rail terminus at North Station in Boston), distinguished by their wooden, braced towers and pivoting, folding trusses, that serviced the north side of Boston Proper, Draw No. 7 represents first-generation, movable span bridge technology that was developed as early as 1835 and patented in 1849 (Condit, pp. 101-102). Despite the fact that the tower was rebuilt in 1933 and the extant girders installed in 1917 and 1956, the bridge still operates according to engineering principles developed when American movable-span bridge technology was in its infancy.

B. Bridge Technology and Application

Horizontally folding drawbridges rank among the earliest type of movable span technology in this country, and the type was used extensively in the greater Boston area beginning, according to industrial historian Carl Condit, in 1835 when the Boston and Lowell Railroad erected a horizontally folding bridge across the Charles River from East Cambridge to its passenger terminal in the north end of Boston Proper. "The bridge consisted of a plank and beam deck resting on several parallel wooden trusses laced together, the whole structure hinged at the corner of one end. A system of cables radiating from the top of a tower to points along the length of the bridge made it possible to swing the span in a horizontal plane to a position ... parallel to the river channel" (Condit, pp. 101-102). The designer/engineer of the Boston and Lowell Railroad bridge is not known.

Prior to 1835, movable span bridges seemed to have been limited to the simple drawbridge, a technology developed in the Middle Ages but limited in both the size of the leaf and the live-load capacities owing to the necessity of physically raising the bridge. An 1828 sketch showing the filling of the former mill pond to create the land in the vicinity of North Station and Haymarket Square (Figure 1) shows two such drawbridges; the unfinished Warren Street bridge in the closed position and the Causeway Street bridge, with its crude plank deck, in the open position. Both were intended for pedestrian and cart use. With the development of the railroad in the Boston area during the mid-1830s and the desire to have direct rail access across the rivers defining the northern limits of the Boston peninsula, it was necessary to develop a stronger movable bridge.

Joseph Ross (1822-1903), a contractor from Ipswich, Massachusetts, is credited with designing and popularizing the horizontally folding draw which, because the movable span was a truss hinged on one end that did not have to be lifted to clear the marine channel, became a commonly used technology. January 2, 1849, letters patent (#5997) were issued to Joseph Ross for a "swinging bridge" utilizing the same engineering principles as the 1835 Boston and Lowell's Charles River bridge (Appendix I). From the drawing that accompanies the specifications (Figure 2), Ross's bridge appears to be nearly identical to the Boston & Lowell Railroad's Charles River bridge. The drawing illustrates the same technology that continued to be used for railroad bridges in the Boston area for the next 100 years, especially for the lines entering Boston from the north. Ross built several of his bridges for the Eastern Railroad, later acquired by the Boston and Maine Railroad Company, with the first being erected at Manchester Harbor in 1845 (Condit, p. 102). The Manchester bridge is not extant. By 1858 it is known that at least ten horizontally folding draws were in service in the immediate vicinity of Boston Proper, but which of them were specifically the work of Ross is not known. No original plans for any of the 19th century, horizontally folding draws, including Draw No. 7, have been located. This bridge type proved particularly well adapted to railroad use because it was capable of carrying heavy loads safely, although it was applicable only for narrow crossings. It often worked in tandem with pile trestle bridges.

The horizontally folding drawbridge with its distinctive frame tower was not unique to the Boston area or Joseph Ross. The same type of bridge was apparently used in 1834 by the New Jersey Railroad and Transportation Company over the Passaic or Hackensack River on its line to the Hudson River (Flagg letter to Stott, 10/19/83). In 1853 the Paterson and Hudson River Railroad built a double track, double folding drawbridge over the Hackensack River (north of the previously cited bridge). The 1888 issue of The Railroad Gazette (Railroad Gazette, XX, July 20, 1888 pp. 486-471) describes the structure as "an interesting and unique specimen of a draw-bridge ... composed of two Howe truss spans 71 feet long. The two spans operated independently of each other and turned in opposite directions. The free end of each was supported by chains from a gallows frame," and it provided for a 40'-wide marine channel. The New York, Lake Erie & Western Railroad replaced the horizontally folding draw with a center-bearing rim swing span in 1888. (op. cit.)

The most detailed, mid-19th century drawing of a horizontally folding drawbridge located to date is contained in the volume of plates that accompanied the 1856 Report of the Board of Railroad Commissions (of New York) (Figure 3). Still operated by hand, the bridge, identified as the property of the Hudson River Railroad (sic), has a folding girder, an improvement which permitted a wider channel opening and became de rigor for similar bridges. Note that Ross's patent shows a folding girder. The location of the New York bridge is not known.

C. Terminology and Technology

Draw No. 7 is identified by Carl Condit as a "jack knife" bridge, and the term is commonly associated with the structure, but it appears, when reviewing the technical publications of the late-19th and early-20th century, that the term "jack knife" applied to Draw No. 7 is a modern moniker rather than a historic description of type. During the late-19th century, the term "jack knife" apparently referred to bridges where the movable leaf was hinged in the middle and was pulled upward at the hinged point by cables from a tower to form an inverted V when in the open position. That technology is credited to Capt. W. Harmon and was used in 1892 for the Canal Street Bridge over the south branch of the Chicago River, but it proved to be too light and unreliable and thus did not become popular (ASCE. Transactions. Vol. 109 (1944),pp. 998-1002). Mansfield Merriman and Henry S. Jacoby also identify Harmon's patented technology as a "jack knife" in the 1898 edition of their A Text Book on Roofs and Bridges Part IV (p. 71).

In his 1925 tome Bridge Engineering, J.A.L. Waddell discusses a variety of movable bridges, including horizontal-folding draws and jack knife or folding bridges, thus establishing a clear distinction between the two types of movable span bridges. Not particularly impressed with the horizontal folding draw, which he calls "such an objectionable style of railway construction as hardly to merit even passing notice," Waddell goes on to describe the mechanics of the bridge. He states, correctly, that "there are still many such bridges scattered throughout New England." The jack-knife or folding bridges were, according to the opinionated Waddell, "a freak design that passed out of existence more than a decade ago" (ca. 1915) (Waddell, p. 665).

When the term "jack knife", originally applied to a different technology that was developed much later in the 19th century, was applied to horizontally folding draws is not known, but it was certainly well entrenched by 1960 when Condit, perhaps somewhat casually, applied it to the technology patented by Joseph Ross and represented by Draw No. 7. There is a period citation in a 1906 issue of The Engineering News to a "jack knife" bridge over Chelsea Creek, and it is likely that it was, in fact, a horizontally folding structure making that the earliest, known, documented use of the term "jack knife" applied to the popular Boston-area horizontally folding bridges (The Engineering News, July-Dec. 1905, p. 517).

D. Rail lines in the Boston Area and the Construction of Draw No. 7.

The 1830s and 1840s were a period of vigorous rail development in heavily industrialized eastern Massachusetts with no less than four major lines entering Boston Proper from the north and one line linking those four with the wharfs in East Boston. Until the less financially successful lines were consolidated with their stronger competitors during the last quarter of the 19th century, each line maintained its own rights-of-way, terminals, and yards. Consequently, each of the four lines entering Boston from the north (Fitchburg, Boston and Lowell, Eastern, and Boston and Maine systems) crossed the Charles River over their own bridges with all of the lines using horizontally folding draws. Horizontally folding draws were also utilized for crossing the nearby Millers River (filled in the late 1920s) and the Mystic River, both slightly north of the Charles River (Figure 4).

The first horizontally folding draw across the Mystic River at the location of the present Draw No. 7 was erected in 1849-50 by the Grand Junction Railroad and Depot Company, a circumferential or loop route conceived to link the four major lines entering Boston from the north with the sea via its wharfs and warehouses in East Boston (Figure 5). The Grand Junction was incorporated in 1846 as the Chelsea Branch Railroad Company, but its name was changed in April, 1847. The line was authorized to cross the Mystic River with a bridge "with a good and sufficient draw, (constructed) under the direction of a commissioner, to be appointed by the Governor and Council at the expense of said corporation: and the said corporation shall be held liable to keep said draw in good repair and to open the same, and afford all proper accommodations to vessels having occasion to pass the same by day or by night" (Grand Junction Railroad and Depot Company. Annual Report, 1848). The 1849 annual report stated that "the bridge over Chelsea Creek and the Mystic River are contracted for "and that the Mystic River bridge would be completed in 1850" (op. cit., 1849).

The Grand Junction line, an ambitious concept for its time to provide an integrated transportation and transfer system, was overcapitalized and not financially successful. By the end of 1856, $564,297 had been expended building the line, exclusive of the wharves and warehouses in East Boston (Poor: History of Railroads, 1860). The line opened 6.81 miles of track from the Boston & Maine line in Somerville to East Boston in 1849 and had completed the loop to the Boston and Worcester (later Boston and Albany Railroad) in 1856. "The income of the company has been trifling when compared with the capital, and in no year sufficient to pay the interest on the debt" (Poor, op. cit.). Concluding its affairs in the late 1850s, its facilities eventually became part of the Boston and Albany (incorporated in 1867 by the merger of the Boston and Worcester and Western railroads). The Boston and Albany became part of the New York Central system in 1900. The Eastern Railroad Company, which was leased by the Boston and Maine in 1884, was also involved with the Grand Junction line.

The Eastern Railroad Company was incorporated in 1838 and developed as the major coastal line in Massachusetts, New Hampshire and Maine. Unlike the other rail lines north of Boston, it did not initially enter Boston Proper via a direct rail connection. It opted to terminate its route at the wharves in East Boston and to enter the city by ferry. Realizing that it was to its advantage to secure direct entry to Boston Proper, the board of the Eastern began planning for a route into the city as early as 1848, but it did not come to fruition until 1854 due to some trepidation on the part of the board of directors. In 1848 the Eastern received permission from the state legislature to change its route and enter Boston via existing lines. The same year the company entered into a lease agreement with the Grand Junction "to build a line inside the Grand Junction right-of-way from some convenient point in their road in North Chelsea (Revere) to the point in Somerville where the Grand Junction commences a curve to meet the Lowell and Fitchburg lines" (Grand Junction Annual Report, 1848-49). The Eastern had entered into a contractual agreement with the Grand Junction line on November 19, 1847 to become a subscriber of the Grand Junction, and pledged to purchase 100,000 shares of stock with $25,000 in cash and the balance being gravel to fill the flats in East Boston for the Grand Junction's warehouses and wharves (Grand Junction Railroad and Depot Company. Annual Report, 1853). Such agreements between large lines and the many smaller, "grape vine" local lines was a common period practice to protect the interests of the large lines. The Eastern stopped work on its Boston terminus in 1850, but under the leadership of new president Albert Thorndike, work began again in 1852.

