

AMERICAN CANALS

BULLETIN OF
THE AMERICAN CANAL SOCIETY

BULLETIN NUMBER 89

Editorial Address—968 Chapel Road, Monaca, PA 15061

MAY 1994

President's Message

Don't forget to sign up for the next International Conference on Historic Canals, to be held September 20-23, 1994 in Peterborough on the Trent-Severn Waterway. (See details in separate article, this page.) These are productive, stimulating meetings well worth attending. This one, hosted by Parks Canada, will celebrate the anniversary of the extraordinary Peterborough Lift, and the theme will be "Canal Heritage Interpretation."

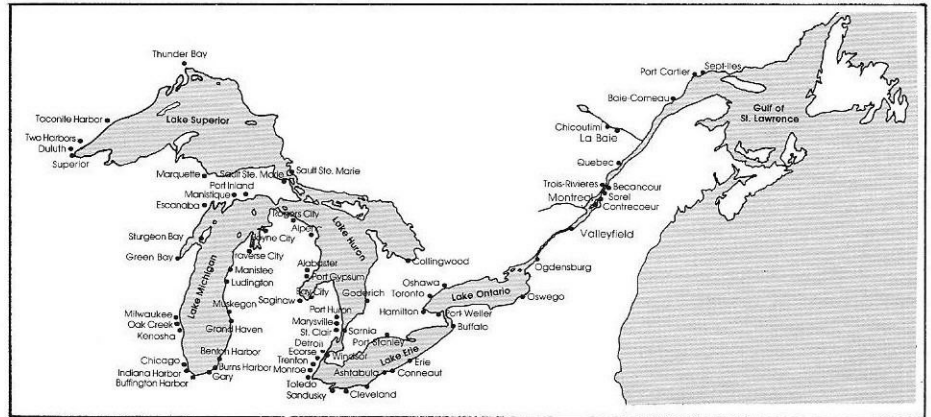
Bill Shank has just returned from the annual meeting of the Society for Industrial Archaeology, alias SIA, where he gave the only canal paper, a history of the St. Lawrence Seaway. We canal buffs often complain that meetings and magazines don't have enough on canals, but if we don't give the canal talks and write the canal articles, who else will? And who else will spread the word about *AMERICAN CANALS* as an information resource, and let people know about our projects, such as Carroll Gantz' CANAL BOAT CONSTRUCTION INDEX? Don't build a boat without it!

We also complain that so many of America's canal locks are falling down. What can we, as amateurs, do about it, and when do we have to call in the professionals? Down here in Virginia we just had our Second Annual Canal Lock Preservation Workshop, sponsored this time by the Petersburg Department of Tourism. Forester Rick Bryan discussed tree and brush removal and the proper use of defoliant sprays; stonemason John Friedrichs showed us how to test old mortar and repoint stonework; and archaeologist Lyle Browning discussed the precautions to take while doing all this, so as not to destroy historic information. We plan to have more hands-on workshops at other canal sites around the state, and to get better each time - we still have a lot to learn. If you have a similar program and would like to compare notes, write to Nancy R. Dunnivant, 7563 Sambar Road, Chesterfield, VA 23932. Is anyone interested in working up an ACS handbook on canal lock preservation?

For those who yearn to participate in canal restoration projects in Britain but can't get there, you can now "Adopt A Shovel." For five pounds payable to "Waterway Recovery Group Canal Camps," 22 Bridgewater Avenue, Anchorsholme, Blackpool FY5 3NA, England, the WRG will send you a colour (sic) picture of your shovel, a nice letter, and details of where your shovel will be during the year. According to the article in the March issue of *Navvies*, "This is a limited offer and will run until we either run out of photographs or get bored." If you'd like to do your own "Adopt-A-Something" scheme, we'll announce it in *AMERICAN CANALS* - just send your notice to Denver Walton!

(Concluded on Page Twelve)

THE SEAWAY - AFTER 35 YEARS



Toronto — June 4, 1994. William Shank, a speaker at the 23rd annual conference of the Society for Industrial Archeology, reviewed the history and performance of the Saint Lawrence Seaway, after 35 years of operation. He pointed out that the opening of the Seaway in 1959 was one of the most significant events since the building of the Panama Canal as it opened, for the first time the heartland of North America to ocean-going ships world-wide, serving ports from Montreal to Duluth in both Canada and the United States.

The beneficial effects of the new waterway were evident immediately, although in recent years the Canadians have been disappointed with the slowdown in world trade brought about by the recent recession.

The Seaway is a joint venture of Canada and the USA, with five locks on the Canadian side of the St. Lawrence River, 766 feet in length by 80 feet in width, costing \$330 million, and two locks, same size, (the Snell and Eisenhower locks) on the American side, costing \$130 million. The \$650

million cost of the hydro-electric facilities created, was shared equally by the Hydroelectric Power Commission of Ontario and the Power Authority of the State of New York.

The new Seaway was opened to traffic April 25, 1959 and was formally dedicated shortly afterward by Queen Elizabeth and President Dwight Eisenhower, bringing to full realization a century-old dream fulfilled.

First negotiations for the Seaway began in 1895, when Congress authorized the appointment of a Deep Waterways Commission to investigate the feasibility of building a deep-water channel from the Great Lakes to the Atlantic Ocean. This Commission met with a similar group in Canada shortly thereafter and the American portion of the job was turned over to the Army Corps of Engineers. Perhaps if the Panama Canal had not occupied the attention of the Americans at the turn of the century, work on the Seaway might have started fifty years earlier. It was also opposed and delayed by USA railroad and east coast port authorities who saw it as competition.

INTERNATIONAL HISTORIC CANALS CONFERENCE - 1994

The Trent-Severn Waterway of Parks Canada is hosting the International Historic Canals Conference in Peterborough, Ontario Canada in 1994. The Conference theme is *Canal Heritage Interpretation*, a topic which is taking on increasing importance with wider awareness of the importance of heritage canal resources.

Dates of the Conference have been confirmed for September 20th until noon on September 23rd with registration taking place early in the evening of September 19th. The Conference is being held in Peterborough in conjunction with the 90th anniversary of the Peterborough Lift Lock.

The Holiday Inn at Peterborough will serve as the base for the Conference. The Conference will include both the presentation of papers and field trips on the Conference theme. Those planning

to attend can make their reservations directly with: Holiday Inn, 150 George St. N., Peterborough, Ontario K9J 3G6; Phone: (705) 743-1144.

When making your reservations, please indicate that you are attending the International Historic Canals Conference as a block of rooms have been set aside for the conference. The cost will be \$76.00 Cdn. + taxes per room per night.

At the Conference last year in Dartmouth and Halifax, Nova Scotia, a number of those attending indicated an interest in taking a cruise on the TSW in conjunction with attending the conference. The operators of the Kawartha Voyageur, the only vessel cruising the length of the Trent-Severn Waterway, will provide trips at your convenience. For further information write John Lewis, Supt. Trent-Severn Waterway, P.O. Box 567, Peterborough, Ont. K9J-626; Phone (705) 742-9267.

American Canals

BULLETIN OF THE AMERICAN CANAL SOCIETY

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AMERICAN CANALS is issued quarterly by the American Canal Society, Inc. Objectives of the society are to encourage the preservation, restoration, interpretation, and use of the historic navigational canals of the Americas; to save threatened canals; and to provide an exchange of canal information.

Annual subscription to AMERICAN CANALS is automatic with A.C.S. membership. Send dues payment (\$15 minimum) to Sec'y/Treas. Charles W. Derr, 117 Main St., Freemansburg, PA 18017. Single copies may be purchased at \$3.00 from the publisher.

Manuscripts on subjects consistent with the objectives of the A.C.S. are welcome. They should be sent to the editor.

NEW CHENANGO CANAL BOOK TELLS STORY OF THE 1837 WATERWAY

Hidden among the trees of the Chenango, Oriskany and Sauquoit valleys in central New York are remnants of the Chenango Canal which connected Utica on the Erie Canal and Binghamton from 1837 to 1878. The remains are monuments to the engineering genius of another century. The canal was designed by John B. Jervis, resident engineer on the Erie Canal. There are still lock walls, aqueduct ruins, culverts and hand-dug ditches to be found which have stood the test of time.

A new book, *Limestone Locks and Overgrowth: The Rise and Descent of the Chenango Canal* by Michele McFee (published by Purple Mountain Press of Fleischmanns, NY) directs readers to remains of the canal which are accessible near towns along its path (mostly routes 12 and 12B today), and reveals the history of this remarkable landmark.

The Chenango Canal was intended to reach the coal fields of Pennsylvania. As early as 1838, a survey was done along the Susquehanna River from Binghamton to Waverly for an extension which would tie the canal to a Pennsylvania system. Construction began in 1863 and stopped in 1872 when only 20 miles of the 40-mile extension had been completed. The book's chapter on this episode is the most comprehensive account of the subject to date.

The book, a large-format, quality paperback with 240 pages and 200 illustrations, is available for \$25.00 at book and gift shops in Central New York or from the publisher, Purple Mountain Press, PO Box E3, Fleischmanns, NY 12430, 1-800-325-2665. Add \$3 shipping and sales tax.

