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CONTENTS

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The Propulsion of Cross-River Ferries in 19th Century Maine

Preface:

Virtually every type of transportation media used in Maine has been studied and pictured in historical and research reports, except, apparently, cross-river ferries propelled manually or by the wind or water currents. Individual ferries are often mentioned in community histories and a set of photos are also found in other books by authors such as Mc Lane and Thorndike and especially W.H. Bunting whose efforts were a primary inspiration. Therefore, it seems appropriate to attempt to remedy this oversight. Our approach has been to survey as many accounts as possible on Maine's major rivers, the Kennebec, Penobscot and Androscoggin, summarizing what we do and do not know at this point and laying out 'theoretical' issues as a guide to further research.

Historical Context:

In recently established (1820) Maine, a law was passed in 1830 to deal with the rapidly growing numbers of cross-river ferries. The legislature was evidently too busy to deal with such minor matters so it assigned the power to license them to the counties, provided that they not allow propulsion by steam or horse power.[1] The state reserved the right to directly license ferries running up and down rivers and at their mouths and off shore. In addition, they reserved the right to exempt any location from these county prohibitions by appeal to the state legislature. In the same session as this law was approved, two towns asked for and were allowed to operate horse ferries, Bath and Hallowell. There are accounts of both in operation but no pictures or descriptions. One other, in Bucksport, is said to have functioned later but again with hardly any detail. In most of the state therefore, cross-river ferries employed a range of legal and "natural" technologies apart from rowing and poling and manually pulling on cables.

The most extreme device was never verified to function adequately. In Sidney around 1870 a farmhand mounted a windmill on a barge linked to a propeller made of junked farm machinery. A caustic news report from Bangor doubted that it could possibly work against a headwind. The best systems appeared to 'sail the current' by angling the hull and often side boards against the current supplemented by pulling on the cable or poling when the current was not strong enough. However, the means of propulsion was rarely discussed so we are left, in most cases, to speculate based on what can be made out from available pictures. Beyond town histories, diaries of travelers may turn out to be the best source of information but this one has yet to be explored.

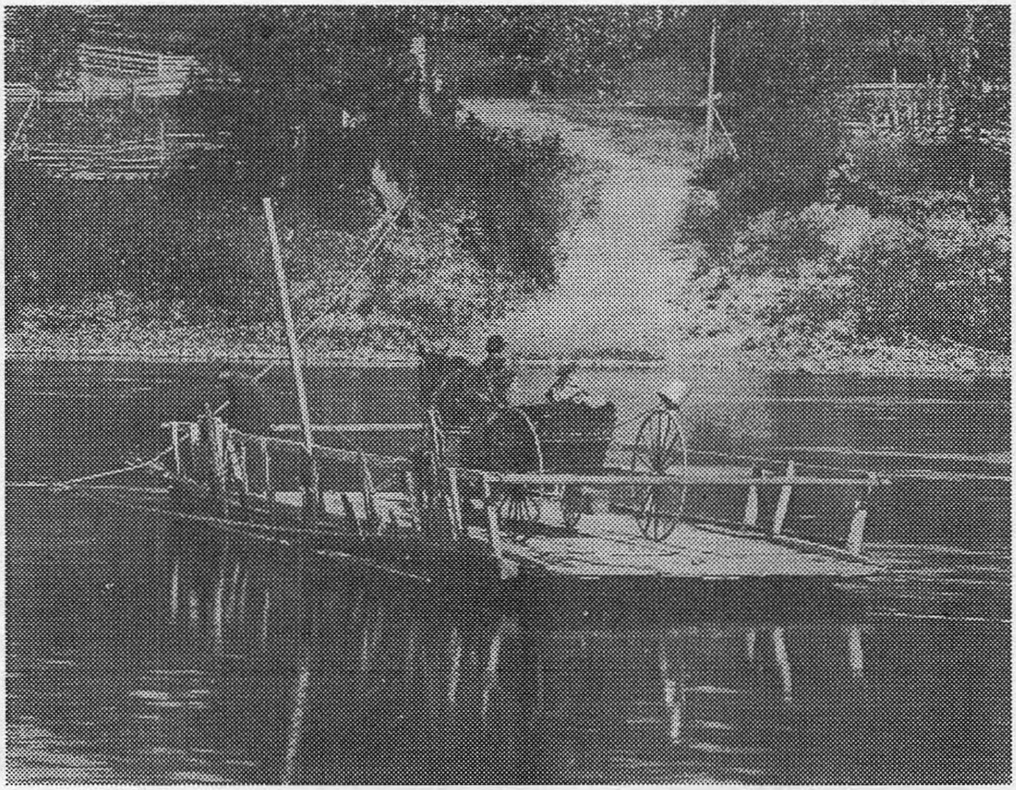
Operation:

We wish to explore the mechanics of operating cross river ferries, however propelled. The number of variables is daunting. Each crossing had its unique set of headlands, depths in crossing, obstructions, landing areas-depending on varying river depths, current speeds, floating obstructions such as ice cakes and logs as well as longitudinal (up and down river) ferries and other craft. There were no approved or even recommended designs for hulls or other boat features and no regulations about tying vehicles and animals down nor any known texts to assist builders except in the case of the prohibited horse ferries (at least known or cited in Maine). We do have an idea of the dimensions of some ferries from photographs either by explicit mention (quite rare) or analytic guess work from the sizes of vehicles and people on board. Most were sized to carry one or two wagons and a few foot passengers. (40-60 ft in length and 12-20 ft beams, not including the landing ramps and a number were smaller).

The majority utilized a "cable" of rope or steel to free them from the extra effort needed not only to cross the river but to counter its downstream flow. Steel cables probably began to be used in Maine soon after the Civil War and their availability presumably opened up a wider range of suitable sites. Some crossings, however, were either too wide for cables(weight and cost), or were subject to regular longitudinal ferries such as Sidney, which faced a Waterville to Augusta steam boat line for some years. (As soon as it ceased operation they restored their cable). Cable-less, they "often had trouble making their desired landing spot". (Perhaps, like some early trolley passengers near Bath faced with inadequate electric power as they approached a hill at the end of their run, they had to get out in the shallows and push their craft to the desired landing area.)