Under a new charter, approved in 1852, the Eastern and Grand Junction filed their location from the point in Somerville where the Grand Junction crosses the Mystic River (Draw No. 7), along side of the Boston and Maine Road, into Boston to the westerly side of Market Street (Figure 5) and it was the intention of the Eastern Road to commence at once the building of the road into the city (Grand Junction Railroad and Depot Company. Annual Report, 1853, p. 9). The Eastern Railroad opened its station on Causeway and Friend streets in Boston Proper on April 10, 1854. It was reached by new track from North Chelsea (Revere) to Chelsea where it connected with the Grand Junction right-of-way which it used until East Boston where it operated on the Boston and Maine track to enter Boston. The Eastern completed its own line south of Prison Point in 1856 (Humphrey. p. 75). The company's initial route into Boston was so circuitous that the line was accused of planning it "to enable the traveller to gaze upon all four sides of the Bunker Hill monument" (Bradlee, p. 85). The approach varied after 1855 to incorporate the Eastern's acquisition of the Saugus Branch line and its right-of-way through Malden, South Malden and Lynn into Boston.

The Eastern's involvement with the Grand Junction provided the vital link in its access to Boston Proper, but it was costly. The 1857 Annual Report of the Eastern line stated that the Grand Junction had failed financially, and that its stock in the company was now worthless. In 1858, the Eastern Railroad Company's Annual Report stated that "the bridge over the Mystic River, built by the Grand Junction Company, has been almost entirely reconstructed, at a cost of about $11,000; and on account of its former imperfections in building, this amount ought to be charged to the company, if they possessed any ability to respond to the claim." Thus the crossing at Draw No. 7 was so important to the Eastern that they rebuilt it at their own expense.

Once chartered in 1867, the Boston and Albany company took steps to formally acquire the defunct Grand Junction line. In its first Annual Report, issued in 1869, the Boston and Albany reported that "steps have been taken by the Boston & Worcester Railroad (one of the two original lines that formed the Boston and Albany) to connect their wharves at East Boston with their main road in Brookline by locating upon the Grand Junction Road, under authority given for that purpose, have been carried out by this corporation" and it was "confidently expected that the negotiations which have been so long pending would before this have been brought to a close, and given us a clear and undisputed title to this property. That result has been delayed by the interposition of third parties claiming to have certain rights in the property which might be jeopardized by a transfer of the legal title to us. The road, however, has been rebuilt and repaired, and is now in a condition to be operated. Its possession will not only add to our facilities, but will afford our neighbors on the north easy opportunities for carrying their freight to and from deep water" (Boston & Albany Railroad. Annual Report. 1869). Although not mentioned in their annual reports, the "third party" claims were no doubt registered by the Eastern line which had a vital interest in maintaining its right to cross at Draw No. 7. Use as well as title to the bridge was eventually vested with both the Boston and Albany and Eastern lines.

Draw No. 7, along with all of the other horizontally folding draws on the north side of Boston except Draw No. 5, the Boston and Lowell line's bridge, were rebuilt in 1893-94 when the first union station was built on Causeway Street in Boston Proper (Engineering News-Record, November 5, 1931, p. 718). Prior to building the union passenger terminal, each of the four lines entering Boston from the north (the Fitchburg, Boston & Maine, Eastern, and Boston and Lowell lines) had their own snub-ended terminals built on filled land with three of them on Causeway Street and one in Haymarket Square (Figure 4). The land was created, beginning in 1804, on the site of the old mill pond by leveling Beacon Hill and gradually filling the swampy area between the base of the hill and the mill dam which followed the line of the present Causeway Street (Figure 1) (Whitehill, p. 78). With land in the center of Boston becoming increasingly valuable, there were efforts in the 1890s to consolidate the stations into one so that the railroad land could be devoted to other purposes. Also, by 1893, when the union station act was passed by the legislature, the Boston & Maine controlled all of the lines entering Boston from the north except the Fitchburg. Union Station, as North Station was originally known, was built by the Boston & Maine in 1894 (Figure 6) (Humphrey, p. 9).

The 1894 station was replaced by the present North Station in 1927-28. The last phase of the terminal project was a major track realignment program that resulted in replacing six horizontally folding draw bridges (Draws No. 1 through 6) and nearly 3,000,000 square feet, or 65 acres, of open trestle work that comprised the track yards for the old North Station. The six bridges, along with Draws No. 7 and 8 which crossed the Mystic River to the north of the station and were not affected by the realignment program, represented the largest concentration of horizontally folding draws still in active use and some with their original wooden lattice truss stringer girders, in the country. Four of the bridges (Draws No. 1,3,5,6) were replaced in 1931 by four Scherzer rolling lift bascules (two are extant), each carrying two tracks. That bridge is presently known as Draw No. 1. Two more horizontally folding bridges across Millers River were eliminated when the swampy area they crossed was filled. The replaced/eliminated bridges, with the exception of Draw No. 5, were all built during 1893-94 (Engineering News-Record (November 5, 1931), p. 718).

An in-depth article entitled "Rare Old Bridges Replaced in B. & M. Railroad Terminal Improvements at Boston" in the November 5, 1931 issue of Engineering News-Record summarized the history of the removed bridges. The accompanying location map (Figure 7) emphasizes their concentration, but it, unfortunately, does not cover the Mystic River area to the north where the two surviving folding draws were located.

Drawbridge No. 1, Charles River--This bridge is approximately in the same position as the double-track bridge built in 1853, leading into the old Eastern Railroad station on Causeway Street and the two-track bridge built in 1856 leading into the first Boston and Lowell Railroad station on the same street. In recent years the bridge carried eight tracks, and handled the passenger trains in and out of North Station.

Drawbridge No. 2, Millers River--This bridge was approximately in the same position as the old Eastern Railroad bridge built in 1853. The Boston & Maine and Fitchburg railroads used it later. It was removed in 1927 when the channel was replaced with pipe conduits.

Drawbridge No.3, Charles River, and Drawbridge No. 4, Millers River--These bridges are on the location of the Boston and Maine Railroad Extension Co. in 1844. Improvements were made on them in 1869 and again in 1887. Bridge No. 4 was eliminated by the installation of pipe conduits.

Drawbridge No. 5, Charles River--This was the Boston and Lowell bridge. The original bridge was authorized in 1832 and was opened to traffic June 26, 1835. The bridge was used for both passenger and freight traffic until 1857, from which date it was used for freight only. Between 1835 and 1905 various alterations were made to the old bridge. When the Charles River dam was built (about 1905) the old bridge was removed to a point downstream from the original location.

Drawbridge No. 6, Charles River--This was the old Fitchburg Railroad passenger bridge, originally built about 1847 for two tracks. A third track was added later, these tracks leading directly into the old Fitchburg Railroad stone station on Causeway Street. In later years this bridge carried one track.

The Charles River bridges afforded a 35' marine channel. The new channel, serviced by the 1931 Scherzer, is 65' wide and is located north of the original channel.

Draw No. 8, located slightly to the northwest of Draw No. 7 (Photo: View from Route 99 looking north up the Mystic River to Draw No. 7 and Draw No. 8) was removed about 1972 when the former Boston & Maine right-of-way was redeveloped by the Massachusetts Bay Transportation Authority (MBTA) as the rapid-transit Orange line. It was a double-tower, four-track bridge with steel, Warren-type trusses that appear to be identical to those still in use on Draw No. 7 (Boston & Maine Historical Society: Photo Collection; Draw No. 8). The tower of Draw No. 8 was completely destroyed by fire around 1945, but it was rebuilt reusing the original technology due to a shortage of steel during World War II. At that time it was thought to be a temporary solution, but the bridge continued in service for more than 25 years (Talbot). Draw No. 8 was designed to carry heavier loads than Draw No. 7.

The fact that so many horizontally folding draws remained in service in the Boston area illustrates that Joseph Ross's technology of raising slightly and then swinging the girders to one side to clear a marine channel proved both practical and functionally successful enough to make the bridge type one of the most popular and long-lived of the movable span technologies in the vicinity. It is certain that economics had something to do with the decision in 1893 to rebuild the curious, old folding draws rather than replace them with steel bridges, but it is unlikely that an early-19th century technology would have been retained had it not proved a workable solution to local needs. The marine channel serviced by the draws on the Charles and Miller Rivers were not highly trafficked as most of the marine activity was located east (outside) of the Charlestown vehicular bridge or along the Mystic River and Chelsea Creek (Figure 6). Draws 7 and 8, however, serviced the upper Mystic River where during this century there was barge traffic, especially to fuel depots. Now the Draw No. 7 services primarily seasonal pleasure craft traffic.

Several other horizontally folding draw bridges located in the Boston vicinity like Draw No. 7 also survived into the 20th century. A "jack knife" draw, which carried the Boston and Albany across Chelsea Creek, collapsed into the creek in November, 1906 (Engineering News Record, 1906, p. 517). It was not replaced in kind. Another was located on the south side of town on the Midland branch of the New York New Haven & Hartford Railroad across the swampy area near Fort Point Channel. The need for that bridge was eliminated as the area was gradually filled.

The 1893-94 construction of Draw No. 7 was completed under a joint agreement between the Boston and Albany line and the Eastern Railroad, then part of the Boston & Maine Railroad Company. On October 29, 1894, President Bliss of the Boston & Albany Railroad wrote to G. S. Morrison representing the Eastern Railroad agreeing to assume one-third of the cost of the construction and one-third of the maintenance when it was completed. Since that time the B & A. has been billed that portion of the maintenance, wages, supplies of the draw tenders" (ICC). Each line owned the draw span on its own tracks with the B & A portion located on the easterly side and the B & M the westerly.