BOOK AWARD



Bill Shank, left, receives a citation from an official of the Pennsylvania Federation of Museums & Historical Organizations at the PFMHO Awards Banquet, April 11th, for "Picture-Journey along the PA Main Line Canal."

CANAL BEER!

A microbrewer, Middlesex Brewing Co. of Burlington, Mass., has introduced a Brown Ale with a dark red label and an Oatmeal Stout with a dark blue label both under the "Middlesex" brand. What is interesting is that both labels prominently feature a drawing of a canal packet boat, towed by horses, moving along a canal.

Dave Barber

I&M HISTORICAL MAP NOW AVAILABLE

The recently published **Historical Map & Guide to the Illinois & Michigan Canal National Heritage Corridor** is the nation's first.

Several years in the making, this full-color **Historical Map & Guide** allows the visitor easily to locate key features of the heritage corridor, the I&M Canal's surviving engineering works and buildings, as well as many other sites of interest along the route of this historic waterway. All these are shown against a modern map, divided into six sections, each accompanied by descriptions of historical highlights for that section.

The I&M Canal NHC Commission has negotiated an agreement with the University of Chicago Press for the latter to market and sell this unique guide. Retail price of the **Historical Map & Guide** is \$6.95, plus 8.75% sales tax for Illinois residents only. Handling and postage is \$3.50 for the first guide, plus \$0.75 for each one after that. The ISBN number of the publication is 0-226-09260-7 and should also be referenced in the order.

Orders should be sent to: University of Chicago Press, 11030 S. Langley, Chicago, IL 60628. Illinois residents can call 312/568-1550 and out of state residents can call 1-800-621-2736. The Press also accepts Visa and Mastercard orders.

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Other publications: *The Best from American Canals*,

William H. Shank, editor and publisher. *American Canal Guides*, William E. Trout III, editor and publisher.

ERRATA

I note on page 7 of *American Canals*, Bulletin Number 88, that ACS claims to be "the largest canal historical organization in the Western Hemisphere" with 841 members. Since the Canal Society of New Jersey has 1,140 members as of April 1, 1994 we will have to claim this honor for New Jersey. However, I hope that we will be challenged for this position in the future as other canal societies grow.

Bill Moss

ROBERT FULTON — CANAL DELINEATOR

A Review of a 1796 Treatise by Robert Fulton

By Don Postle

Why did structures on Clinton's Ditch in 1825 so closely resemble those on the Canals in England and France? There were no schools offering civil engineering training in the United States until the French helped to establish West Point Academy in 1802. Rensselaer school was developed in 1823 in order to fill a need for training canal engineers.

The British canal engineer William Weston was employed to assist in designing and constructing the Middlesex Canal, but apparently we used very few other European engineers for canal building. Many tow path canals had been built and were in use in Europe at the time that canal building started in this country, but few authors who write about canal building in that era in the United States cite sources that would have been useful to the inexperienced builders.

In my continuing search for descriptive literature that would have been available and useful to the constructors of canals built in the U.S. before 1825, I discovered three treatises published in England within a five year period toward the end of the eighteenth century.

These three publications could have been available to our canal builders, but I have found firm evidence that only the Fulton Treatise was available in the U.S. in the early 1800s.

The three publications, and their dates of publication:

1791: *A Treatise of Universal Inland Navigation.*

1792. *General History of Inland Navigation.*

1796. *A Treatise on the Improvement of Canal Navigation.*

Whereas in recent times one would expect these publications to have appeared as articles in scientific journals, and that the earlier articles would have been cited in the subsequent ones, these three rather similar works were each published independently with no references to the others.

The title pages of each make interesting reading:

- A Treatise of Universal Inland Navigation and the use of all sorts of mines. A work entirely new. Recommended to the Inhabitants of Great Britain and Ireland. Author: Edmund Leach, Surveyor. London 1791.

- A General History of Inland Navigation, Foreign and Domestic: containing a complete account of the canals already executed in England with consideration of those projected. Author: John Phillips. London 1792.

- A Treatise on the Improvement of Canal Navigation; Exhibiting the numerous advantages to be derived from SMALL CANALS, and boats of two to five feet wide, containing from two to five tons burthen. with a description of the Machinery for facilitating conveyance by water through the most mountainous countries, independent of locks and aqueducts: Including observations on the great importance of water communication, with thoughts on, and designs for aqueducts and bridges of iron and wood. Illustrated with seventeen plates. By R. Fulton, Civil Engineer. London 1796.

In this article, I shall limit my review to the Fulton Treatise.

Robert Fulton was born on a small farm near Lancaster, Pennsylvania in 1765, and died in New York City in 1815. As a youth he worked in a gun factory where the well regarded 'Kentuck' model was produced (Daniel Boone was the owner of one of these). At age 17, he apprenticed to a Philadelphia jeweler making miniature lockets by



Robert Fulton - Self Portrait
(New York Historical Society)

plating human hair, and painting miniature portraits. At age 21, he took a sea voyage to England for his health (weak lungs) where he apprenticed to painter Benjamin West.

A commission to paint portraits took him to Exeter in southwest of England, where he met the Earl of Stanhope, who was regarded as an inventive genius. This was also near the area where Leach had recommended narrow canals using inclined planes and small boats.

While Fulton was still in Devon he was awarded a silver medal by the Society for the Encouragement of the Arts, Commerce, and Manufactures for his design for a mill for sawing marble.

In 1794, he was granted a patent for "A machine or Engine for conveying Boats and Vessels and their Cargoes to and from the different levels and upon Canals, without the Assistance of Locks or the other means now known and used for that purpose".

He subsequently toured several of the English canals then in operation or in development, and briefly held a contract in 1794 to cut a section of the Park Forest Canal. By 1795, he was suggesting the utility of using tub-boats on small canals, and in 1796 he published his Treatise.

Finding no major support in England, he went to France in 1797 where he continued his work on submarines, torpedoes and steamships. He attempted to get support from the French government to develop material to sink British warships which were currently blockading French ports. While in France, he was granted a patent for 'lockless' canals, and his Treatise was published in French.

Unsuccessful in gaining major support in France, he went to Holland, before returning to England under the pseudonym of Robert Francis. Before returning to the U.S. in 1806, he had sent a copy of his Treatise to George Washington and to Governor Mifflin of Pennsylvania. Fulton had read Governor Mifflin's message to the House of

Representatives in 1795, and agreed with the Governor's ideas on the necessity of affordable transportation. In his letter to Governor Mifflin, he hoped the Governor would find from the Treatise that Fulton's system "totally explodes" the old practices for two reasons: Lockless canals could be built for half the cost of those currently being built, and goods may pass through the most mountainous country at six miles per hour. Rivers "are unreliable for most transport due to floods or drought". The value of produce would be diminished "in proportion to the distance from market". "Would not the lands around Fort Pitt (sic) be as valuable as those around Lancaster if the produce could be brought to market for the same sum, and would not then population be encouraged?"

"...I have the strongest conviction that canals are the only effectual means of producing easy communication...Each state might establish a society to investigate the propriety of forming (canals) in such districts as the present state of population and trade may most require...(it is important...that all future canals may be constructed on one scale and principle...(canals) are still more important than formerly (before his Treatise) because they may now be fitted to every kind of country, and by their cheapness, approach the expense of constructing turnpike roads".

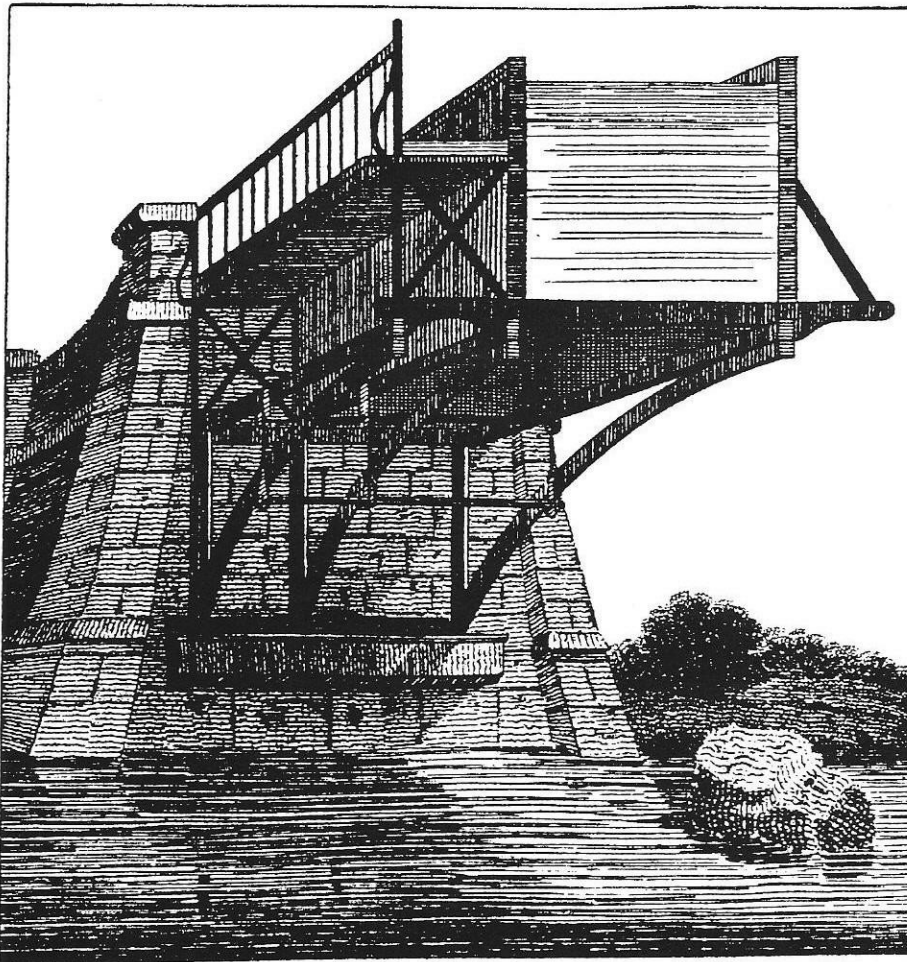
He suggested that the Governor consider a comparison of transport costs, exclusive of tolls, on a 350 mile stretch (Philadelphia to Fort Pitt). By canal, a man and a boy with one horse could convey 40 tons 20 miles per day, covering the distance in 18 days. By road, four or five horses could pull two tons that distance in 14 days (25 miles per day). Canal cost per ton would be less than half that for wagon.