Legal powering systems in general use in Maine:

1) Sailing (used largely where cables were not allowed or feasible due to excessive width or cost). 2) Rowing or poling. 3) Manual pulling or pushing on-deck mounted cables by means of "grab handles"- poles with a notch permitting quick release and an angle parallel to the deck. The operator would walk from bow to stern holding this pole, then release it and repeat. The cable passed over two pulley wheels at the extreme ends of the ferry leaving as much 'power walking space' as possible. 4) "Sailing the current" by angling the craft with the stern let out down stream with the bow "close to the wind" in sailing terminology. Supplementing this strategy, many ferries also used from one to three side("lee" in sailing language) boards to grab more force from the current. (Sailors' lee boards are, in ferry terms, down stream while ferries had to position their boards upstream to get the best leverage) The best of these "current sailers" used a double wheeled "trolley" running the full length of the barge on the overhead cable with separate adjustable lines to the bow and stern. Generally this system was supplemented by direct manual efforts on the cable, (except, of



course, for out-of- reach overhead cables) and perhaps rowing or poling when the current was slack. 5) Hypothetically one can imagine many other systems and then look for any use of them. e.g.. Using draft animals on each shore to raise a weight on a pole high enough to pull the craft across the river like a clock weight! Or having an animal on either side pull on a cable running in a continuous loop around a drum on its side with two lines each the width of the river. As it pulled the ferry across from the other side -running out one line-it would also be winding up the line which would effect the return trip. Also why not use a winch on board with a continuous loop?

The following is an example of just this last system but it was never used for ferries as far as we have seen. In logging operations on lakes and wide rivers barges moved masses of logs via a large capstan head in the middle with a shore to shore cable turned by a group of men which could winch itself along. Needless to say there was no room for any cargo or passengers but a ferry version could be imagined.

Cable systems had their own variations. Some lay on the bottom to avoid conflict with other boat traffic. These had the obvious disadvantage of having a lot of slack to be offset heading upstream at the end of each run. They also snagged waterlogged trees and could have rocks washed over them in floods. Such positions were very common between off shore islands and nearby mainland, among islands or across harbors.

Some cables were hung well overhead owing to the opportunity presented by a high headland. Or they could have been mounted this way to avoid other boats. Any other advantages? Would over head cables have provided some buoyancy by using the rivers force to not only propel the ferry across the river but also lift it a bit on its up stream side? The major disadvantage, mentioned above, would be not being able to propel the ferry by "walking" the cable from bow to stern.

Deck level and overhead cables were normally as tight as feasible, with the former passing over the deck through two wheels at an ideal level for manually supplemented power. However, land fastening would presumably have to be adjusted as the river's level changed whether due to rainfall or tidal action or both. In addition, even when steel cables became available (if such modest ferries could afford them), there would still be some slack and thus a 'moving apogee' as the ferry approached land. The current would weaken and the most steeply angled point in the trip, vis-à-vis the 'behavior' of the cable, would occur as the craft had to go 'upstream' somewhat. Thus an alternative source of power-such as poling or rowing- would be called for to make a successful landfall. Embarking with a load often required the momentary shift of people and cargo to the bow in order to lift the stern off the bottom.

At this point the contribution of a retired naval architect, Norm Hamlin, was enlisted to deal with issues beyond my competence. I asked him to calculate the effort necessary to manually propel a specific ferry with which we both had some experience- Arthur Hopkins' cross harbor ferry between North Haven and Vinalhaven. By the time we knew it shortly after WWII, it finally had a motor but before the war he had reportedly pushed or pulled it across by hand. Hamlin's full demonstration will be printed in a subsequent version of this paper. What he proved, with necessary caveats, was the feasibility of one man to move an average ferry with a normal load at a speed of one knot meaning that this trip took 30 minutes. The operator's most difficult task was getting started. Once the underwater cable (made necessary in such a busy harbor) began slipping overboard from its stern pulley wheel, the task of pulling it up on the bow became much easier. If his customers were in a hurry they could try to help though it is doubtful that a significantly greater speed resulted, but at least Hopkins could manage to exert less effort himself.

Differences between the Kennebec and Penobscot, and the Androscoggin. The first two of Maine's major rivers are tidal for many miles inland. They thus facilitated passage upstream on the incoming tide and were also forgiving of grounding out-except at monthly high tides. But this advantage refers to longitudinal traffic not to cross-river ferries. Therefore the ferries above "head tide" (above Hallowell on the Kennebec) used a different system than those below. All of those above relied on high overhead cables. Those below head tide were limited to cables on the bottom, and thus had to rely on sails or oars. The Androscoggin on the other hand is tidal only to Brunswick, a coastal town. It has a waterfall there and in Lewiston and generated dams in both towns and in many places above. Therefore the Androscoggin could not link Maine to the world but served as a source for power and easier cross-river transportation. It is narrower and slower than the other two rivers resulting in a major difference in its use of overhead cables. Instead of staying out of the operators' reach as on the other rivers, they were rigged to be pulled down to operator chest level like an underwater cable or one set at this level permanently. This way, operators could benefit from spring flooding and sudden downfall high currents and resort to the grab pole when necessary. This arrangement called for two poles on each side and a system of pulleys and weights on shore as well as on board.

There is another difference along the Androscoggin not yet fully explored. The width and speed of the Kennebec led to counties and towns to use it as a boundary but not so often in Western Maine. (Bethel, on the Androscoggin, had 4 ferries whereas along the Kennebec a town of this size would have had only one, if any.) This may have something to do with the greater number of ferries along the Androscoggin since, 1.town borders often ran across the river 2. Towns frequently subsidized their ferry service and 3.service was cheaper since smaller boats were used.

Landing ramps:

Since both ends of all ferries were canted, one might suppose it was to accommodate sloped shores. Actually the end pitches functioned mainly as a modest effort at a marine shape to pass more efficiently through the water. In addition, the operators tried to avoid hull contact with the bottom since if they arrived empty to pick up a load, they could end up well anchored as soon as the load was on board. (However, the special case of operating in tidal rivers such as the Kennebec and Penobscot permitted touching bottom on the incoming tide.) Therefore the ramps bridged the gap to shore as well as serving as temporary anchors with the addition of a sharp pole run through a hole in the ramp on the upstream side. Also the hulls' slope rarely would facilitate loading since shorelines varied so much and a different and variable angle was called for. Since the ramps were heavy, most used a balance beam with a locking mechanism while some had winches. Once ready to leave the docking area the ramps had to be raised out of the water.

Why did they not build docks with their

own variable ramps such as were built on islands for ferries? Basically, economics! These operators were farmers of modest means who usually owned land on only one side of the river. Also spring floods would have taken out such facilities on a regular basis.