The bridge is still operated through the joint agreement entered into in 1894. The Eastern Railroad, which suffered from poor management and questionable financial decisions, was leased by the stronger Boston & Maine company for 54 years in 1884, and it ceased to be a corporation in 1890. On November 10, 1900, the New York Central and Hudson River Railroad leased the Boston and Albany line for 99 years, and merged into the New York Central in 1961. The New York Central merged into the Penn Central system and on April 1, 1976 the line became part of Conrail, the current owner of the Boston & Albany's one-third interest in Draw No. 7.

The Massachusetts Bay Transportation Authority (MBTA), created in 1964, is empowered to operate, directly or by contract, public transportation in the 78 towns and cities in the metropolitan area. Passenger service on the Boston & Maine line had not been profitable since 1958, and it petitioned to discontinue its operations. In 1964, the MBTA agreed to subsidize its passenger operations if the Boston & Maine Railroad would withdraw its discontinuance applications, thus preserving and restoring passenger service to the communities north of Boston. The Eastern Route passenger service, now operated under contract with the National Railroad Passenger Corporation (Amtrak), crosses Draw No. 7 and enters Boston at North Station. Conrail also used the track to reach its freight operations in East Boston.

II. Physical Description

Draw No. 7 is a distinctive horizontally folding, steel, movable span railroad bridge with a braced and stayed, 65'- high, wooden tower that supports the lifting cables and stabilizes the lateral motion of the bridge during operation (photo: oblique view, northwest side from new bridge, looking southeast). It is part of a 590' long crossing with wooden pile trestle approach spans on the northerly and southerly ends. The bridge opens to create a marine channel approximately 42' wide. It is powered by two, independently operating, direct current electric motors (one to raise the bridge approximately three (3) inches off its rests and a second to power the rack and pinion gears that move the steel sweep arm that swings the horizontally folding girders). Although two of the original three girders remain (the westerly girder was removed about 1972 after it was severely damaged in a marine collision), only one track, the original middle track known as Boston & Maine girders 3 and 4, is in active use. The bridge was built in 1893-94, replacing an earlier bridge of the same type, but it appears that little, if any, fabric from 1893-94 survives. In continuous service since 1894, the bridge has been upgraded, repaired, and stabilized, often with the original elements replaced by modern materials. It does, however, still operate utilizing technology that dates to the middle of the 19th century.

The bridge is located in a heavily industrialized area on the flats of the Mystic River in the cities of Somerville (south) and Everett (north), working-class communities immediately north of Boston Proper. One of the two northernmost bridges of its type in the Boston vicinity, Draw No. 7 is located on the right-of-way northeast of the turnout known as Reading Junction. It is located between the Amelia Earhardt Dam and Locks, built as part of a regional flood program and the Alford Street (state Route 99) bridge, a reinforced concrete and steel viaduct with a double-leaf bascule bridge. The precast concrete, box beam construction, multispan replacement bridge rising approximately 60' above the waterline at its highest point is upstream (northwest) approximately 100' from the historic span. The replacement bridge is scheduled to be completed and put into service in late 1989.

A. Approach Spans and Substructure

The 60' movable span is accessed by wooden, pile trestle bent approach spans. The southerly approach of 360' is comprised of 28 bents while the northerly approach of 180' is made up of 15 bents, both set 12' on center. The bents, which carry a triple track, ballasted deck, have 5 piles per side with a common center post. The outer piles of each side are battered and each group of piles has lateral crossing bracing. The deck carrying the gravel ballast consists of 3" by 10" creosoted timbers. Large, ashlar granite blocks are used for the abutments.

To accommodate the folding, or collapsing, of the movable spans from an original closed width of 40' to approximately 17' when open, the heel bearing pier is skewed and braced back to the last squared bent (bent 0) and then braced diagonally from the southwest end of bent 0 to the northeast end of bent 1 of the south approach trestle. Timber cribbing supported by closely spaced piling supports both the hinge pier and the rest pier on the north end. A secondary rest pier extends beyond the bearing pier and is set at the height of the bottom of the truss span. Both the truss and shallower steel girder, fitted with battered pedestals to compensate for the height differential, have wood bearing blocks on the bottom flanges to ease the movement across the secondary rest pier. The toe rest at the northerly side of the channel is also parallel to the channel.

C. Movable Girders

When built in 1893-94, Draw No. 7 had three independent sets of shallow, wooden, lattice trusses identical or very similar to those used on the other horizontally folding draws in the Boston Proper vicinity. The 1916 Valuation Plan field notes prepared for the Interstate Commerce Commission states that original Boston and Maine trusses were replaced in 1905 (inbound) and 1910 (outbound). Such upgrading was typical of the period as rolling stock increased in weight during the 1890s and 1900s, and bridges were strengthened in order to safely carry the increased tonnage. Perhaps because of its use as the rail link with the port at East Boston (Photo: map of rail lines and port facilities in greater Boston in 1893), all three sets of girders at Draw No. 7 were replaced with steel Warren trusses in 1917. Apparently designed by the Office of Boston & Maine Chief Engineer, Benjamin Guppy, the trusses were fabricated by the Fort Pitt Bridge Company of Cannonsburg, Pennsylvania. A complete set of plans for the 1917 trusses is owned by the Boston & Maine Corporation (N. Billerica, Massachusetts), a successor to the Boston & Maine Railroad. The 5'-4" deep, steel, built-up truss is comprised of riveted channels and angles with laced verticals, built-up I-beam diagonals and gusset plates at the panel points (Photo: Truss detail, 1917 span, southwest elevation looking northeast). In lieu of diaphragms or lateral sway bracing, S-shaped, tiebars are pinned to the top of the bottom cord and the top of the top cord which pivot and allow the trusses to fold up, are used (Photo: Detail, west pier with truss detail). Ties are not used, and the track is secured by angle clips bolted to the top flanges of the trusses and girders. The toe end of the trusses rests freely (no toe locks) on the rest pier while the heel end fits into a steel pinned, hinge bolted into the hinge pier. While the heel hinges serve as the fulcrum point, the trusses also rotate on pivots which connect them to the two steel, riveted, built-up needle beams, an integral part of the operating mechanism of the bridge, located towards the free or toe end of the girders (Photo: Detail of Needle beam-guy connection and pivots, view to northwest. Photo: Detail of Needle beam-guy connections, east elevation looking southwest).

In 1955-56, the Boston and Albany truss was replaced by a pair of 3'-2" deep, steel girders with hinged diaphragms (Photo: East side, oblique view to west). The new girder is attached to the truss by two, randomly spaced, hinged struts that move the spans in unison. The steel girder is no longer in active service, but it remains in place. The northernmost of the Boston & Maine trusses was removed about 1975 after it was severely damaged when rammed by a barge in 1972. A third needle beam was also removed when the truss was eliminated.

C. Tower and Operating Mechanisms

The most dramatic feature of the bridge is the skewed, 65'-high wooden tower located at the western or heel end of the movable spans (Photo: South elevation view to north). It was erected in 1933, replacing the 1893-94 tower, which, according to the 1916 valuation plan field notes, was scheduled to last only 30 years. Its design is predicated on its dual function of carrying and providing access to the lifting mechanism as well as supporting and stabilizing the bridge during operation. Fabricated of built-up creosoted, timbers of varying dimensions, the 44'-8" wide and 16'-10" deep out-to-out, 3-level tower is reinforced on the downriver side by a 5-panel, laterally braced transverse brace strut and on the south and west, 18" x 20" tower legs by struts of varied heights (Photo: Tower Detail, north elevation, looking south). Diagonal braces, joined to the vertical members by cast bevel plates to avoid weakening diagonal cuts in the timber members, provide lateral stability on all four sides of the tower (Photo: Typical bevel casting, north side, between second and third levels of tower, looking north). Iron tie rods, anchored through (with angle anchor plates on the outer edge) and around both the vertical and horizontal frame members, take the load when the timber members are in tension. The two systems operate independently of one another. Backstays or guys with turnbuckles for adjusting the tension run from the top of the southeast and southwest corners of the tower to cast anchors on the caps and piles of the approach spans (Photo: Brace struts and guys, east side, view to west). The stays stabilize the torque generated as the movable spans swing downriver as well as counteract the weight shift when the bridge is in operation. Only one of the original cast iron rod guys survives. The others have been replaced with wire rope 15/16" to 17/16" in diameter and ferrous rods. Most of the tower members date from 1933, according to longtime bridge maintainer, Leo Talbot, who worked for the B & M from 1931 until 1955.

Each of the 3 levels of the tower provides access to the operating mechanism which lift and lower the movable spans via a series of cables and levers (Fig. 8. Sketch of plan and elevation showing position of operating equipment). The 10-horsepower, direct current, electric motor, friction brake, and drive shaft which connects the 2 operating winches (third winch is in place but is disconnected) is located on the first level reached by a flight of stairs from the fender on the westerly side. Power is transmitted to the winches by a chain belt to a sprocket on the drive shaft. Hoisting chains from the winches run to eccentric levers on the second level (Photo: Winch, first level, with hoisting chain, looking southwest. Photo: Lever connected to hoisting chain, bridge in closed position, view to west). Pinned on brackets located on the southerly end of the tower and connected to the chain on the northerly end, the lever connects to a rod which extends to the casting, fitted with flanges to anchor them to the horizontal frame tower members at the top of the tower. The large iron castings have two movable arms, or fingers, on each side with the rear one connected to the pull rod and the front one fitted with shackles to accept the eye end of the guys that are joined to the ends of the needle beams with identical fittings (Photo Casting with arm and shackle connection, northeast corner, top level of tower). The casting is fitted with a back stay that is anchored by metal brackets to the approach span piles. To open the bridge, the motor-driven winches wind the chain around their channeled drums which in turn pulls down the pull rod on the second level and the arms of the large casting which raise the bridge from its seat the approximate three inches necessary to clear its seat. The spans are raised by the needle beams, and shackle fittings on the ends of the large castings permit the guys to rotate downriver as the bridge is pulled open or pushed closed.

A sweep arm, fitted with a rack and activated by a geared pinion drive mechanism on a frame located behind (down river) the operators shanty, moves the bridge (Photo: Sweep arm drive mechanism and belt chain from motor, view to east). It is powered by a 20-horsepower, direct current, electric motor connected to the drive machinery by a chain. The steel sweep arm, installed in 1947 replacing an wood and steel member that failed repeatedly, is joined to the downriver girder by a pinned connection that permits the movable spans to rotate and fold into an 18'-wide pocket in the southeast fender to create a 42'-wide clear channel (Fig. 9. Sketch plan of bridge in operation) (Photo: Detail, sweep arm connection to 1955 girder, looking north). The sweep arm travels across the east fender and is carried on a roller support on the south side of the fender.