He proposed a system for canal construction and rate setting by the state: Whereas in England, canals were built and operated by a company of subscribers who received handsome returns, the distances and sparse population in the States create a different situation. He suggested building the first 50 to 100 miles of canal using state funds, then tolls on this section could be used to pay some interest, as well as to extend the main line and some laterals. In order to make the tolls affordable, the rate should be constant beyond a certain distance, thus making it affordable for produce from Fort Pitt to be shipped to Philadelphia, as well as increase the value of the land and encourage population. He estimated that such a canal would serve farms 50 miles to either side. "Hence...cultivation will flourish, and enjoyment will be more equally diffused; canals will pass through every vale, meander round each hill, and bind the whole country in the bonds of social intercourse..."

While in England Fulton met the Duke of Bridgewater and greatly admired his canal: "The first canal in England which deserves notice..." The canal (which nearly parallels the river Mersey) "...yet it was not long finished when the eyes of the people began to open; the Duke could work on his canal when floods or dry seasons interrupted the navigation of the Mersey; this gave a certainty and punctuality in the carriage of merchandise, and insured a preference to the canal; the emoluments arising to the Duke were too evident to be mistaken; and perseverance having vanquished prejudice, the fire of speculation was

(Continued on Page Four)

ROBERT FULTON-CANAL DELINEATOR



Cross-section through an iron canal aqueduct designed by Fulton. Very similar to various iron aqueducts later built by Thomas Telford. (Plate 13)

(Continued from Page Three)

lighted, and canals became the subject of general conversation."

Fulton gave credit to William Reynolds for introducing inclined planes and small boats. "...stepped from the accustomed path, constructed the first inclined plane and introduced boats of five tons".

In comparing land transport costs with those of the proposed smaller canals, he noted the cost of horse maintenance and that the number of horses could be reduced. "But as the true criterion for judging of all improvements, where the object is to increase the produce of labor, is the cheapness with which the work may be performed; that mode which will convey the most goods for the least money will consequently be the best... It is therefore necessary impartially and deliberately to investigate this subject".

He argued for smaller, less costly canals in areas where appropriate. The canals of the time were designed for boat size of 25 tons, using locks and aqueducts. "Whereas a 25 ton boat can pass an elevation of 100 feet with 12 locks in one hour, it would require a string of six four-ton boats four hours and 48 minutes to pass the same locks, if all traffic were passing one way. Hence small and cheap canals cannot be formed on the lock principle; locks demand large boats". He argued that large boats increased costs by requiring larger size for tunnels, bridges, aqueducts, land, digging,

reservoirs, etc., thus excluding canals from districts that could not support the heavier expenses. He recommended the use of one horse pulling a string of 10 four-ton boats. He estimated the cost of building a canal to accommodate four-ton boats to be one-third the cost of a canal built to accept 40-ton boats.

After making an economic argument for smaller canals..."I do not hesitate to prognosticate the annihilation of lock canals...". He conceived of a few situations which would warrant large boats, such as through flat country, or a canal used to connect large rivers. He reported that within the three year period 1793-1796, five million pounds sterling had been subscribed to construct 1,060 miles of 'large' canals; the same sum could have built more than twice that mileage of 'small' canals.

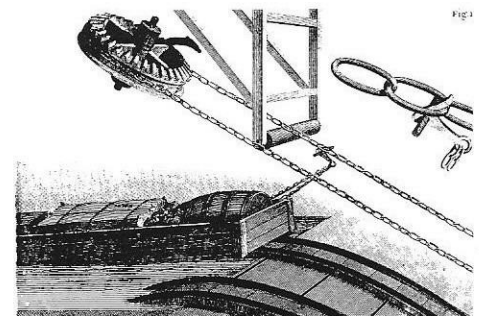
His recommendations for four-ton boats to be used on lockless canals included: Boats 20 feet long, four feet wide, and three feet deep, with flat bottoms and square ends (see Plate I, c: the common 4-ton boat). Each boat would have four 10-inch wheels, cast solid with the axle, and the two axles would be fastened to the boat bottom, 10 feet apart, supported by two parallel keels six inches square in cross section. The axles would turn on brass or cast iron bushings. The wheels were intended to support the boat at each plane, by running on iron rails. He recognized three potential objections to this design: The wheels may occasion some additional friction when passing the machinery (planes); The possibility of wheels being damaged; and resistance in water from the

wheels and axles, plus the square-ended design of the boats. He tried to forestall the objections: "It must be observed she (boat) will not undergo so much hardship in passing 200 miles (of plane track) as a common waggon (sic) one mile on the usual roads". A horse could..."tow a string of 20 such boats, and when repairs are needed, only one boat needs to be removed for repair...". As to the probable objection to increased resistance in water, he devoted several pages to a detailed discussion of the relationship between resistance and shape, weight and velocity. "The true principle of conveying goods cheap is to move slow and take a quantity". He referred his readers to Chambers no further reference: (Possibly Ephraim Chambers Cyclopaedia, 1788) for a more detailed discussion of the relationship between velocity and the resistance of a body in water. He presented a table indicating the towing capacity of one horse at different velocities: 36 tons at two miles per hour compared to four tons at six miles per hour. His recommendation: One horse towing 20 boats at two miles per hour. The boats..."being only 20 feet long, incline to the bending of the canal like the links of a chain...a string can be guided around sharp turns by a man on the tow path using a boat hook".

In a concluding chapter, Fulton restated his strong conviction in favor of developing small relatively inexpensive canals, that could be afforded by even poorer sections of the country. His fervor can be illustrated by some quotes: "...in the true sense of national improvement, to facilitate agriculture and merchandise, the whole ponderous carriage of a kingdom should...be conveyed by canals, thus reducing expense, opening easy communications, exchanging the produce..., improving the country, reducing the number of horses, rendering manual labor more productive, and spreading with great regularity the comforts of life. ...Yet, however desirable this may be, it cannot possibly be performed by lock canals; locks load a canal with certain and heavy expenses...".

"When a company of gentlemen wish a canal, they apply to, and give credit to, the reputation of an engineer; he consequently acts to the best of his judgment, which judgment is usually formed on established customs; and which, in many instances, has been judiciously exerted. But if such a system of operation was invariably to be continued, there would be no more scientific improvement among men, than in a bed of oysters".

"...I, by chance, stumbled on this subject...I mention this to shew (sic) that I do not arrogate to myself a great deal of the ingredient which is called Genius; But that some of the most useful discoveries is by accident. I found the subject interesting, and I have had the pleasure, in prosecuting it, to find it worth pursuing. It has also been



Fulton's wheeled canal boats passing over the crest of an inclined plane on metal tracks.

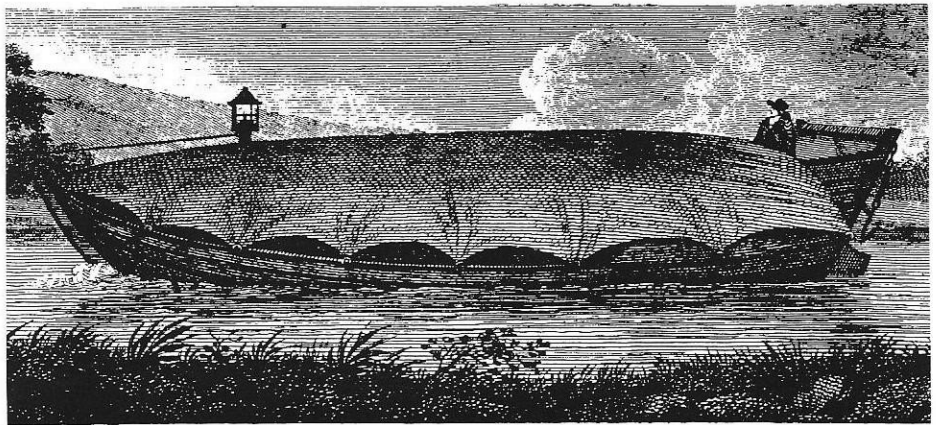
some satisfaction, that it appears of national importance: and, as I conceive, I have now removed the principal part of the rubbish (except one strong strata of prejudice), and got my machines ready to work, I lay the enterprise open to the inspection of all, in order that, if there is any intrinsic worth, it may be assayed; and, I have some hope, it will not all evaporate in fusion.... I do think it most seriously important, for speculators and their engineers, to consider this subject well, before they...prosecute another canal. If the system is sound, the sooner it is adopted the better; if not, let it be buried in its own insignificance".