Collecting accidents as a research strategy. Another theme to be developed in my research is accidents. Many features of these cross river ferries would be best exposed when things went wrong. Fortunately one of our set of pictures included an over loaded truck falling off the Westport Island ferry in 1952. Better yet two of the participants are still with us. A building supply truck from nearby Wiscasset tried to board the ferry when it was not securely fastened to the shore. The front wheels started pushing the ferry off shore before the rear wheels were on board. Gunning the motor in desperation, thinking that surely the ferry's grip on the shore would soon take hold, the driver accelerated his problem resulting in the loss of most of his load of cement bags into the ocean. A somewhat related problem was described on a current river ferry in Montana which boarded a truck full of cows resulting in an unstable high center of gravity, which anyone today walking on a small float buoyed up by thick Styrofoam blocks- would also find very tippy. The truck emptied all the cows into the Missouri River. It turned out that all of the cows could swim contrary to expectations.(seewww.videomontana.com/)

Balancing heavy high loads was a well understood issue for experienced ferrymen but their being no Vocational Education courses in those days most men had to learn the hard way. It was a job not a career since the only available estimate for average days per year of ferrying was 146. Spring floods, log drives, ice and droughts in addition to repairs and accidents restricted productive days in operation. Some alternative income was occasionally obtained by running a B&B for stranded clients! (This brings to mind stories, on both sides of the Atlantic, of coastal dwellers causing wrecks by lighting misleading "light houses" so they could collect shipwrecked goods. Ferry operators, on the other hand, set their own hours and decided when 'conditions were safe' to operate.)

Normally a farmer who happened to border a river might seek to augment his off season income by running a ferry. Only a few towns built their own ferry service hiring operators as employees. (So far I have found two in Bethel-Hanover and one in Sidney-Vassalboro.) As in the case of trolleys, the state or county "helped" ferry service in very few ways. They regulated rates and separated the ferries by minimal distances. Otherwise they were on their own.

This very preliminary paper has tried to present what few hard facts have been unearthed at this point and then lay out conjectures to serve as hypotheses for future findings OR explanations for why these apparent possibilities were unlikely or impossible. Since so few accounts have explained how these cross-river ferries operated and since the pictures usually recorded ferries "at rest" on shore or at least not in motion so as to accommodate slow shutters or film, every effort is being made to obtain the most detail-hence access to original prints. Travelers' accounts, especially of accidents, hopefully will yield some valuable insights. Other topics will include how their locations were chosen and what sorts of negotiations occurred between the towns on either side.

Good local accounts:

History of Clinton, Maine, p249:

"Ferries

While it was feasible to bridge the Sebasticook River and the streams in the area, the Kennebec River was a major obstacle during the days of wooden bridges. Its size required a ferry and also made one a financial success.

Benjamin Noble, by tradition, is credited with establishing the first ferry across the Kennebec River at what is now called Noble Ferry, two and one-half miles south of the present bridge over the river. Noble came up the Kennebec from Swan's Island at Dresden and in 1770 lived on the west side of the river, but some time after 1781 moved to town, for he voted here in 1787. No land was purchased by him in town, so he probably took up residence on the land settled by James Malbon, who had moved to Canaan. By 1790 Noble had moved to Fairfield. Dean Wyman probably took over the ferry from Noble, as he was living on settlers Lot No. 20, purchased from James Malbon in May 1791. The ferry was known as Wyman's Ferry in 1797, for on 7 October of that year Rev. Paul Coffin recorded in his diary that he crossed there and went down to George Fitzgerald's. Just when the ferry ceased to be used is not known.

Today when one speaks of Pishon Ferry he usually is referring to the area east of the bridge over the Kennebec River in the north-west section of town. The telegraph office and railroad station on the west side of the river were called "Pishon's Ferry" until June 1904, when they became Hinckley. Both the east and west bank settle-ments derived their name from the ferry that plied between the banks of the river. Charles Pishon was a resident when he married here in September 1790 but later made his home on the west bank. He was a descendant of the Pechin family that settled on the east bank of Eastern River at what later became Dresden.

How long Pishon operated the ferry is not certain but he died about 1830. Some of the other ferrymen have been: Henry Cobb in 1850. J. S. McNally in 1889, and Sanford Strickland in 1904 or be-fore. Strickland was the last ferryman, as the bridge was built in 1910, when the ferry ceased to operate. The old ferry landing on the Hinckley side was just south of the present bridge abutment, while on the Clinton bank it was just north of the bridge.

The ferry was first operated by oars and then it became a cable type. What is a cable ferry and how is it operated? Well, a heavy cable is stretched across the river and made fast to each shore. Two small pulleys ride on the cable and these are attached to chains which extend to either end of a flat-bottomed boat. In order to cross the river the boat is pushed from the shore, the chain connecting the forward end of the boat with the pulley is drawn up so that that end of the boat is nearly under the cable and the chain at the opposite end of the boat is let out so that the boat lies diag-onally toward the cur-rent. A board on the up-river side of the boat is let down into the water much as a centerboard of a sailboat is dropped. The current striking this board lies diagonally to the propelling power. The ferryman also had a pole about four feet long with a device on the end that would lock onto the cable so that he could pull the ferry along, when there was little or no current."

Crossing by ferry on the Androscoggin
by Frank Worcester, *The Bethel Courier*
Vol. III #2 June 1979, p1

The ferryboat was retained in its proper position on the river by means of a large steel cable suspended across the river from two large double poles on each side. On the ferryman's home side the cable was run down through a windlass between the two poles which allowed for adjustment of the cable to the rise and fall of the river level. A two wheel cable trolley was connected to each end of the boat by a heavy rope which ran from the center of each trolley down through a single pulley block which was firmly attached to the deck level and from there rose to and was wound around the rope crank shaft which was positioned on the rail for comfort-able operation. This allowed the fer-ryman to posi-tion the boat on an angle to the river flow causing the boat to be propelled across the river. The wedge shaped stream forced or squeezed the boat through the water with the boat angled upstream to the direction traveled. On each up-stream end of the boat were two heavy sideboards which by means of levers could be lowered further into the water to increase the water pressure against the boat sides thus giving further momen-tum to its speed. Across each end of the boat were large aprons which could be lowered for on and off traf-fic. In later years some of the ferries used four cylinder car engines suspended on the upriver side of the boats on channel and angle iron brackets. They had reversible propellers. The aid they could have given to the boats' operation was many times offset with frequent engine failure.