D. Tenders Shanty and Controls

The frame, gable-roofed clapboarded, 10'-6'' by 10'-6" tenders shanty is located on the east fender adjacent to the easterly legs of the tower. Its exact date of construction is not known. The 1916 valuation plan field notes are annotated suggesting that it was replaced in 1933, but longtime maintainer Leo Talbot, who began working for the Boston and Maine Railroad in 1931, remembers it as an old building. Finished with boxed overhanging eaves and a chamfered corner with a window on the northwest so that the tender can check the weight moves along the northeast leg of the tower to indicate the position of the draw spans, it has windows on the north and east elevations.

The freestanding control board (Photo: Control board in tender's shanty, east wall), believed to have been installed in 1927 when the ca. 1910 gasoline Jaeger Type R Series 5 engine was replaced with direct current electric motors, is set against the east wall while the rheostats, and brake release used to move the bridge are grouped in the northwest corner (Photo: Operating Controls in northwest corner of tender's house, looking northwest). The power to open the bridge is controlled by an interlocking, prescribed sequence system. The block signals, located at either end of the bridge and controlled by the bridge tender, are brought to red (a stop signal) by switch 14 on the control board. The safety gates at either end of the approach spans are then lowered, and when they are in place, the pins in the toe locks are automatically withdrawn and the electrical connection with the regional control tower is broken, indicating the bridge is open. Once the block is secured, the operator can then turn on the power to open the bridge. Originally, tracks in either direction could be operated independently, but since the removal of B & M girders 3 and 4 ca. 1975, one control services devices in both directions. Lights on the control board also indicate when a train is approaching the signal block and from what direction.

The operator then moves to the rheostat controls. The secondary power switch on the north wall is used to direct power to each of the two operating motors; they are not serviced in tandem. Using the secondary switch, power is directed to the lifting motor located on the first level of the tower. The foot pedal to release the belt, friction brake, also located on the first level of the tower immediately east of the electric motor, is depressed (it must stay depressed during the raising and lowering operation), and the rheostat which activates the motor driving the winches is turned on. It cuts off automatically once the bridge has been raised the prescribed height. A weight connected is to a cable along the northeast leg of the tower to indicate the height of the movable girders thus providing the operator with visual confirmation that the spans are in the proper and safe position for lateral movement. The rheostat control is returned to the off position, and the operator returns to the secondary power switch and transfers the power to the sweep arm motor. It is controlled by a separate rheostat that also is set with an automatic stopping point. The operator can, in the instance of an wide vessel, use an "incher" to slowly open the bridge further.

To close the bridge, the steps are executed in reverse sequence exception for the actual rail alignment. To prevent hard contact between the mitred rails, the "incher" is used. The incher is also used to lower the spans back onto their rest pier seats so that the proper tension and number of wraps is maintained on the winches. There are no toe locks on the bridge, only the electrical lock that established the signal block circuits.

E. Fenders

Draw No. 7 is flanked by a fender and pier system, carried on laterally braced timber piles, that is designed to protect the movable span as well as define the 42'-wide marine channel. Finger piers with cut water end details were located at the northeast and southwest sides of the channel. The 190'-long northeast survives, but the northwest one was reduced to 39' in length to accommodate the construction of the replacement span. It is 29' wide and serves as the landing for the main tower stairs. The 72'-long southeast fender pier, set with the 18'-side pocket for the spans when in the open position, serves as the base for the transverse braced strut, the tenders shanty, a non-functioning toilet, metal shed, wooden shed, and the motor and sweep arm assembly. Fender piers have some pressure-treated wooden decks.

F. Modifications to Draw No. 7

With the exception of the installation of the modern stringer girders in 1955-56, work on Draw No. 7 since World War II is best categorized as repair rather than modification. The trusses and needle beams have periodically been repaired in kind, and worn elements of the castings, shackles, and eyes as well as the guy fittings have been replaced, also in kind. The frame for the sweep arm gear was replaced in 1966.

The 1933 tower, which has greatly exceeded its 30-year useful life expectancy, has been reinforced several times to correct deflection and torque problems. The panel points have been reinforced by bolted steel gusset plates, and a steel channel was added to the northeast leg of the tower. In 1957 the tower was strengthened by the addition of an iron stay added to the southeast leg.

By 1978, the connections with the down river strut brace and many of the backstay guys on the east side of the tower were failing because of the load put on the tower when the bridge is in operation as well as the lateral wind load and the inherent tendency of the bridge to lean downstream. About 1980 a steel I-beam with wire rope guys anchored to the piles and braces of the southeast fender was added between the eastern legs of the tower. The connections between the tower and the strut braces were also reinforced with both plates and bolts as well as guys.

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MAPS

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"Map Showing the Terminal Facilities of Boston." 1893. Boston Athenaeum.

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PRINTS

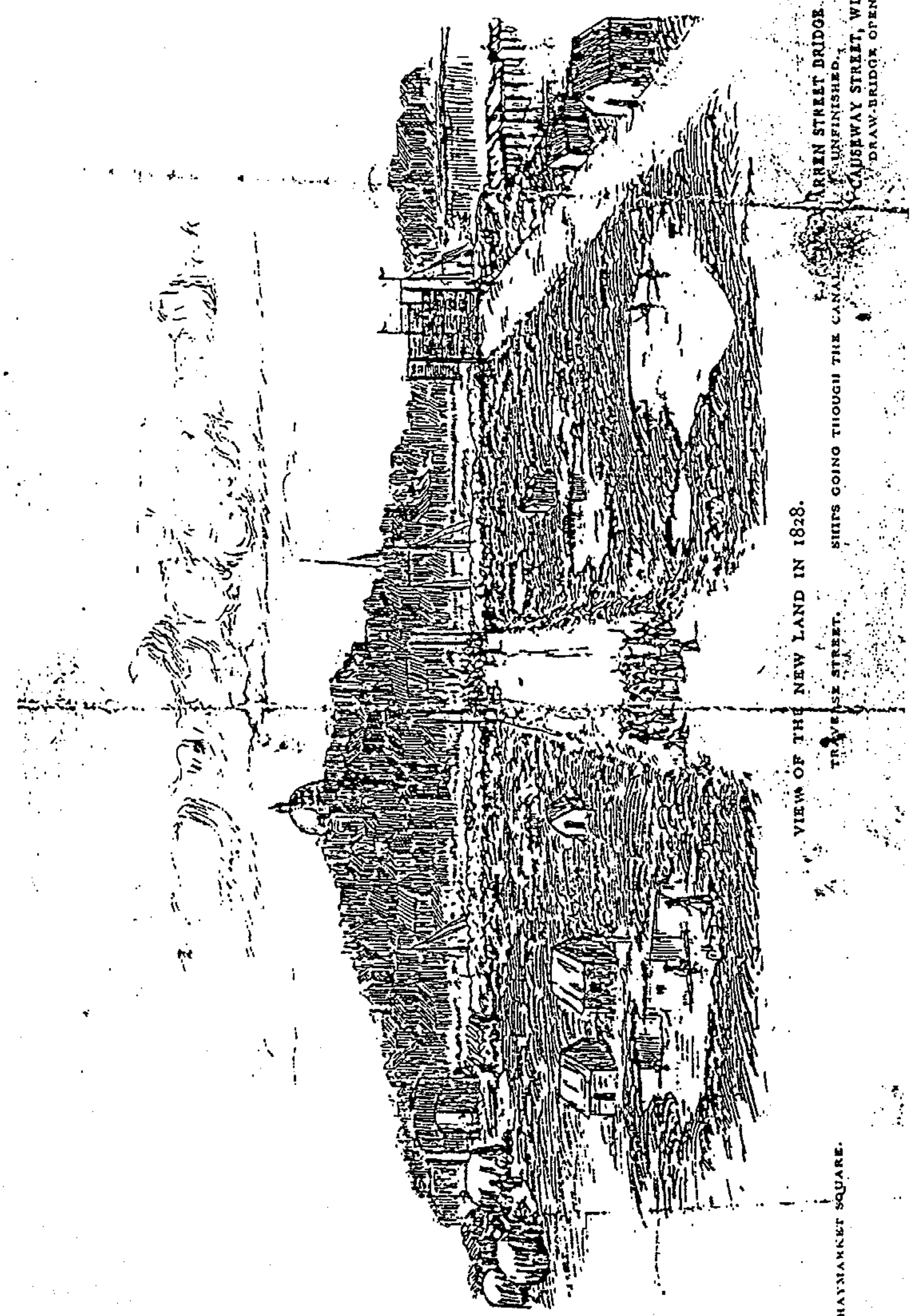
"View of New Land in 1828." Sketch. Boston Athenaeum.

INTERVIEWS

Talbot, Leo (bridge maintainer from 1931 until 1955). Interview with Mary McCahon, 19 November 1988.