"...I hold myself perfectly justifiable in criticising (sic) (engineers) who may hereafter either wilfully, or ignorantly, prosecute the lock principle, and draw their employers into the consequent errors...when the small canals are well understood, they will become so numerous, and perform the work at such low (cost), as to reduce the lock canals...to the utmost insignificance...I hope a wise legislature will see that competition is the true polish of society; that to reduce the expense of public works, is to improve the nation, and will therefore take off many of the restrictions with which they are now shackled". He recognized that his recommendations were quite contrary to the existing trend to build lock canals.

Several historians have discussed the impact that the Fulton Treatise might have had on canal design. To begin with, he has been faulted for identifying himself as a Civil Engineer on the title page of his Treatise. He has not been credited with being the engineer of record for any of the canals of Great Britain. He was recorded as having been a contractor on one section of the Peak Forest Canal.

There has also been debate about the influence of Fulton's plans for a cast iron aqueduct. In discussing cast iron aqueducts, Rees quoted several paragraphs from Fulton, then followed with: "Since the above period, a most stupendous work of this kind has been undertaken by Mr. Jessop, on the Ellsmere Canal, and is now nearly completed, for crossing the Dee River at Pontcysyllte...nineteen massive conical pillars of stone, at 52 feet from each other, the middlemost of which is no less than 126 feet in height...a cast iron aqueduct 329 yards long, 20 feet wide and six in depth, composed of massive sheets of cast iron, cemented and riveted together, having on its south side an iron platform and railing for the towing-path." In its completed form, the Pontcysyllte Aqueduct strongly resembles the aqueduct depicted in Fulton's Plate 13.

Clearly Fulton was not the first to recommend inclined planes, or that they be water powered. A canal, closely resembling the Bude Canal, (opened in 1825) had been recommended by two



The four-ton canal boats recommended by Fulton. Each boat had four ten-inch wheels for traveling up and down the inclined planes. (Plate 1, Figure 3)

or more persons before 1796. Some authors believe that engineer James Green, who built the Bude Canal, was influenced by Fulton's work, especially in the plane at Hobbacott Down, which was powered by a tub-in-well system. In 1971, Russell wrote: Hobbacott Down plane had an elevation of 225 feet, used bucket-in-well system, simple in theory but disastrous in practice. "All was well as long as nothing broke. When it did - usually one of the chains - either bucket or boat descended with frightening speed. Replacements were expensive and often slow to arrive. A steam engine was installed to operate the plane when the buckets were inoperative, but (proved to be) too expensive. The well, the engine house and the incline keepers cottage still stand at the top of the Down, which commands a superb view of the coast. The incline keeper, when he had time to look, could have enjoyed some of the finest scenery in England - some compensation for the poor wages and the frequent wrestling with recalcitrant ironmongery".

Perhaps a valid evaluation: Fulton was an inventive man, blessed with much optimism, but found little success in 18th century England. He may have taken many ideas of the time, and with his artistic skills, brought them to a wider audience.

Perhaps the most interesting sections of this book is to be found in the illustrations. These could also have been the most instructive portions for canal builders in this country.

Fulton illustrated his Treatise with 17 handsomely engraved plates offering great detail. In the lower right corner of each page of illustrations appear the words: R. Fulton invent et delin. His prior experience as an artist shows in the quality of these engravings.

Description of the Plates:

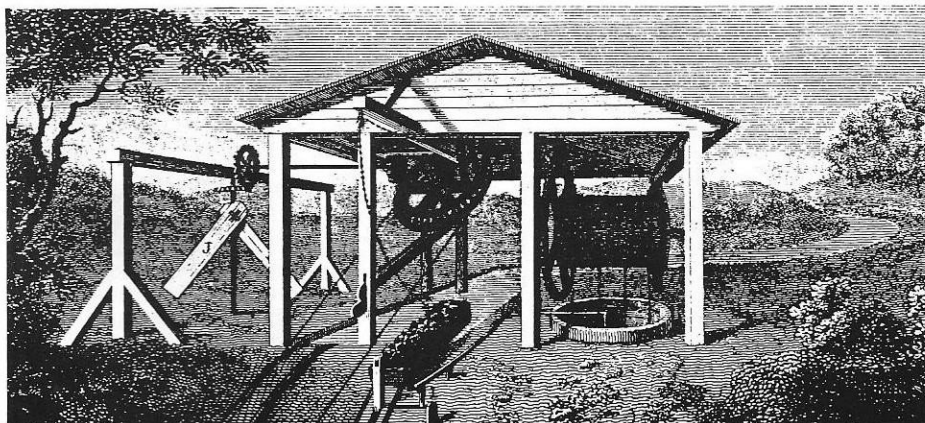
Plate 1 is entitled Boats, in which he illustrated three categories of boats: Fig. 1, the market or passage boat; Fig. 2, the dispatch (boat), "for conveying such goods as require expedition"; and Fig. 3, the common 4-ton boat. Of these, his interest is concentrated on the 4-ton boat. In the text in which he referred to plate 1, he again defended his design of the small square-ended boat with wheels attached. He believed that in passing a plane, a wheeled-boat-on-metal-track would require less time in passage, and permit a continuous motion of the leading chains - as contrasted to using a plane carriage or cradle, which must be stopped for both loading and unloading. He admitted that although a plane equipped with rollers to support the boat might be useful in some cases, he pointed out expected difficulties with rollers: forming rollers to operate in a straight line; keeping the rollers true; and should any one roller be out of repair, the entire plane would be non-functional during the repair period.

He described construction of the 4-ton boat, and mentioned the advantage of the location of the wheels, as shown in the bottom view of a boat in figure 3 of plate 1. The wheels "are to be two feet distance from extremities...close to the bottom of the boat, secure from the possibility of touching the side of the canal, or receiving injury..."

Plate 2: The Double Inclined Plane. "For the purpose of passing boats and their cargoes to, and from, the different ponds (sic) or levels in canal navigation". He explained that if the reader could understand the mechanism and principle used in the double plane, all of his subsequent explanations could be clearer, so he prepared the reader that his details related to this plate "appear a little tedious". He enumerated 15 items on which he wanted to elaborate:

- A double or inclined plane, running about 60 feet into both upper and lower canal.
- A pit or well, in depth equal to the distance between two levels; 10 to 11 feet in diameter, and lined with stone or brick.
- A sough to drain water from the bottom of the pit into the lower canal.
- A tub or cistern to move in the pit, able to receive water from the upper canal; used as a power source. The dimensions: nine feet in diameter and five feet deep, capable of holding eight tons of water. See details in plate 5.
- A trough to convey water from the upper canal to the tub.
- A drum wheel, mounted over the pit, from which the tub and a counter weight are suspended. The drum wheel must be capable of supporting 10 to 12 tons.

(Concluded on Page Twelve)



Double inclined plane of Fulton design. The large pulley-wheel at the top drove two sets of wheeled boats, balanced against each other on parallel planes. (Plate 2)

CANAL SOCIETY OF NEW YORK STATE HOSTS D. & H. CANAL TOUR



Friday evening briefing for the trip next day. David Barber, the lecturer, is in a white shirt in the left foreground.

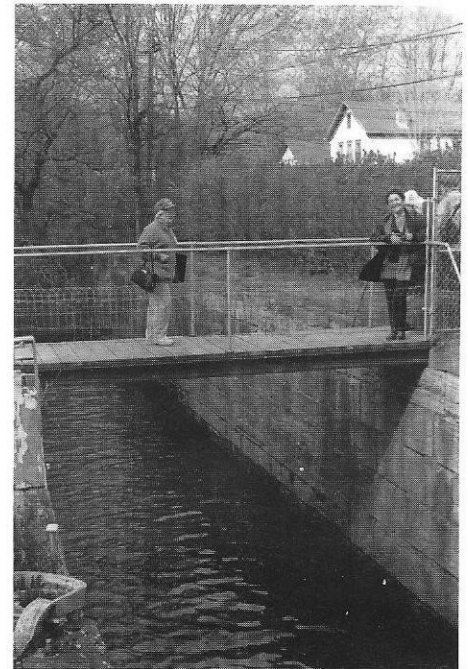
By Bill Shank

A record-breaking crowd of over two-hundred canal buffs signed up for the Spring Field Trip of the Canal Society of New York State along the lower reaches of the Delaware and Hudson Canal April 29-May 1. CSNYS was host to the New Jersey and Pennsylvania Canal Societies. Headquarters for the weekend were in Kingston, New York at the Holiday Inn. Dave Barber, assisted by Thomas Grasso, President of CSNYS and Linda House, Secretary of the CSNJ, constituted the Program Committee for the three-day weekend.