Hi, friend and reader, would you like to be the ferryman and take the boat across? Fine. I will show you the way. Well now, you have a customer and he or she is driving a wagon with a load of hay. First place the trig blocks such that the wa-gon's weight will be centered on the ferry. Now place your cant hook into the ground through the apron notch and signal your man (or woman) to drive on slowly and carefully. That was easy. Now place the trig blocks against his back wheels, and put bar in place at each end. Next unwind rope on the shore end enough so that it will drift down-stream when leaving. Now lift the apron beam and make sure the holding dog is in place. Step onto the shore and with your canthook pry the boat out into the stream. Move back onto the boat quickly, drop your canthook and run to the other end of the boat, then lift the sideboard and quick-ly wind that end of the boat to angle it upstream. Had you left the sideboard down catching the cur-rent your task of winding the boat upstream could have been diffi-cult. You can lower your side boards on both ends and you now have your boat moving toward the other shore. You now have time to pick up your canthook, place it against the rail, and visit with your customer or collect the ferry fee. Soon the other shore approaches and you must guide the boat to its landing. First lift the sideboard, it might touch bottom, then release the cranklock and wind or unwind it as needed to bring the apron to the wheel tracks on this shore. Well done; perfect land-ing. Remove the trig block and bar, then drive your canthook deep into the mud by the apron notch, hold on tight, and caution the driver to start up slow and easy. All goes well and you were a suc-cessful ferryman!

Friends it is now time to reverse the opera-tions for the return to your home shore and I hope you are enjoying the experience as many have here in the foothills of the White Mountains and the beauti-ful Androscoggin River Valley with the pleasant memories of the river ferries. Take with you the quiet sound of water rippling by the boat; the cant-hook hitting the deck; running feet to the other end of the boat and the gentle sounds made by the ca-ble trolleys as they make their uneven journey across with us. There blows the ferry horn (another memory), back on the shore we have left, and I must answer the call as soon as you land on your side of the shore.

You have just made a journey back into the 1800's, through the 1920's, 30's, 40's, and into the edge of the 50's, and you are about to step back onto the shore of almost the 1980's. Pleasant mem-ories to you. Thank you for coming back with me into the past-and please come again!

Special Acknowledgement

To William H. Bunting for his two volumes on A DAY'S WORK for their great contribution to our understanding the lives of ordinary Mainers at work as well as to publishing pictures of unusual-ly good definition with well researched explana-tions. His own commentary is also of great help and is leavened by a dry sense of humor.

Rather than footnote his sources through-out the text, here are the pages used; Vol . I - pg. 152, 208, Vol. II – pg 14,70,208 on ferries and Vol I- pg 150,174,176 on the use of horses powering treadmills for farm machinery. It has yet to be securely documented that this system, which was the basis for The Hudson River ferries referenced above, was ever used in Maine although permitted in several cases.

Footnote

1. In this case, where Maine appears to have opted out of the running, an extraordinary project has carried out the study of a surviving horse ferry at the bottom of Lake Champlain. It not only cov-ers this research effort but also describes the histo-ry of horse ferries throughout the US and some of Canada as well as European antecedents. Therefore in spite of the apparent paucity of horse ferries in Maine, we will include them in our review of all types of these craft. See K.J. Cristman and AB.Cohn WHEN HORSES WALKED ON WATER Smithsonian Institution Press, Washington 1999. Those wishing to access one of the best historical sites on this topic will find it eas-iest to lean on Google for "Horse ferries on Lake Champlain" since the site's title is unusually long.

Bunting, on Pg.174 in A DAY'S WORK, Part I, describes how Maine inventors in Winthrop developed a two-horse-powered treadmill for farm machinery as early as 1834 but finding too limited a market at home moved to the West in 1839.

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Chapter Presidents' Comments

SNEC-SIA President's Note

The chapter officers are deeply involved in the planning and management of the 2004 SIA Conference to be held in Providence. Conference brochures will be mailed out to SIA members in mid-April. While we hope to have many Southern New England-Northern New England members attend, we hope to re-visit some of the tour sites as chapter activities after the conference. Greg Galer and his sub-committee have done an outstanding job in identifying mills and factories worth touring and especially in persuading plant managers to allow an SIA visit. The tour sites include Narragansett Bay historic military installations, a number of specialty textile mills, jewelry manufacturers, marine industries and the New England Wireless and Steam Museum. Jonathan Kranz and his sub-committee are publishing a tour guide that will be available for sale to chapter members after the conference. It should be a useful guide to the remaining industry in the Blackstone and Pawtuxet valleys.

Bob Stewart
President SNEC-SIA

NNEC-SIA President's Note

The chapter will not host an official tour this spring. Instead our members are urged to attend the 33rd Annual Society for Industrial Archeology Conference and Tour to be held in Providence, RI, June 10-14. Earlier this spring, I sent a note and a copy of the conference flyer to chapter members living in Northern New England who are not on the SIA membership list, urging them to attend if possible. Attendance will not only provide you with a fine introduction to New England's industrial heritage with participation in a tour and attendance at paper sessions, it will show our Chapter's support of the massive effort made by the Southern New England Chapter, which is hosting the event.

Plans are well underway for our Fall Meeting and Tour, which will take place in mid October in Henniker, New Hampshire. David Coughlin (2ndVP) is making arrangements for visits to sawmills and timber processing operations that are centered there. David has a professional background in forestry and promises an educational and interesting experience. Members of the Henniker Historical Society are assisting David. Plans include participants' exposure to very early stone arch bridges and 18th century mill waterpower systems. An official notice will be mailed later this summer.

Dennis Howe
President NNEC-SIA

The New Palmer River Ironworks 1721-1757

The New Palmer River Iron Works in Rehoboth declared itself open for business on March 17, 1721 by registered deed to Hannah Cm, widow. At that time the owners were Jonathan Kingsley, Blacksmith- Edmond Ingalls (Inguls?): Fbenezar Gamfiy, Housewright; and Richard Carr, shipwright (deceased). Richard Carr had developed a shipyard in neighboring Swansea, in the 1700-1720 time frame. His daughters married Jonathan and Jonathan's son, Aaron Kingsley. Aaron was also listed as a blacksmith and an owner in 1735, when the property was sold to Boston ironmongers Bollen, Laughton and Wood and thence to a local, William Jones. who continued to operate it.