INDEX TO FIGURES

Figure 1

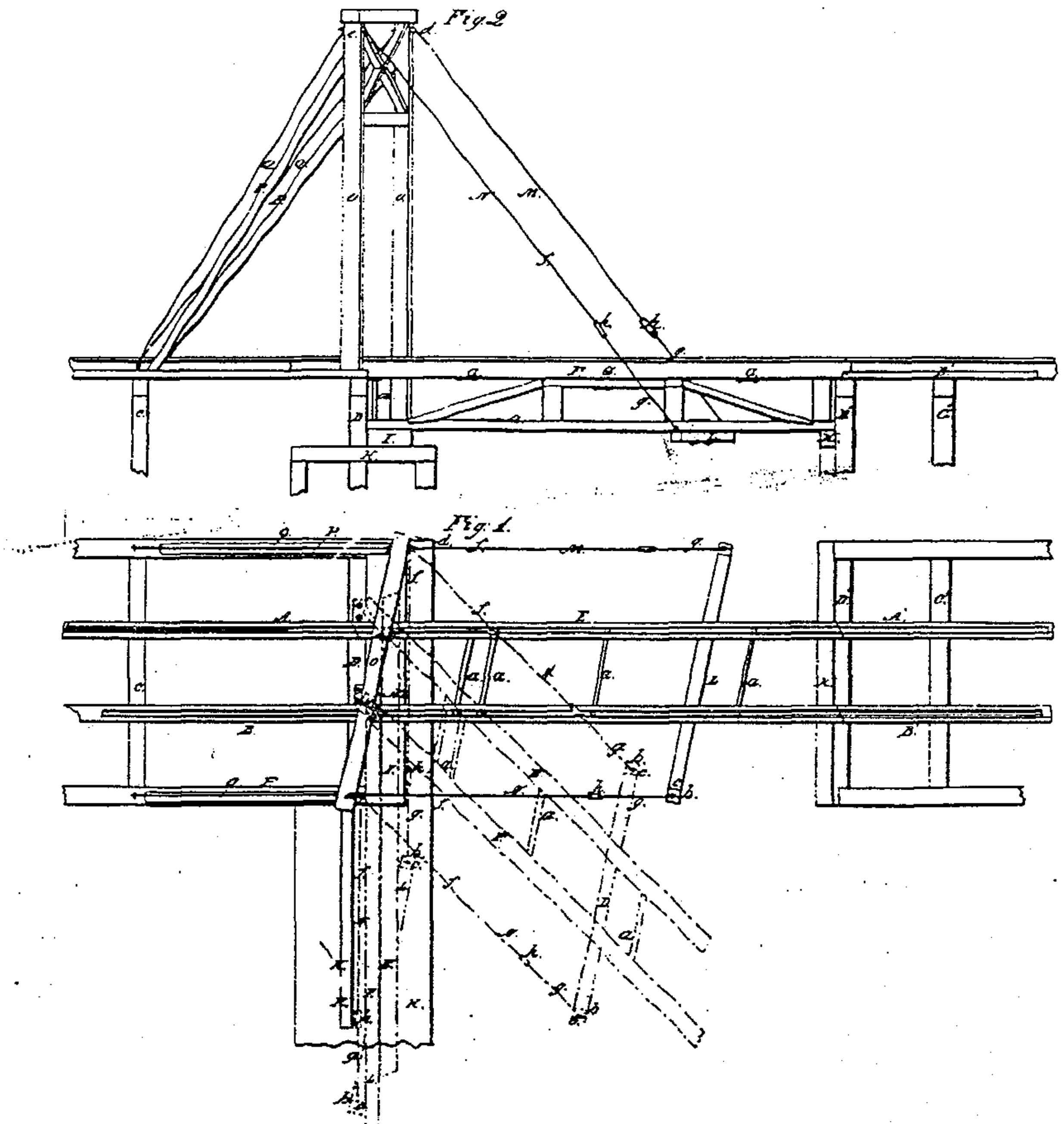


VIEW OF THE NEW LAND IN 1828.

Figure 2

J. Ross.
Bridge.

N° 5,997. Patented Jan. 2, 1849.



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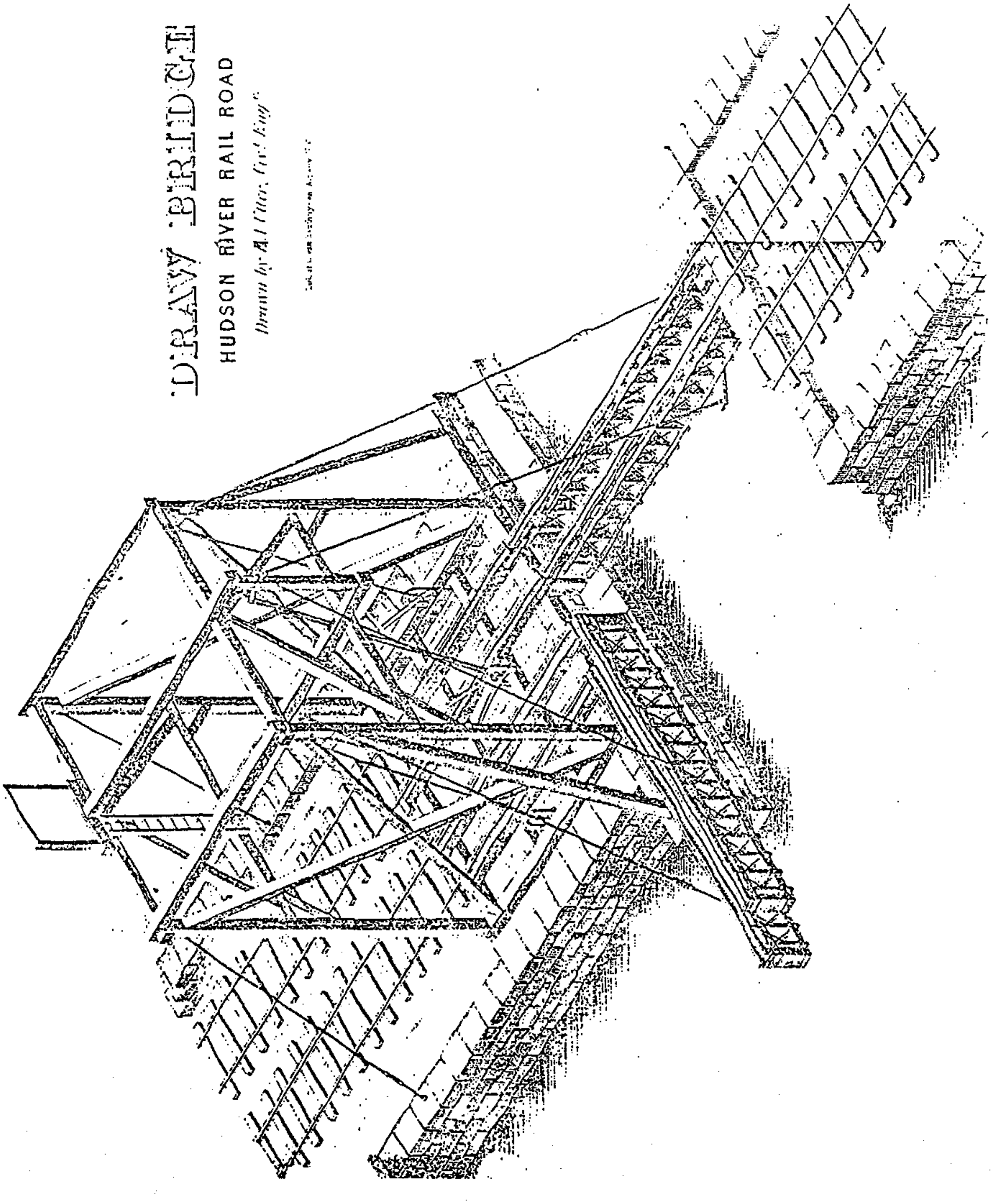
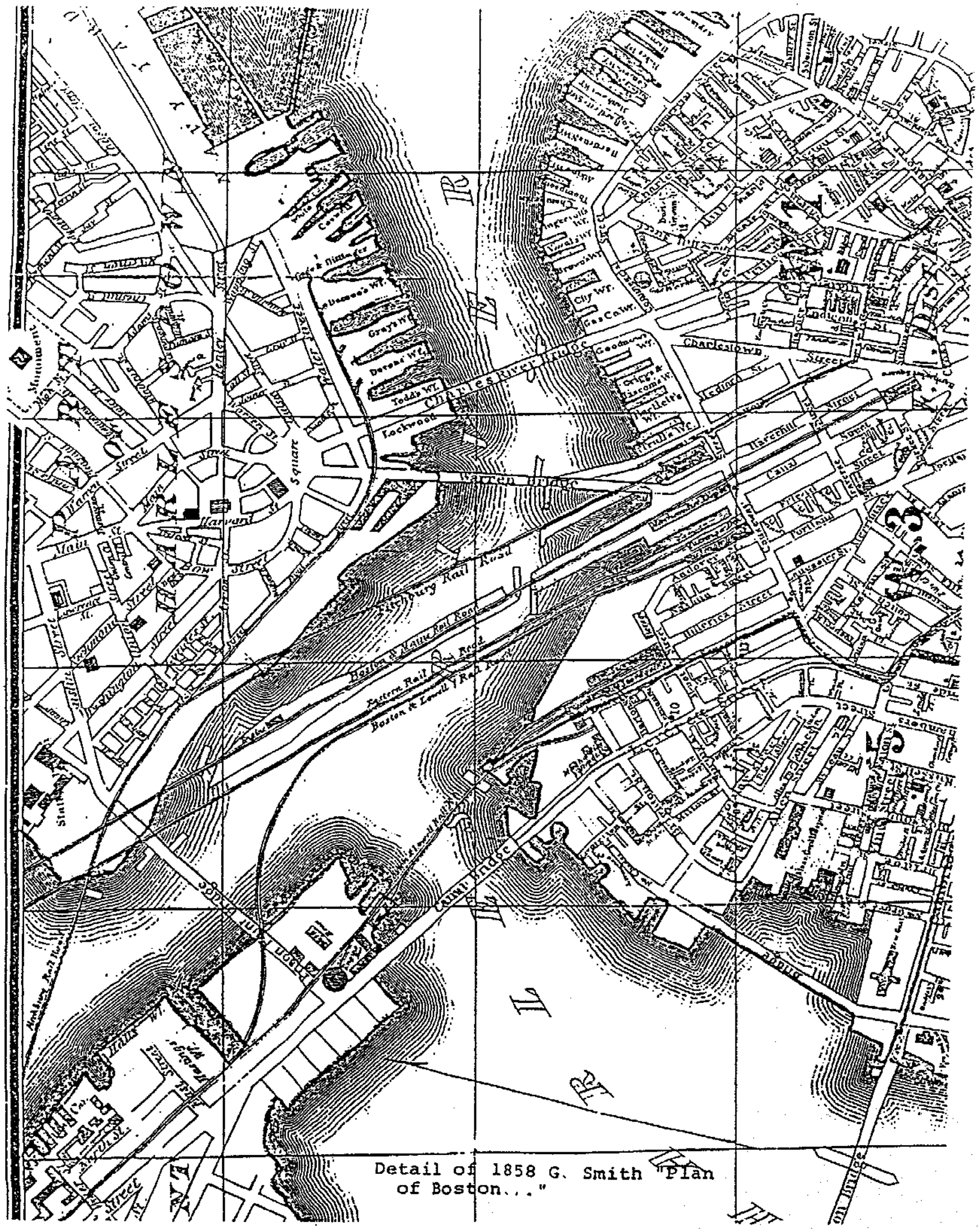
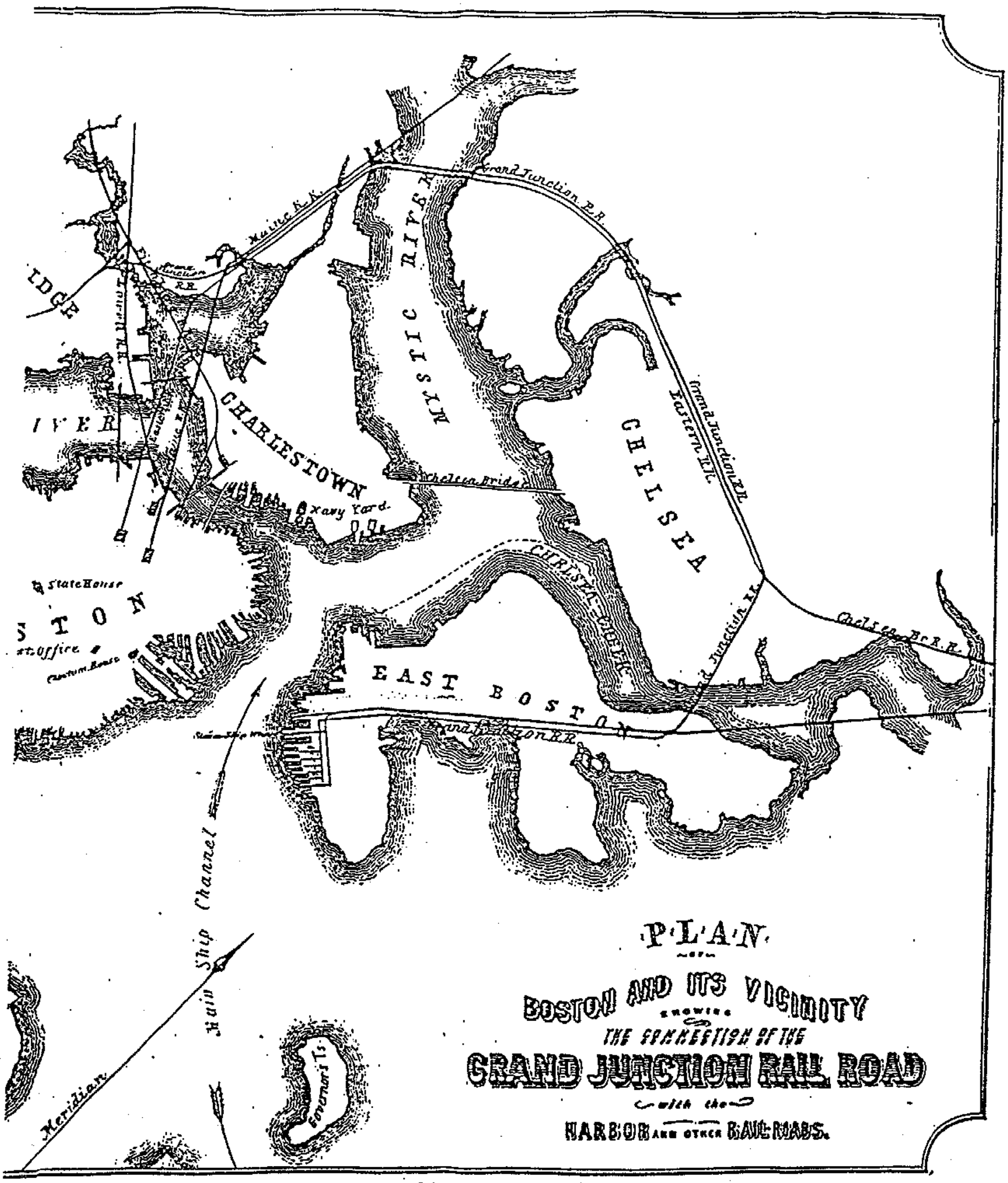