For the early birds, there was a tour of the Hudson River Maritime Museum on the water-front in Roundout. Also on the water's edge restoration work continues on the "Elsie Ann Conners", an 1881 tugboat.

In connection with the tour, Tom Grasso, CSNYS President and Dave Barber of Hopedale, Massachusetts had prepared an excellent, 88-page brochure giving a history of the D. & H. Canal and a great deal of pertinent geology of the region, including the cement formations at Rosendale, and many historic photographs and maps of the entire area of the tour between Roundout and Port Hyxson.

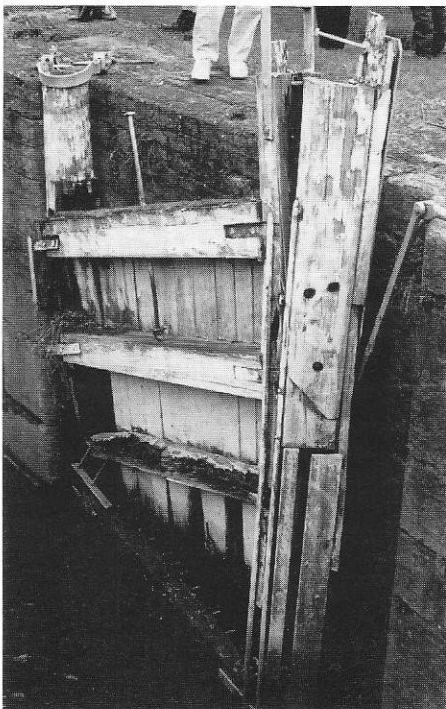
Friday evening the group was entertained with a slide-show by Dave Barber of points to be visited



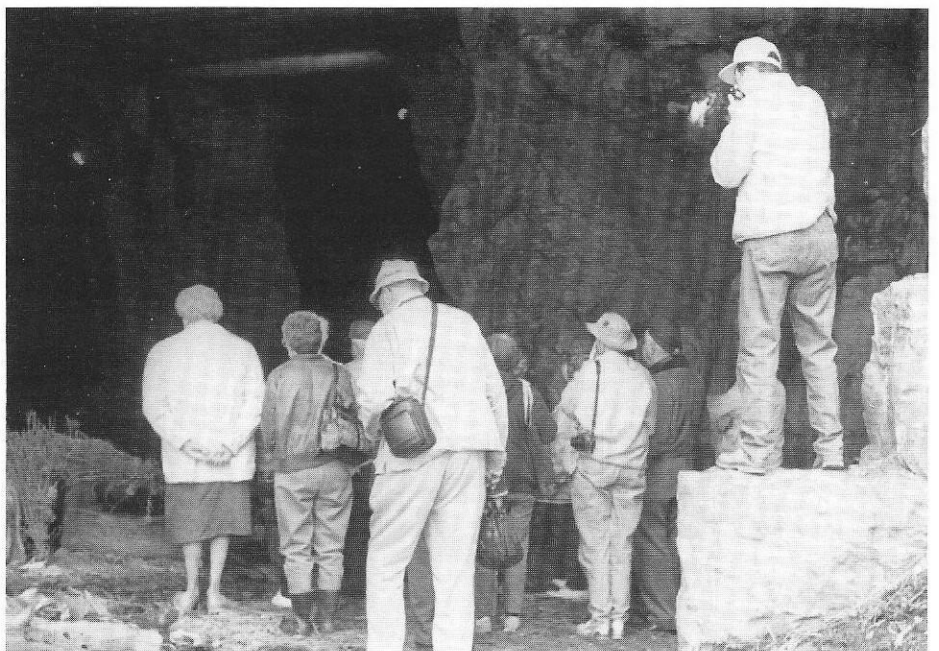
One of the well preserved locks of the D. & H. Canal at Roundout. Masonry still in excellent shape.

next day and a general introduction to the geology of the region by Tom Grasso.

There was a bus-trip (two buses) on Saturday, with a drive-by of the Feeney Boat Yard and a stop at Eddyville for a visit to Lock Number One, site of the D. & H. Weighlock, and drive-by of the Eddyville Guardlock. Next stop included the well-preserved "Creek-Locks" Numbers Two and Three, scenically located along the Roundout.



To our amazement we found what appeared to be an original wooden lock gate, almost in place in one of the Roundout locks.



Our canal group gathers at the entrance to one of the large, underground cement mines on the Snyder Estate.

Next stop was at Lock Number Four, with its adjoining drydock, followed by a drive-by of the Village of Rosendale. Next stop was the Snyder Estate, which with its multiple buildings and quarry, provided historic evidence of the hydraulic cement industry and its importance to the D. & H. Canal and the region generally.

A major stop was made at the Village of High Falls, New York with lunch (in two stages) at the High Falls Community Church. Highlight of this stop was a leisurely visit to the Delaware and Hudson Canal Museum, and the activation of fully-detailed miniature canal lift lock with boat model, carried through the lock by water. Nearby were the ruins of the first and second aqueducts which carried the canal across Roundout Creek—the second a suspension structure by John Roebling.

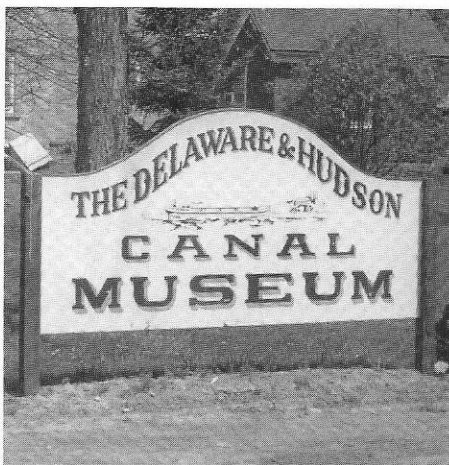
Next bus stop was the original Lock Number 21 on the earlier canal and next the Peterskill Aqueduct and the final stop at the Port Hyxson Feeder Dam and Lock and the nearby drydock site.

Saturday evening the entire group (now nearly two-hundred strong) re-convened for a sumptuous banquet and lecture by Dietrich Werner, director of the Snyder Estate, whose subject was "The Rosendale Cement District and the D. & H. Canal".

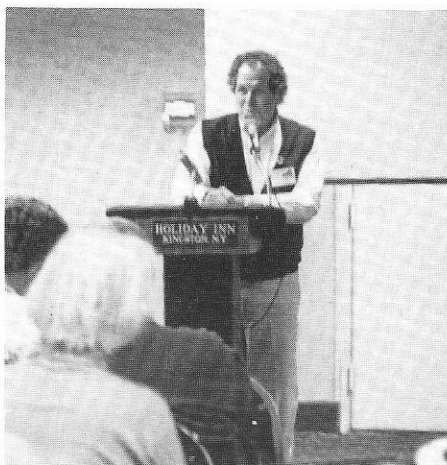
Sunday, there was a boat cruise of the lower Roundout Creek, aboard the "Indy" (Hudson River Cruises), as far as Eddyville, with a visit to the historic lighthouse at the Hudson River end. There was also an optional cruise on the "Rip Van Winkle" to Hyde Park in the afternoon.



Mary Cassai poses on the lip of the High Falls south abutment of the John Roebling Suspension Aqueduct — the second aqueduct to be built at that point.



The Canal Museum at High Falls is clearly identified.



Tom Grasso answers questions at the Friday evening "briefing".

ROBERT LEGGET 1904–1994

By way of Alan Dietch of Foster City, California, we have just learned of the passing of one of our favorite Canadian authors, Robert Legget of Ottawa, Ontario.

He is credited with having developed a National Building Code in Canada. Excerpts from the Toronto Globe and Mail April 20, 1994, follow:

OTTAWA—Robert Legget, the man who developed the national building code, making Canadian houses and public buildings safer, has died of a stroke. He was 89.

Mr. Legget was director of the National Research Council's division of building research from 1947 until his retirement in 1969. He was a civil engineer, geologist, university professor and author of 16 books, several on Canadian Canals. He died Sunday in Ottawa.

Canadians see Mr. Legget's work whenever they enter a building by a wheelchair ramp, travel on the Toronto subway, hear a smoke alarm or see a worker protected by a hard hat on a construction site.

After the Second World War, Mr. Legget predicted a building boom and argued that buildings needed to be safer, said George Seaden, director of the NRC's Institute for Research in Construction.

"For the building code to be current, he said it had to be supported by research and the best science one could imagine," Mr. Seaden said. "Mr. Legget was the driving force behind what has become part of the Canadian construction system."

Born in Liverpool, England of Scottish parents, Mr. Legget moved to Canada to work on a hydro project in Northern Ontario in 1929.

"He was active until he died," his son, David, said. "We never knew where he was until we got a postcard from Potsdam, Texas or some other place." His best known works are "John By—Builder of the Rideau Canal and Founder of Ottawa" and the "Rideau Waterway", available from the University of Toronto Press.