Seven deeds describe the iron works as follows Dams (plural) with all privileges and appurtenances, coal bans (plural), coal houses (plural), waterwheels (plural), iron works, forge with house over the forge, hammer, anvil, tongs It was complete with iron hoops and wagon wheels when sold again in 1757 to a local person, Nathaniel Bliss. Later, in 1853, the site was deeded by Cyrus Wheaton with the deed comment "including the structure still standing". However, Bad Luck dam (a couple of miles upstream) broke in 1859 and rearranged the landscape as it did downstream.

According to town records and deeds, a piece of the site was claimed by the town as a "Town Pound" in 1708, 1754 and 1890. The Commonwealth of Mass. relocated Rte 118 in 1952 through the middle of the site. At that time local historian E. Otis Dyer identified notched wood timbers, uncovered dining the work, as typical of wooden dam construction of the period, and caused studies and paperwork to clarify town ownership of the stone enclosure. An adjoining resident found dozens of large lumps of scoria, during the sites usage as a potato field. We also know that the Boy Scouts restored or changed the stonework then, but lumps of scoria can still be found on the site. The Rehoboth Antiquarian Society was given a set of old, very crude forging tongs, identified in the 1757 deed of sale to Bliss, in a barn on the site, buried under debris, when the barn was being restored. One of the tongs weighs around 20 lb. and is most suited to gripping 2 1/4 inch square bar. About a ton of Cumberlandite is on the site today. Curnberlandite is a magnetic mineral found exclusively at Iron Mine Hill in Cumberland, RI. It is high in titania as well as magnetite, and was known to be difficult to smelt due to the titania. Ironmongers Laughton and Wood owned Iron Mine Hill at about this time period.

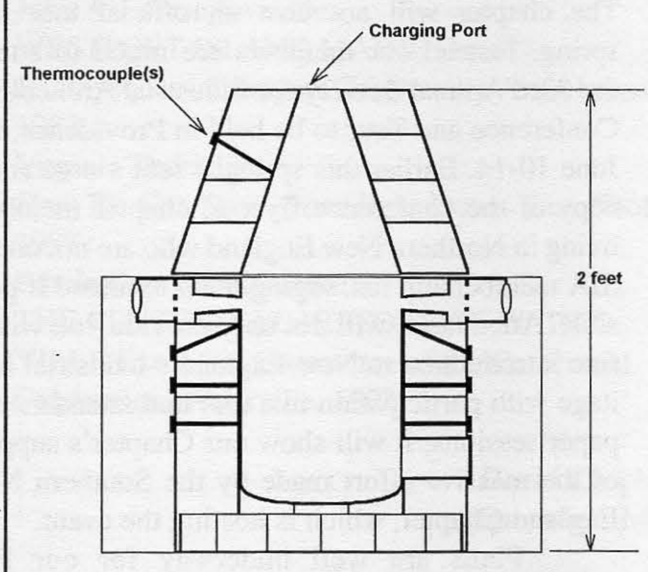
If this was the "New Palmer River Iron Works, what/where was the old. Iron works? Jonathan was 50 years old at the time of startup. Who taught him? Town records show that one Ichabod Bosworth established a "forge run by water" in 1705. We also know that Joseph Jenks 1I a Saugus Iron Works and Rhode Island iron entrepreneur, was active in Rehoboth at this time. The Leonard's had iron ore interests in Rehoboth. A local Peck family started a bloomery on Palmer River around 1720-50 according to historian Leonard Bliss, and probably another one a few hundred yards upstream, since today we find many lumps of scoria at the upstream site as well as at the Peck site. One of these people/families may well have been Jonathan's iron teacher and mentor, a necessary ingredient to iron making.

The 22-1/2 acre site sold in 1757 to Bliss was one of the bog ore sites. It had been a beaver pond prior to purchase by Kingsley et al. Even today, the site is encircled by earthen works topped by remains of a circular horse-trotting track. This must have been the reason for choice of the location because the elevation drop and water source is not otherwise suitable for powerful, year-round] waterwheels. There may also he another 9 acre bog ore site across County Street, owned earlier by brother John Kingsley).

James Johnston

James Johnston's Rehoboth Research Bloomery

James Johnston, a retired metallurgist, has been experimenting for several years with an experimental bloomery. The purpose of this facility is to establish parameters for the production of iron as practiced prior to the industrial revolution. The sub-scale equipment is set up to study charcoal burning rates, air consumption rates, ore reduction rates, temperature distributions and tuyere nozzle mechanics. The experimental bloomery can also investigate the physical properties and physical chemistry of the air/charcoal combustion zone, the scoria formed immediately at or beyond the combustion zone and the stag that sometimes forms at the bottom. Johnston has prepared a computer simulation model of the reactions that occur in forming iron and the experimental bloomery is intended to validate this model. Several kinds of iron ores: bog ore, lake-bed ore, magnetite, hematite,