Figure 4



Detail of 1858 G. Smith "Plan of Boston..."

Figure 5



1853 Map of Grand Junction and Eastern Railroads

Figure 6

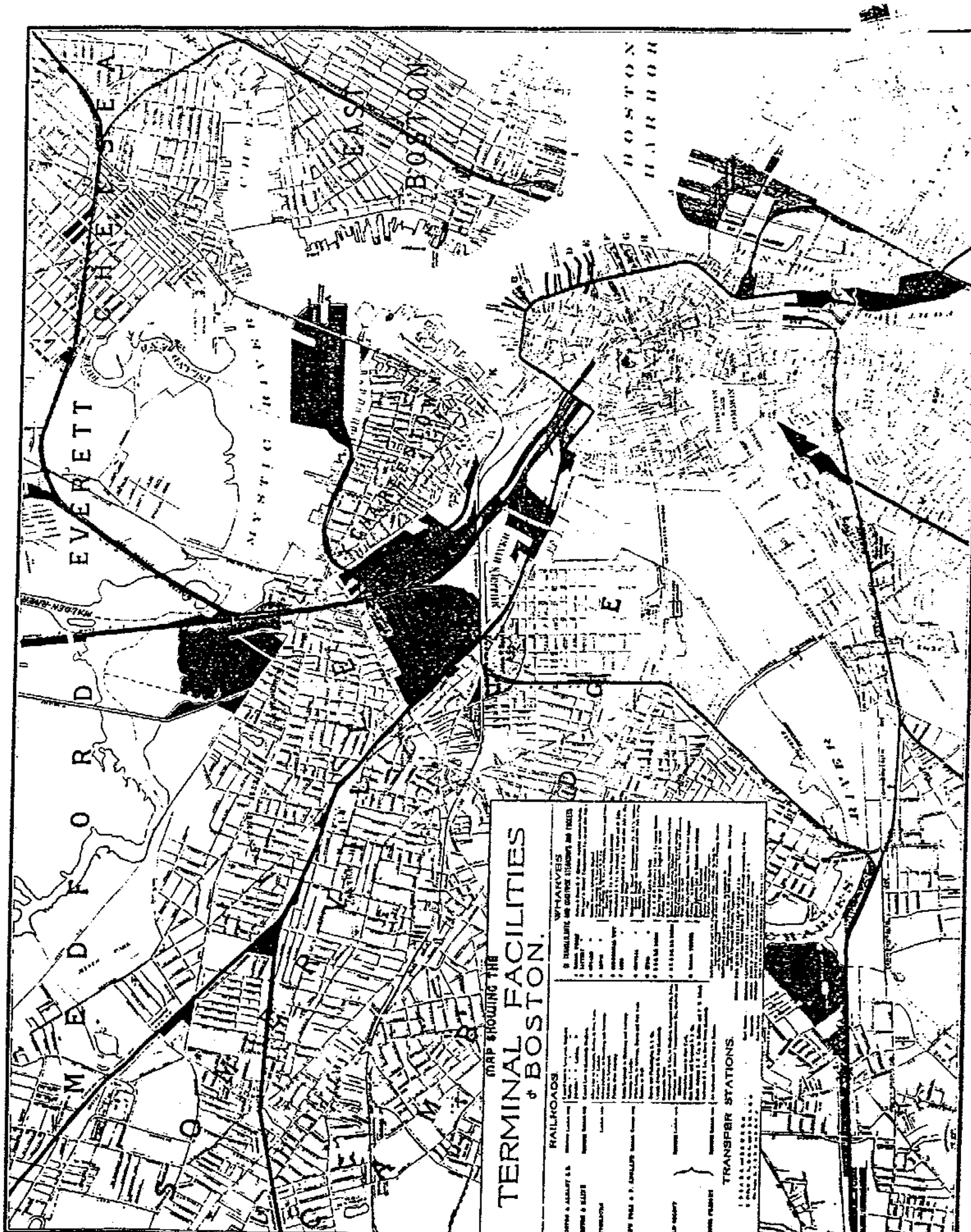

MAP SHOWING THE
TERMINAL FACILITIES
of BOSTON.
RAILROADS
WHARVES
TRANSFER STATIONS.
EVERETT
EAST BOSTON
BOSTON HARBOR
MYSTIC RIVER
MALDEN RIVER