"CANALBOAT TO FREEDOM"

The Neversink Valley Area Museum is happy to announce the availability of an adventure novel for young readers on the Delaware and Hudson Canal, *Canalboat To Freedom*. This outstanding book was originally published in 1966 by Dell-Yearling, and was favorably reviewed by the New York Times, Library Journal and Young Reader's Review.

Canalboat To Freedom is a wonderful adventure story of a young emigrant boy named Benja, who becomes a muledriver for a cruel canalboat captain on the D&H Canal. Benja develops a special friendship with a former slave who also works on the canalboat, secretly using the boat as part of the underground railroad to smuggle escaped slaves from the south.

While the story is fictional, the author did extensive historical research on the D&H Canal, and describes many places along the canal which actually existed, including Port Jervis, High Falls and Cuddebackville with its famous Pie Lock. Many of the people portrayed in the story such as canal boat captains, blacksmiths and store owners are some of the many different types of people who would have lived along the canal. Mr. Fall weaves accurate historical details with an exciting adventure story that entertains as it teaches.

The book is \$7.95, \$7 for Museum members. make checks payable to: the Neversink Valley Area Museum, P.O. Box 263, Cuddebackville, New York 12729.

PASSENGER PACKETS ON THE OHIO AND ERIE CANAL — PART II

By Terry K. Woods

[Part 1 traced the development of Ohio and Erie Canal passenger vessels up to the inauguration of express packet service in 1837.]

These packets were the epitome of fashionable traveling. Nearly everything the railroads did later with passenger trains was, in reality, an echo of things done on the packets. Dining while traveling, mail runs, sleeping berths, even political excursions, had their beginnings with the packets. During the presidential campaign of 1840, when the Whig nominee, William Henry Harrison, was to speak in Chillicothe, the owner of the New York & Ohio Line, apparently a staunch Whig, offered free passage on his packets to the event to any good Whig who cared to attend. Over 200 people from Portsmouth traveled free by packet for the occasion.

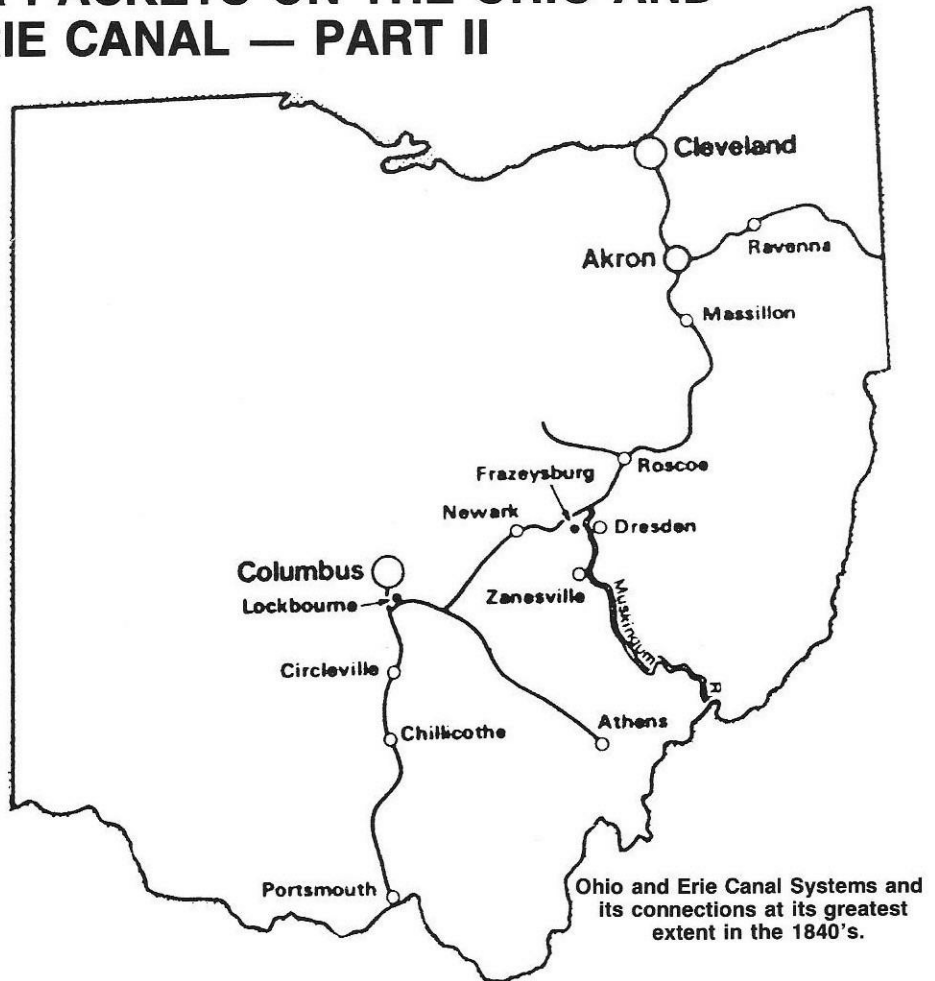
A packet's dimensions weren't materially increased during the heyday. Though the area previously designated for cargo was now converted to passenger cabins, space on any packet was necessarily at a premium. Men and women of the highest social strata in the 1830s and 40s weren't used to eating, sleeping, or existing in close proximity to strangers. All complained, but many quickly became familiar with the close quarters and found the experience enlightening. As young Bradley put it, when he left his packet at Chillicothe:

"We chartered a hack, with two seats and four horses, and put off about eight. There were four of us, all old friends; that is we had been thrown together in the same boat for twenty-four hours, and he must have an abundance of sourkrout in his composition who does not get acquainted with his shipmates under such circumstances."

In the early days of packet traveling, when passenger manifests were high, narrow canvas "sleeping shelves" were suspended from the cabin walls upon thin cords. With the use of these "hammocks," a packet could sleep ten men in a 10' x 10' cabin. When conditions were less crowded, however, and in the more luxurious latter-day packets, passengers slept on cushions scattered about the cabin floor or on convertible settees. The early combination packets carried from 12 to 20 people in their bow passenger cabins. The Ohio & Erie Canal express packets carried a maximum of 30 to 50. Apparently their owners never resorted to the flagrant overcrowding found on several of the packet lines on the eastern canals. On Pennsylvania's Main Line, craft no larger than those in Ohio were reported to have carried as many as 150 people! In some cases, though, captains of the Ohio packets did follow a Pennsylvania practice and assign sleeping locations by lot. As one man testified after an 1838 trip on a packet from Cleveland:

"Shortly after leaving there the list of names was called by the Captain, so that the passengers should choose their berths in order. I had the good fortune to stand third. So large a number of persons as there were on board necessarily created much confusion; not a few of those last called having the last choice, grumbled at their quarters for the night."

To maintain the advertised schedules, it was necessary for a packet's horses to be kept at a brisk trot. One Ohio line, in 1837, bragged that their boats could make the 309-mile trip from



Cleveland to Portsmouth in 80 hours. This dictated that an average speed of nearly four miles per hour be maintained for more than three days.

The pulling force required to keep a loaded canal boat moving varied directly as the square of the speed. In other words, it took four times the force to pull a boat at four miles per hour as it did at two. Also, to get a boat up to speed from a dead stop after each of the 146 lockages required a temporary output of maximum force from the towing animals.

This burned up horses fast. It was estimated that a horse could only be used to tow canal boats from one to three years before it was worn out. Mules could stand the work better than horses and were used to pull packets on a few of the nation's canals, but there is no direct evidence of their being used to any great extent on the Ohio & Erie.

A team of horses was limited to working no more than 10 to 14 miles before they were replaced with a fresh team. This meant equipping and maintaining way stations all along a packet's route. Obtaining the horses and boats and setting up the extensive system of way stations needed for an express packet line required a large outlay of cash before a line could even begin to handle passengers. It is little wonder that the Ohio Canal Packet Boat Company had to capitalize at \$50,000.

A financial panic struck the entire nation in 1837, and it was an inauspicious time to begin any new business that required extensive outlays of cash. Another collapse two years later shattered what remained of the nation's economy and reduced public acceptance of paper currency to practically nothing. It was in this economic atmosphere that the Ohio express packet lines attempted to

operate. Passenger traffic on the canal actually grew during this period, peaking around 1840; but it was the cheaper line boats, carrying bankrupt immigrants from the east to new beginnings in the west, that kept the numbers up.

There were fewer and fewer Ohioans with cash who could afford to patronize the express packets. Through the years, passenger lines came and went. The Daily Line, Ohio Line, and New York & Ohio Line were only three of several. In 1842, the short-lived Mail Line was established. North and south-bound Mail packets continuously traversed the state between Cleveland and Portsmouth. Akron's connection with the P. & O. and the east was considered important enough that both Mail packets were scheduled to interchange there between 7:00 and 8:00 a.m. each day.

At least one line operated two sets of packets, one on a northern division and one on a southern division. Mr. William Case of Cleveland describes one of the resulting interchanges that took place in June of 1838.

"At One P.M. we arrived at Frazeyburg. The GRIFFITH proceeds no further, as this is the end on the northern section, 155 miles, one mile more than half through. The other section is run by another boat, the TRAVELER I think. They intend to meet here at the same time, but the boat from the north generally arrives four hours sooner than the other. I cannot imagine what inducement there can be to stop here instead of Newark, some 20 miles farther. This is a little insignificant, dirty Dutch place of a dozen houses, with not even the convenience of a decent tavern to rest in, while at Newark a stop of two or three hours would be very interesting."