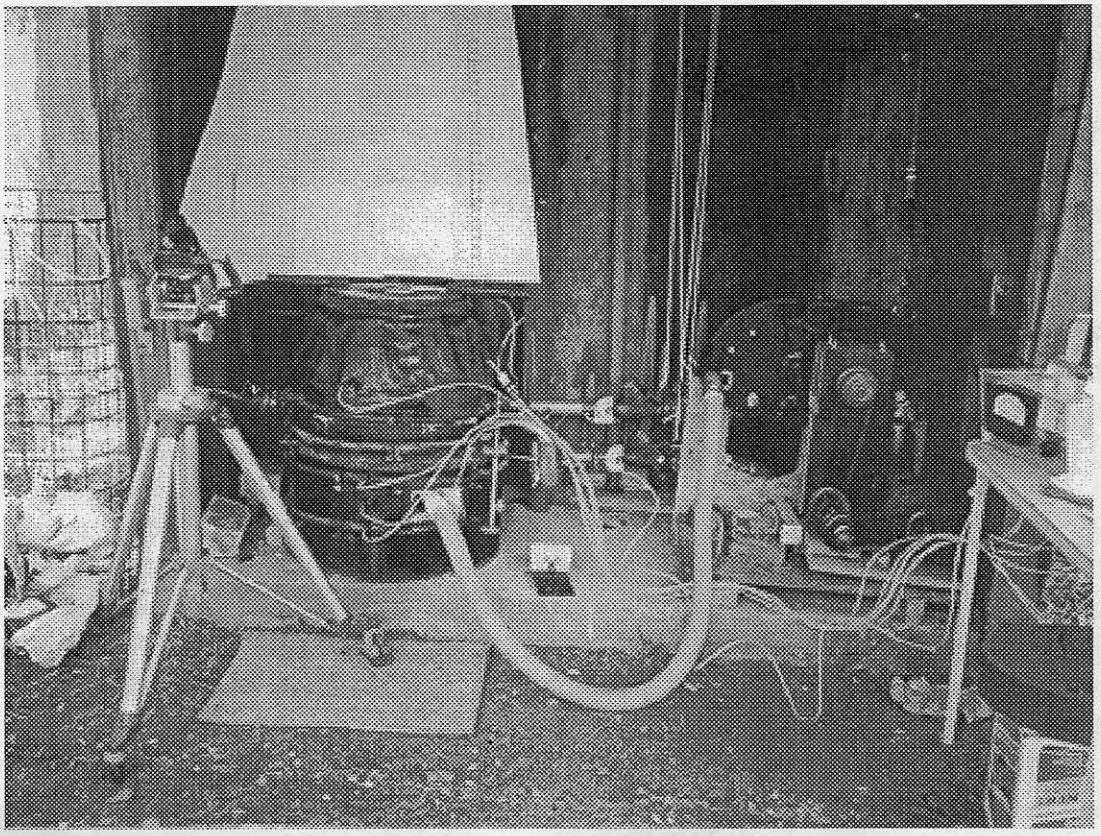


Section through the Experimental Bloomery

and a Rhode Island mineral, Cumberlandite, found at the New Palmer River Iron Works site, will be investigated.

The furnace chosen for this work is that described by Sir John Percy in his book "Metallurgy". "Iron and Steel" volume III, 1864 on Page 279. The furnace was found in the Pyrenees in 1820 together with 2 blooms of 35 lb. each. Johnston chose this design because its configuration promised the potential of reasonable control and recordation. Instrumentation for temperature verification is accomplished with thermocouples. The location of charcoal movement can be controlled, as can be the reduction mechanism and gas sampling. The process can be "frozen" at the end by closing up all air access. Its most significant feature is [be single tiny access hole at the top for charging charcoal and iron ore. 'There has never been any thought or intent to "recreate" a l7th century forge, nor to make big iron blooms. The experiments will include making wrought iron from bog ore dug al the New Palmer River Iron Works site.

Tests have also included visual examination of the combustion zone right at the tuyere nozzle, together with video records. This has been done both in the furnace and using a separate unit



The experimental bloomery and testing apparatus.

with raters to measure combustion zone size. Visual sightings inside are very limited by the angle necessary to avoid the exhaust flame and the severely restricted view through tuyere port glasses. Temperature and gas sampling in the combustion zone is difficult to measure but must be inferred by reaction products in the tuyere nozzle vicinity.

Findings will be summarized in a form suitable for both the interested public and for researchers in the field, and in a detailed form for publication in a technical journal.

Saugatuck River Railroad Bridge

Connecticut DOT's Bridge 08032R, the Metro-North railroad bridge over the Saugatuck River was originally known as Bridge 83 of the New York Division of the New York, New Haven & Hartford Railroad Company (NYNH&H RR). Crossing Ferry Lane and the Saugatuck River in Westport, Connecticut, this bridge is one of eight original movable railroad bridges constructed on the railroad's main line in Connecticut. It illustrates the historical development of Connecticut's railroad empire during the early 20th century and illustrates the distinctive characteristics of turn of the century engineering.

Seven of the aforementioned bridges remain in operation today. The Saugatuck Bridge, a Scherzer rolling lift bascule bridge, has undergone extensive repairs and rehabilitation over the years. Although this bridge is approaching its centennial, it is still providing mechanical operation and structural support for the railroad. However, the bridge is now approaching the end of its useful life and is proposed for replacement. This newsletter article has been prepared as partial mitigation for the potential replacement of the bridge.

Since the completion of a railroad line between New York and New Haven in 1849, there has been some form of railroad-bridge over the Saugatuck River at this former ferry crossing. Originally a single track railroad, the line was double tracked in 1854. Up until the current bridge was built (c.1905), the bridge over the Saugatuck consisted of three 90-foot long, fixed deck truss double-track spans and one double-track swing span.

By the 1890s, the main line trackage of the NYNH&H RR was insufficient to meet demand, causing major delays. In 1896-1897, the main line from Woodlawn Junction, in New York, to New Haven was widened to four tracks. However, due to cost and logistics, three 4-tracked bridges over major rivers—the Mianus (Cos Cob), the Saugatuck (Westport), and the Connecticut (Warehouse Point)– were not completed for almost a decade. [1]

Not only were the bridges not wide enough, but they could not support full train loadings. When the NYNH&H RR bridge specifications provided for a loading of two engines weighing 219,000 lbs with tenders weighing 112,000 lbs (known as an E-50 rating), the bridges had weight limits of 157,000 pounds (lbs) for engines and 100,000 lb cars were "not allowed to run over them loaded to their full capacity." [2]

By the time the Saugatuck Bridge was in the planning stage, the Scherzer rolling lift bridge type was in widespread use and was the primary type of moveable bridge used by the NYNH&H RR. By 1905, more the 40 were in use throughout the country. Invented and patented in 1883 by William Scherzer (1858-1893) of Chicago, the relative simplicity of the lift mechanism, and the minimal power required to lift the bridge, were not the only features that appealed to the railroads. Since the lift span rolled away from the navigation channel as it was raised, it did not have rise as far as other types of lift bridges, reducing the arc of swing and the amount of time the bridge had to remain open. The bridge could also be expanded by adding additional leaves, permitting continued operation during expansion, where swing bridge enlargement would require the construction of a temporary bypass and the complete scrapping of the existing span and its mechanical system. [3]

According to drawings in the files of the Connecticut Department of Transportation, the bridge engineers of NYNH&H RR designed the fixed spans for the bridge during May 1904. The drawings were signed for the railroad by Colin M. Ingersoll (1858-1948), Chief Engineer, and William H. Moore, Bridge Engineer. Ingersoll was a graduate of Yale (1880), joining the NYNH&H RR as an assistant engineer in 1881. In 1900, he was made Chief Engineer, and left the railroad in 1906 to become Chief Bridge Engineer for the New York City Department of Bridges. William H. Moore, born in Limerick Ireland in 1860, received his engineering education at Queen's College, Cork and the Royal University in Dublin, receiving a first class honors degree from at Queen's College and a Master of Engineering from the Royal University. He arrived in the United States in 1885 and in 1886 was employed by the NYNH&H RR as a draftsman. In 1889, he was named Engineer of Bridges for the NYNH&H RR. He remained with the railroad until 1918. [4]

The Scherzer Rolling Lift Bridge Company, the successor firm of William Scherzer, signed a contract in 1904 and completed the design of the lift span 108'-6" lift spans and its mechanisms by the end of the summer of 1904. The steel fabrication company, the Pennsylvania Steel Company of Steelton, Pennsylvania, created the shop drawings for the steel between November 1904 and the end of January 1905.