Figure 7

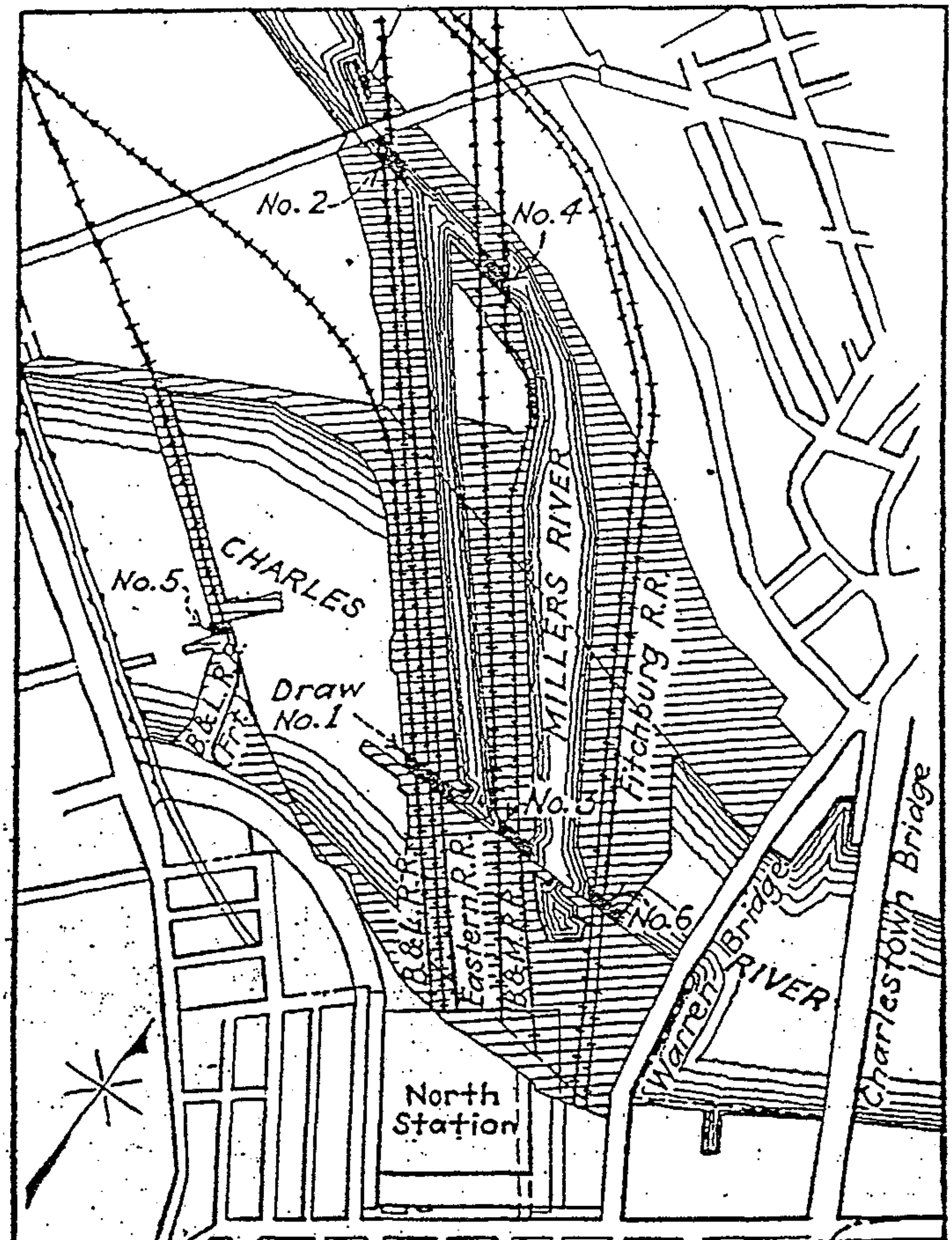

No. 2
No. 4
CHARLES
No. 5
MILLERS RIVER
Fitchburg R.R.
Draw
No. 1
B.&L.R.
Frt.
No. 3
No. 6
B.&L.R.R.
Eastern R.R.
B.&M.R.R.
Warren Bridge
RIVER
Charlestown Bridge
North
Station

Figure 8

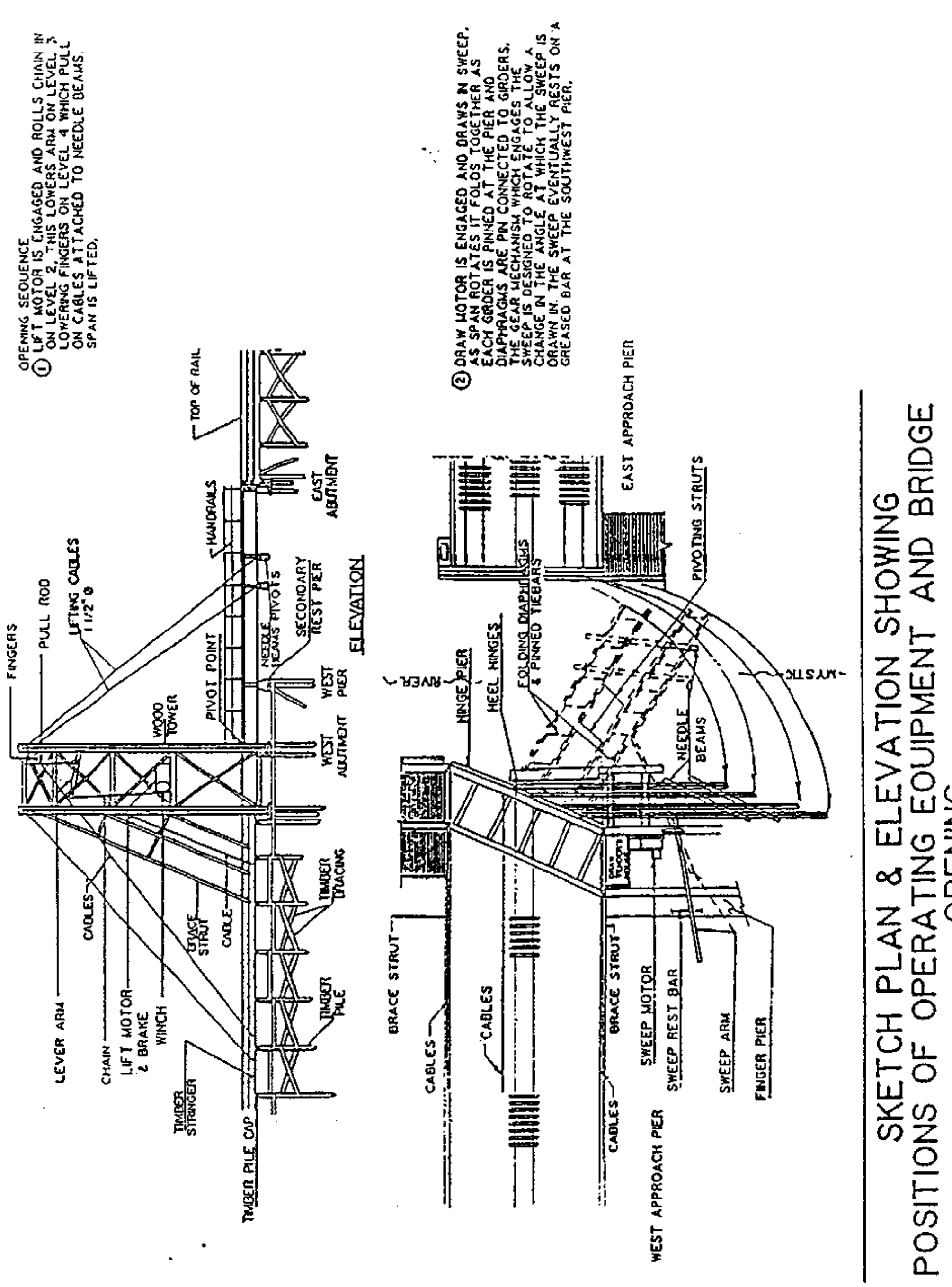
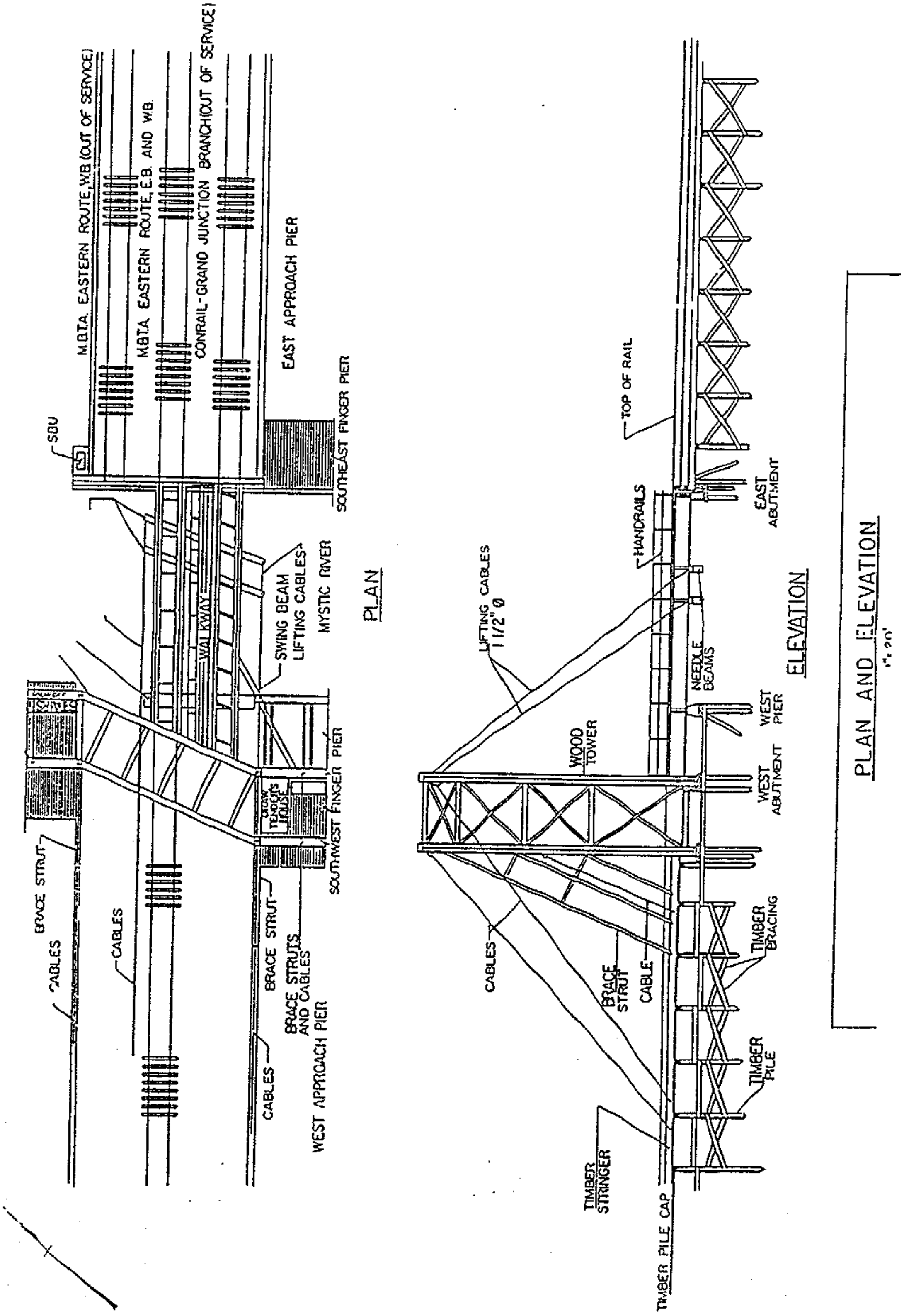