Economic conditions continued to worsen and 1842 appears to have been the last year for the through express packets with the expensive system of way stations. When no less a person than former president John Quincy Adams traveled between Akron and Columbus in November of 1843, he traveled in a packet that carried its relief animals in a stable on board the boat. President Adams described the packet Rob Roy as sumptuously set up, with six compartments, settee beds for all, and a dining hall for 30 people—but there were those horses on board!

Ohio canal packet service didn't die out completely, however, or at least not just yet. As the national and local economies improved during the late 1840s, there proved to be some local market for the finest in traveling luxury. In July of 1849, Curry's Cleveland and Akron Express Packet Line began operating with two packets that were "new and nicely fitted up for the accommodation and convenience of passengers, with separate cabins for the ladies and gentlemen."

The two boats, Fashion and Petunia, left Cleveland and Akron alternately at 6:00 p.m. each day and arrived at their destination between 6:00 and 7:00 the next morning. The completion of the Ohio & Erie's Cleveland terminal facilities in 1829 made the effective length of the canal one mile longer than it had been in 1827, and with a scheduled stop at midpoint Boston, the Fashion and Petunia had to run at an average speed of close to 4 miles an hour to maintain their schedule.

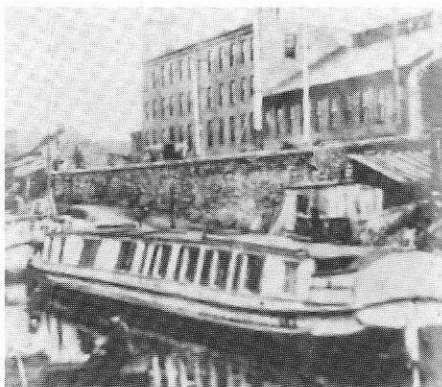
Then, in October of that year, a third packet, the Eclipse, joined the other two and began making the 16-mile circuit between Akron and Massillon on a schedule that allowed passengers to travel from Cleveland to Massillon with a change at Akron. The company changed its name to Curry's Cleveland and Massillon Express Packet Line, and was quick to point out in its advertisements that the line connected at Massillon with Ward's Daily Stages to Zanesville. The fare from Cleveland to Akron—\$1.00, and to Massillon—\$2.00, might have indicated some unusual expenses in the Akron to Massillon run. It isn't clear how the problem of maintaining fresh towing animals was solved, but we can assume the motive power was changed at the Boston stop, requiring each team to work a stretch of 16 to 18 miles—a long, but not prohibitive distance in those pre-S.P.C.A. days. There is also some indication that the old packet-boat stop at Johnny Cake (Everett, Ohio) was in operation from 1837 to 1852.

The Curry line may not have made any money, for they didn't operate the next year. The business must have looked promising, however, as the 1850 boating season found a new packet line running between Cleveland and Akron with, if we are to believe the copy, "new" boats. The run to Massillon wasn't offered, but the packets Cleveland and Akron were promised to be the last word in convenience and comfort. As their ad writers put it:

"These boats have separate cabins for ladies well furnished with every accommodation requisite for comfort and convenience and commanded by careful, experienced, and gentlemanly Masters who will use their best efforts to render pleasant and agreeable the passage of their patrons. Each packet also has an iron safe for articles of value and will convey express packages."

The owners of this line, Chamberlin and Crawford, reportedly made money, but railroads were being constructed at a rapid rate in the area and they moved the line to Columbus before boating began in 1851. There they expected to run a profitable business for several years at least, free of immediate railroad competition.

The Cleveland & Pittsburgh Railroad began operating between Cleveland and Ravenna (on



The Ohio Packet Boat "WAVE" photographed in Columbus, about 1900. This boat was in service between Columbus and Portsmouth starting in 1874.

the P. & O. Canal) in the spring of 1851. Stages met the rail cars at 10:00 a.m. and 6:30 p.m. each day in Hudson to convey passengers to and from Akron and Massillon. Persons with a strong desire to ride passenger packets could board one of the boats of the Clark, Parks & Company Line a half hour later in Ravenna for Beaver, Pennsylvania, and the river steamers to Pittsburgh.

Though Chamberlin and Crawford had relocated their packet line at the beginning of the 1851 season, they still operated a freight forwarding business in Cleveland. Then, in July of that year, apparently reconsidering their decision regarding packets, they reentered the express packet business between Cleveland and Akron with two "new" boats, carrying the same names as the previous year with at least one of the old captains.

The boating season for 1852 found Chamberlin and Crawford again offering an ambitious express packet line, but that year appears to have been the finale for passenger packets on the northern division of the Ohio & Erie. The Chicago & Pittsburgh Railroad was completed through Massillon early in 1852, and the Akron Branch Railroad was finished to Hudson in July of that year. The Cleveland & Pittsburgh Railroad advertised their summer schedule for 1853, but whereas in previous years mentioned had always been made of the connection with packet lines, now it was simply stated that "The above trains connect at Hudson with the Akron Branch R.R."

The southern end of the Ohio & Erie Canal, not as affected by railroad competition as the north, was able to maintain limited packet travel for quite a few more years. In 1851, a daily line of packets was running between Portsmouth and Columbus, the boats arriving at their northern destination in time for passengers to connect with the morning cars of the newly completed Cleveland, Columbus & Cincinnati Railroad. A line of packets was still running between Portsmouth and Columbus as late as 1858, though the frequency of runs had been reduced. Boats left Portsmouth on Mondays, Wednesdays, and Fridays for the 24-hour trip to Columbus. They then returned to Portsmouth on alternate days.

In 1866, the packet Evening Star was making tri-weekly runs between Portsmouth and Chillicothe, some 20 miles away. Patrons connected there with a line of packets running between Chillicothe and Columbus. That arrangement was still in place at the beginning of the 1874 boating season. Now, though, the "new, fast, fine" packet Eagle left Portsmouth every Monday, Wednesday, and Friday at 11:00 a.m., and started from Chillicothe at 12:00 noon each Tuesday, Thursday, and Saturday for the return trip. In

November of that year, 1874, the Eagle was sold to the proprietors of the line operating between Columbus and Chillicothe, and a new line of direct packets was initiated between Portsmouth and Columbus, employing the boats Fitch & Son, Wave, and Capital.

The completion of the Scioto Valley Railroad south from Columbus, parallel to the canal, in 1876, finally removed the last need for passenger packets on the Ohio & Erie Canal.

It was still possible for an individual to take passage aboard a canal boat even after that. Some independent boatmen fitted up their craft to take an occasional passenger; and the line boats still carried both passengers and freight upon occasion for another five to ten years. But the fleet, fancy, Ohio canal passenger packet disappeared into the smoke and steam of the faster passenger trains about ten years before the Civil War on the northern division, and some ten years after on the southern.

CIRCULAR LOCK CHAMBERS ON FRANCE'S CANAL DU MIDI

Along with Mr. Russell, I too was on the Canal Society of New Jersey's trip to the Canal du Midi, and also heard that the circular lock areas were intended to hold up better under water pressure. When you think about it, however, this construction is little more than an arch on its side, and arches do their job under compression, not expansion as would be the case when the chamber was full of water. It would follow then, that the intention was to withstand ground pressure when the chamber was empty or subjected to ground freeze or frost. When water is in the chamber the pressures might not be equal, but something close. Knowledge of the arch was around long before RIQUET'S time and surely that genius would have used it correctly.

A.W. Austin
La Belle, Florida

FROM ROGER SQUIRES

Many thanks for the copy of *THE BEST OF AMERICAN CANALS* Number VI which arrived in the mail today. What can I say. You have done it again!

There is no doubt about it, *THE BEST OF AMERICAN* No. 6, is a fine example of the editor and publishers art. The ability to select key articles from *AMERICAN CANALS* and then to weave them into a volume which draws out the very essence of the knowledge that is transmitted by the ACS Journal requires a special skill.

There can be no one more skilled at doing this than Bill Shank PE. Now in its 22nd year key elements of the ACS Journal have been carefully extracted to provide the researcher and layman alike with easy access to key themes. Carefully indexed, the changing picture of canal interests and knowledge is now available in 'potted' form, yet all the text is there. Nobody who has an interest in canals can afford to be without these key volumes, the latest of which covers up to Spring 1993. If you have not seen the latest, *Best from AMERICAN CANALS*, you do not know what you have missed!

Best Wishes,

Roger W. Squires

THE C&O CANAL AND THE CIVIL WAR

During the Civil War, railroads and canals were among those transportation media which were threatened by troops on both sides. The C and O Canal was particularly vulnerable, following as it did the boundary between North and South along the Potomac River. Here are some accounts which our Historian, **Bill Dzombak** has collected. Most of the major fixtures of the canal were strong enough to resist Confederate attempts to destroy them.

PROTECTION OF C&O CANAL

Poolesville, Md., Dec. 10, 1861

Brig. Gen. Charles P. Stone, commander of the Corps of Observation of the army of the Potomac, with headquarters at this city, has been assigned to the military supervision and protection of the Chesapeake and Ohio Canal.