Sometime in late winter of 1905, contractors Daly & Holbrook began work on the substructure. The existing foundations were reused, but the upper masonry was replaced with piers wide enough for four tracks. A temporary trestle with a simple draw bridge span was built around the site to the north to carry the railroad traffic. [5]

According to the Railroad Gazette, work was well in hand by mid-March 1905: "the old piers and superstructure being almost entirely removed." Passaic Steel Company performed the steel removal and may have erected the superstructure with steel provided by the Pennsylvania Steel

Company. The exact day of completion has remained elusive, but the Railway Gazette noted that the bridge was still under construction in late September 1905, and that it had been "recently placed in service" by the third week of March 1906.[6]

Over the next 94 years, the bridge underwent many repairs and rehabilitations. Steel repairs have been performed on the movable span and support steel. The rocker bearings were replaced with sliding plate bearings, deteriorated rivets were replaced with high strength bolts, and miscellaneous repairs to the segmental girders, rack girders and a rack adjustment were performed. Existing stone masonry piers and abutments were re-pointed and strengthened with steel bars.[7]

The Saugatuck River Railroad Bridge was placed on the National Register of Historic Places in 1987. This bridge, along with seven other bridges located on the Northeast Corridor in Connecticut, was identified in an aerial reconnaissance survey of historic and archeological resources undertaken in 1987 as part of the Northeast Corridor Improvement Project. The seven other railroad bridges that were listed were the Mianus River (Cos Cob), Norwalk River (South Norwalk), Pequonnock River (Bridgeport), Housatonic River (Devon), Connecticut River (Old Saybrook), Niantic River (East Lyme), and the Thames River (Groton).

Footnotes

1. "New Haven Railroad Improvements," Railroad Gazette 38, No. 11: pp 245-246 (March 17, 1905).
2. Ibid, p. 245.
3. Hovey, Movable Bridges, (New York: John Wiley, 1926): pp 101-105. "Rolling Lift Bridge," Railroad Gazette 39, No. 13: p. 307 (September 29, 1905).
4. "Memoir of William Harley Moore," American Society of Civil Engineers Transactions 84 (1921): pp. 892-893; Griggs, Francis, A Biographical Dictionary of American Civil Engineers Vol. II, NY:ASCE, 1991: p. 56.
5. "New Haven Railroad Improvements:" pp. 245-246.
6. "Rolling Lift Bridge," Railroad Gazette 39, No. 13: p. 307 (September 29, 1905); "Scherzer Bascule Bridges," Railroad Gazette 40, No. 11: p. 82 (March 19, 1906).
7. CTE Engineers, Engineering Feasibility and Economic Analysis of the METRO-NORTH Bridge over the Saugatuck River– Bridge No. 08032R October 2000: passim.

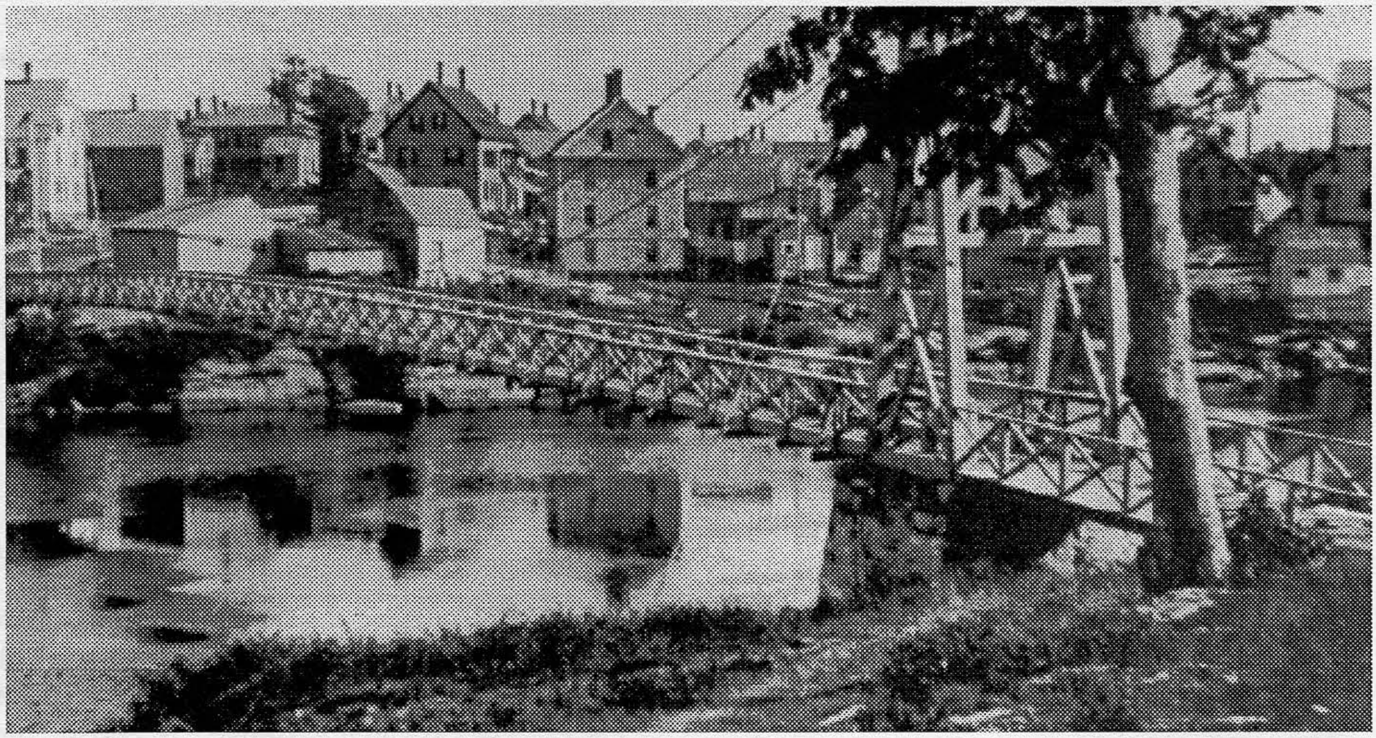
Swinging Bridge Restoration in Brunswick, Maine

The Androscoggin Swinging Bridge between Brunswick and Topsham Maine was named this January 2004 to the National Register of Historic Places. The "Swinging Bridge" is one of three remaining pedestrian bridges remaining in Maine and the subject of a restoration project.