OPENING SEQUENCE
① LIFT MOTOR IS ENGAGED AND ROLLS CHAIN IN ON LEVEL 2, THIS LOWERS ARM ON LEVEL 3 LOWERING FINGERS ON LEVEL 4 WHICH PULL ON CABLES ATTACHED TO NEEDLE BEAMS. SPAN IS LIFTED.
② DRAW MOTOR IS ENGAGED AND DRAWS IN SWEEP. AS SPAN ROTATES IT FOLDS TOGETHER AS EACH GIRDER IS PINNED AT THE PIER AND DIAPHRAGMS ARE PIN CONNECTED TO GIRDERS. THE GEAR MECHANISM WHICH ENGAGES THE SWEEP IS DESIGNED TO ROTATE TO ALLOW A CHANGE IN THE ANGLE AT WHICH THE SWEEP IS DRAWN IN. THE SWEEP EVENTUALLY RESTS ON A GREASED BAR AT THE SOUTHWEST PIER.
FINGERS
PULL ROD
LIFTING CABLES 1 1/2" ø
LEVER ARM
CABLES
CHAIN
LIFT MOTOR & BRAKE
WINCH
BRACE STRUT
CABLE
TIMBER STRINGER
TIMBER PILE CAP
TIMBER BRACING
TIMBER PILE
WOOD TOWER
PIVOT POINT
HANDRAILS
TOP OF RAIL
WEST ABUTMENT
WEST PIER
NEEDLE BEAMS PIVOTS
SECONDARY REST PIER
EAST ABUTMENT
ELEVATION
BRACE STRUT
CABLES
HINGE PIER
HEEL HINGES
FOLDING DIAPHRAGMS & PINNED TIEBARS
NEEDLE BEAMS
PIVOTING STRUTS
MYSTIC RIVER
EAST APPROACH PIER
SWEEP MOTOR
SWEEP REST BAR
SWEEP ARM
FINGER PIER
WEST APPROACH PIER
SKETCH PLAN & ELEVATION SHOWING
POSITIONS OF OPERATING EQUIPMENT AND BRIDGE
OPENING

Figure 9


M.B.T.A. EASTERN ROUTE, W.B (OUT OF SERVICE)
M.B.T.A. EASTERN ROUTE, E.B. AND W.B.
CONRAIL-GRAND JUNCTION BRANCH(OUT OF SERVICE)
EAST APPROACH PIER
SBU
SOUTHEAST FINGER PIER
WALKWAY
SWING BEAM LIFTING CABLES
MYSTIC RIVER
PLAN
DRAW TENDER'S HOUSE
SOUTHWEST FINGER PIER
BRACE STRUT
CABLES
CABLES
BRACE STRUT
BRACE STRUTS AND CABLES
CABLES
WEST APPROACH PIER
TOP OF RAIL
HANDRAILS
EAST ABUTMENT
LIFTING CABLES 1 1/2" Ø
NEEDLE BEAMS
WEST PIER
WOOD TOWER
WEST ABUTMENT
CABLES
BRACE STRUT
CABLE
TIMBER BRACING
TIMBER PILE
TIMBER STRINGER
TIMBER PILE CAP
ELEVATION
PLAN AND ELEVATION

APPENDIX I

ORIGINAL TEXT OF PATENT

UNITED STATES PATENT OFFICE

JOSEPH ROSS, OF IPSWICH, MASSACHUSETTS

SWINGING BRIDGE

Specification of Letters Patent No. 5,997. dated January 2, 1849

To all whom it may concern:

Be it known that I, Joseph Ross, of Ipswich, in the county of Essex and State of Massachusetts, have invented a new useful or Improved Draw for Railroad Viaducts or Bridge over Navigable Streams or Rivers; and I do hereby declare that the same is fully described and represented in the following specification and accompanying drawings, letters, figures and references thereof.

Of the said drawings, Figure 1, exhibits a top view or plan of my improved draw, as applied to a railway viaduct. Fig. 2, a side elevation of same.

In said figures, A, B, A', B', denote the rail stringers of a bridge, each two of which is arranged and supported on two or more piers C, D, or C', D' or in any other suitable manner, the two piers D, and D' being placed at such a distance apart as may not only be necessary for a draw opening for the passage through the bridge of such vessels as may navigate the waters over which the bridge may be thrown, but also to allow of the correct adaptation and operations of the turning draw as will be hereinafter explained.

The draw is made as follows: Two beams or timbers frames or trusses E, F, are disposed parallel to one another, and between the two sets of rail timbers A, B, A', B', as seen in the drawings. They are connected together by any suitable number of bars G, G & c., which are disposed parallel to each other and jointed at their ends to the two beams or trusses E, F, in such manner as will allow of both of the two beams or trusses being simultaneously turned around on their joint pins, a, a, at one end of each of them, the said joint pins being arranged as seen in the drawings, and for the purpose of allowing the two beams or frames E.F. to be each turned out at right angles to the main bridge and over the side pier or wharf H, as denoted by red lines in Fig. 1. It is intended that each beam or frame shall be so hinged or jointed to the main bridge as to allow of its being moved around like a gate on its hinges and into a position perpendicular with the bridge in order to leave the draw opening clear for the passage of a vessel through it. The rear end of each frame is to be sustained on a suitable pier or as foundation I, as well as on the main pier which supports the adjacent ends of the two rail timber A.B. So in regard to the front ends of the two beams or frames, they may be similarly supported (when in line with their respective rail timbers) on a shelf or pier B, and the pier D', or only on the latter as occasion may require. Extending underneath the two beams or trussed frames E, F, and in a direction parallel to a horizontal line passing through the centers of axes of the two turning pins or bolts a, a, is a saddle timber L, which should be jointed or connected to the two frames in a manner similar to that in which each of the parallel bars G, G, &c., are connected to the said frames, the said parallel bars G, G, &c., being respectively arranged parallel to the said saddle timber.

The saddle timber is made to project some distance beyond each of the timbers or frames E, F, and has a square iron collar b, and an eye c, fitted on each end of it, as seen in the drawings. One end of one of two suspension rods M, N, is hooked through each one of the said eyes c,c, the other or upper end of said rod being similarly hooked through one of two eyes of eye bolts d, e, inserted in the upper part of a vertical frame O, raised on or near the piers D, I, the said vertical frame being stayed by inclined stay rods Q Q, and struts P, P, R, disposed as seen in the drawings. Each of the sustaining rods M, N, may be composed of two rods f, g, united by a screw nut h, made with a right and left threaded screw, and screwed on corresponding screws made on the rods f, g, the same being for the purpose of lengthening or shortening each of the rods M, N, as occasion may require. The two eyes of the eye bolts at the upper part of the frame O, should be arranged with their centers in a horizontal line made parallel to a horizontal line supposed to pass through the axes of the turning pins of the two frames or beams E, F. This will enable us to make the two suspension rods M, N, of the same length, and admit of their moving around with the draw, composed of the two frames E, F. In Fig. 1, the draw is represented by the blue lines as open at an angle of forty five degrees or thereabouts with the main bridge.

Suitable contrivances should be affixed to the draw for locking it in place either when closed or open. The iron track rails are to be laid on the rail timbers of the bridge, and also on the upper invention to the use of but two of the turning frames or timbers E, F, as four or any other suitable number may be used, each being supported and made to operate essentially as above specified. Neither do I confine my invention to any particular mode of making side of the two beams, or trussed frames E, F, the ends of the rail timbers and the timbers E, F, where they come together being each made with a chamfer or bevel as seen in Fig. 1.

I wish it distinctly understood that I do not confine my said frames or beams E, F, or the bridge with which they are connected, as all these things must be varied according to circumstances, but

What I do claim as my invention is-- A draw constructed of two or more parallel turning frames or timbers E, F, and supported, and made to operate with respect to the bridge substantially as above specified.

In testimony whereof I have hereto set my signature this twenty fourth day of April, A.D. 1848.

JOSEPH ROSS.

Witnesses:
R. H. Eddy
F. Gould

APPENDIX II

EXISTING PLANS AND DRAWINGS FOR MYSTIC RIVER BRIDGE--DRAW NO. 7

Plans and Drawings Owned by the Boston & Maine Corporation: N. Billerica, Massachusetts.

1916. 11 Sheets: Ink on Linen. Folder 7/1/2/30.
Detailed plans of trusses 1,2,3,4 and the needle beams.

1931. 2 Sheets. Ink on Linen.
Substructure - Draw 7.

1931. 9 Sheets. Ink on Linen. Folder 2/2/2/9
Redrawn in 1942. Plans and timber schedule for rebuilding the tower and replacing some castings and hardware.

1942. 2 Sheets. Ink on Linen. Folder 9/7/2/19.
General plan and sections of southwest fender pier. Steel and Timber details of southwest fender pier.

1943. 1 Sheet. Blue line print.
Fender piers, Draw No. 7. Prepared by B & M Office of Division Engineer.

1945. 3 Sheets. Ink on Linen. Folder 2/2/2/10.
Repair Plan. Repairs to stiffen trusses.

1946. 2 Sheets. Pencil on Tissue. Folder 2/2/2/12.
Plan of headers.

Other plans and drawings relating to Draw No. 7 are listed in the card index maintained by the successor to the Boston & Maine Railroad, but hard copies were not located.

APERTURE CARD COPIES OF PLANS AND DRAWINGS OWNED BY THE MBTA

1913-18. 4 Cards. Small details (rail end device; Plan of tie bars and rail plates; Casting (needle beam pivots); Detail of shackles and links for needle beams).

1938. 1 Card. Repair Plan: Detail of stiffening plates to Boston end.

1941. 1 Card. Street sweep (arm).

1957. 1 Card. Tower strengthening plan.

APPENDIX II (Cont'd)

1966. 3 Cards. Sweep gear frame. Office of Chief Engineer.

1970. 1 Card. West lever casting.

1970. 1 Card. Trestle strengthening and truss bearing support.

PLANS AND DRAWINGS MAINTAINED BY THE NATIONAL RAILROAD PASSENGER CORPORATION - BOSTON DIVISION (AMTRAK)

1917. 1 Sheet. Black Line Print.
Updated in 1936. Details of movable parts (eyes, bolts, pins). Office of Chief Engineer.

1936. 2 Sheets. Ink on Linen.
Details of movable parts, including the sweep and standing rigging.

1945. 3 Sheets. Blue Line Print.
Repair plan to trusses.

1947. Steel Sweep Arm.

1955. 3 Sheets. Black Line Print.
Plans for new steel girder installed on the Boston and Albany's portion of the bridge.

1970. Detail of movable parts.