The 317 foot long bridge was built in 1892 by the John Roebling's Sons Company of Trenton New Jersey. Work on the bridge began in May of 1892 and suffered an almost immediate set back the following month when the two towers of the new bridge were leveled by a freak local tornado. Work resumed on the cabled suspension bridge and was completed by Roebling's company in November of 1892.

The Cabot Company had this small footbridge built to allow mill workers who lived across the Androscoggin River in Topsham to walk to work at the large Cabot cotton mill in Brunswick. The "Swinging Bridge as it is known locally has been in use ever since and now serves primarily recreational uses. It has also been known to be used by speeding motorcyclists trying to elude the local police.

The last major restoration of the bridge took place in 1936 as the result of the severe damage caused by the legendary flood of that year. The flood of 1936 carried away several other more substantial



Androscoggin River bridges but the " Swinging Bridge" survived. Impassible for a time the repairs included new wooden flooring, hand rails, cable replacement and the addition of large concrete anchors on each shore.

Two to three hundred people a day use the bridge and are treated not only to interesting views but to the gently, but very noticeable, "swinging' of the bridge as they walk across.

The bridges wooden decking is fifteen to twenty feet above the fast flowing river and affords the traveler splendid views down the river to the old

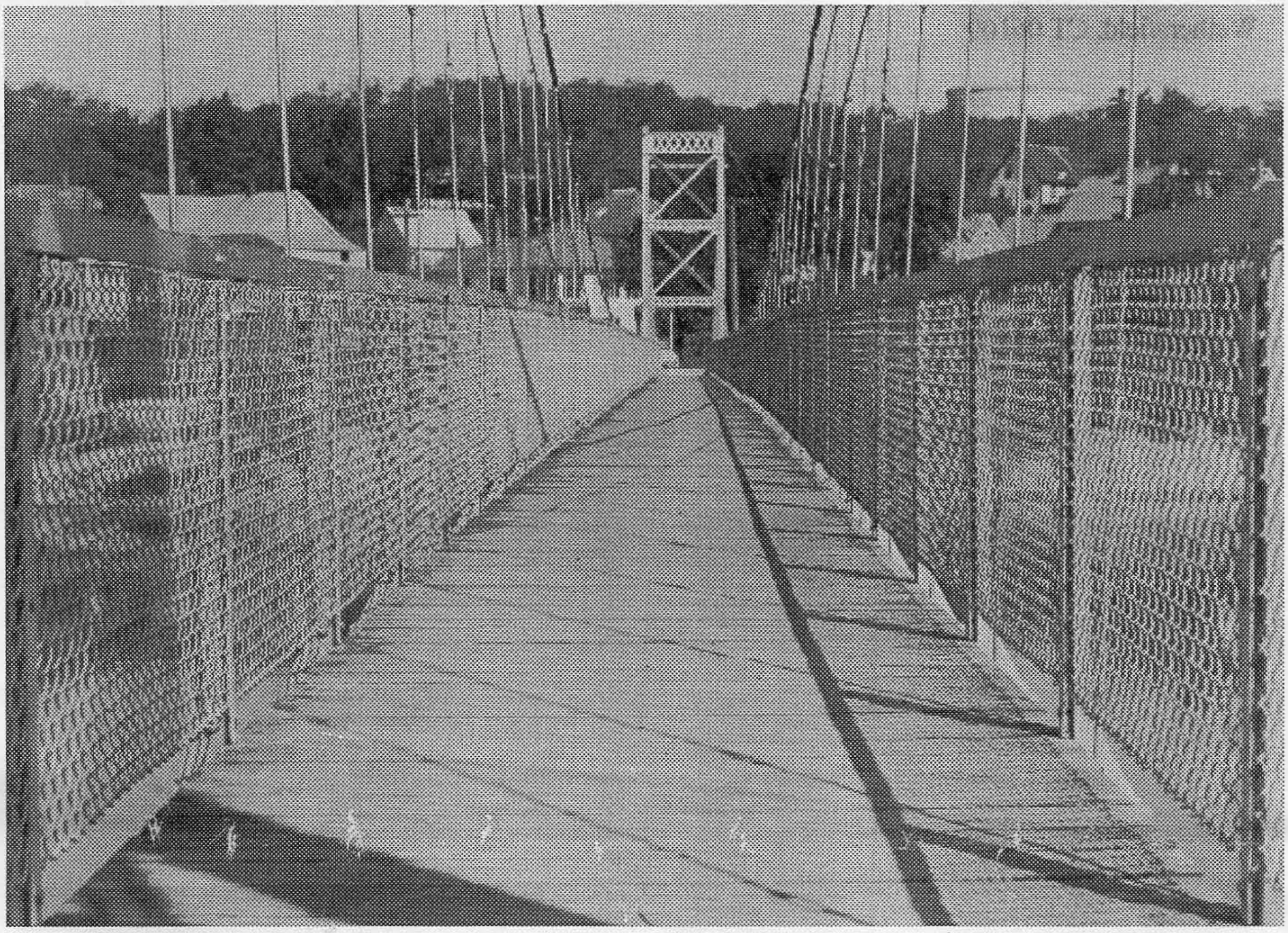
Cabot Mills which have been renovated into several uses ranging from elegant law offices to light manufacturing.

A view up river allows for a good view of what the locals call the "Black Bridge" which has two levels. The top level is the old Maine Central Railroad line connecting Brunswick to Lewiston Maine. The lower level is a wooden planked single lane for automobiles. Great etiquette is required by operators of automobiles to travel over the bridges single lane.

The total estimated cost of the restoration is $ 454,000. Of that figure $ 228,000 is from Federal Enhancement Funds and $ 76,000 in bonds from the State of Maine.

A capital campaign is under way to raise $ 150,000 from the communities of Brunswick and Topsham to be raised entirely from the private sector.

For further information or to donate to the "Swinging Bridge Fund " you can contact or make checks payable to The Swinging Bridge Fund P.O. Box 281 Brunswick Maine 04011 of donate on line at www.saveourbridge.org



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