In an effort to keep the canal open during the winter, and to prevent its destruction by the Confederate troops, Stone was appointed by Maj. Gen. George B. McClellan to protect the canal. It is reported that when the Baltimore and Ohio Railroad is reopened, the Federal government plans to convey stores, brought by railroad to Point of Rocks, Md., direct by canal to Washington. McClellan's order directing Stone to this position is as follows:

The Secretary of War directs that the Chesapeake and Ohio Canal be placed under the military supervision of Brigadier General C.P. Stone, Volunteer Service. The immediate superintendence of the Canal will be under the President of the Company, Alfred Spates, Esq. The officers of the Canal serving under him shall be in all respects satisfactory to the military authority. The receipts of the Canal will be applied to meet the current expenditure of its operations, and any excess or deficit in the income will be placed to the account of the Canal Company.

The President of the company will furnish General Stone with an account current of the monetary affairs of the Company monthly. General Stone will give military protection to the Canal property, and such aid as is consistent with the good of the service in keeping it in repair. Should the execution of this last provision extend beyond the limits of Gen. Stone's command, his requisition on the proper commanders will be promptly complied with.

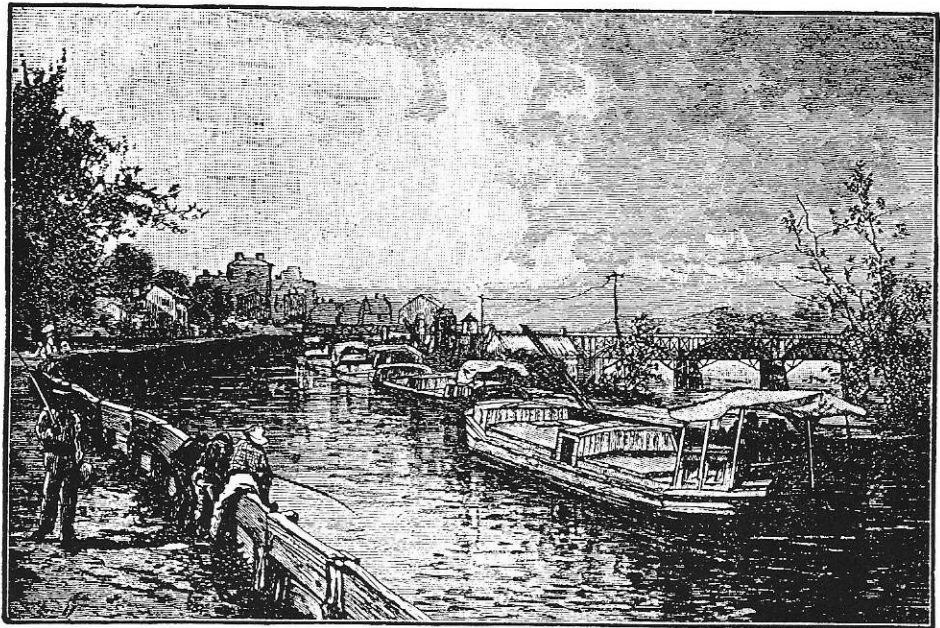
Valley News Echo, Vol. 2, No. 9, page 2, Hagerstown, Md., December 1861.

PROPERTY RESTORED TO CANAL COMPANY

Harpers Ferry, Va., April 21, 1862

The U.S. War Department issued an order today restoring the property of the Chesapeake and Ohio Canal, which had been taken over by the government, back to the canal company. The order, issued by Adjutant General L. Thomas, dated today, is as follows:

All the lock houses, boats, scows, and other property belonging to the Chesapeake and Ohio Canal Company on the line of said canal, now held, used, or occupied by the United States officers or troops, will be forthwith given up and restored to the president of the said company. All officers of the army will respect Alfred Spates as president of the said company, and are hereby



An old wood-cut of C and O Canal Boats waiting just west of Georgetown to unload their coal and return to Cumberland. Note the Alexandria Aqueduct across the Potomack River in the right background. (Contributed by Kay Stevens of Schenectady, NY)

prohibited from interfering in any manner with him in the management of the canal; but are directed to give him such aid and assistance as is consistent with the good of the service in keeping it in repair and removing all restrictions which have been imposed upon the boats navigating the said canal. The president of the said company is authorized to give all passes that may be required to be used on the canal, subject to the approval of the commander of the district.

Valley News Echo, Vol. 3, No. 4, page 1, Hagerstown, April, 1862.

FIGHTING AT DAM 5

Williamsport, Md., Dec. 21, 1861

A Confederate force led by Maj. Gen. Thomas J. Jackson has succeeded in making a breach in Dam No. 5 near Clear Spring, Md. However, the damage is not severe enough to hamper transportation on this canal.

The Chesapeake and Ohio Canal is one of the main arteries of communication between Washington and the West, by which coal, hay, and forage reach the Union capital. Jackson, who is commander of the Valley District of the Confederate Army of Northern Virginia, with headquarters at Winchester, Va., planned to cut off western supplies by breaking Dam No. 5.

On Dec. 7, a force of Confederate calvarymen, commanded by Lieut. Col. Turner Ashby, appeared at Dam 5 on the Virginia side of the Potomac River. The only Union force at that point to oppose them was a company of the 13th Massachusetts Regiment, commanded by Col. Samuel H. Leonard, on picket duty and an unarmed Illinois Regiment. The Confederates commenced throwing shells and shot at the dam and houses on the Maryland shore and continued the fire until dusk. The Federal troops were armed with smooth bore muskets and their fire was not effective at long range.

During the night, Leonard dispatched a canal boat from Williamsport with another company of his regiment, armed with Enfield rifles. These men were concealed as skirmishers along the Maryland

shore. Early on Dec. 8, when the Confederates resumed the fire with artillery and small arms, the Federal troops exposed themselves at the brink of the river. The Federal riflemen opened fire from their concealed positions and in a short time forced the Confederates to abandon their battery and retire. Because of the lack of sufficient infantry force and a battery to protect their movements, Leonard reported that he was compelled to let the Confederate guns remain in position. That night, the Rebels returned and took them off the field.

After this affair, Jackson reported the following to Gen. Joseph E. Johnston, commander of the Confederate Army of Northern Virginia:

"I have made two attempts to prevent navigation on the canal, but have not thus far succeeded... my desire is to complete the work commenced on the dam, and for this purpose have made arrangements for marching with Garnett's brigade at 6 a.m. on Monday Dec. 16..."

The work on the destruction of Dam 5 commenced on the night of Dec. 17. Capt. R.T. Colston, of Company E of the Second Regiment of Virginia Volunteers, volunteered to take charge of the Confederate working party to accomplish the destruction of the dam. Colston's home, Honeywood, is the estate adjoining the dam on the Virginia side.

The river was closely picketed on the Maryland side by the Federal troops. The Confederates commenced their work under the protection of heavy fire. Standing waist deep in the cold water, the men were under the constant fire of the Federals.

On Dec. 19, a volunteer party from Federal Capt. W.B. Kennedy's company crossed the river in skiffs and set fire to the mill owned by Colston, which had afforded good shelter to the rebel riflemen.

Jackson covered the operation of the destruction of Dam 5 by a feint movement of a portion of his troops toward this city and Falling Waters. The demonstrations were made by General James H. Carson. The remainder of the Confederate force took positions so as to protect the working party at the dam. The fighting gradually subsided and when the partial breach in the dam was completed

this morning, Jackson withdrew the main body of his force to Winchester. No offensive demonstrations were made by the Federal troops. Ashby's command returned to their winter quarters established in the vacant houses connected with the Baltimore and Ohio Railroad at Martinsburg.

In his report of the operation, Jackson said: "There is reason to believe that the recent break in Dam No. 5 will destroy any vestiges of hope that might have been entertained of supplying Washington with Cumberland coal by the Chesapeake and Ohio Canal, and consequently their only prospect of procuring that coal must be the Baltimore and Ohio railroad, and for this purpose near 25 miles of track west of Harpers Ferry must first be relaid, and this can be done under a much smaller protecting force stationed at Winchester than would be required if distributed along the railroad, and consequently I must anticipate an attempted occupation of this place by the enemy."

The destruction of the dam, however, was not complete and was repaired shortly after the Confederates retired. Leonard reported to Maj. Gen. N.P. Banks today: "Canal boats running today both ways."

Valley News Echo, Vol. 2, No. 9, page 1, Hagerstown, Md., December, 1861.

CANAL GUARDED AGAINST REBEL RAIDS

Cumberland, Md., Aug. 27, 1863

Because of the numerous raids on the Chesapeake and Ohio Canal recently, destruction of canal boats and capture of teams of horses, the War Department has issued orders authorizing strong protection along this main artery of supply against raids by bands of Rebel guerrillas.

Of these orders and the need for this increased protection, William Evans, editor of the Cumberland Civilian and Telegraph, reported the following:

"Since the completion of repairs and resumption of navigation on the canal, several boatmen have been plundered of their stock by predatory bands, which has very seriously interfered with the shipments of coal, by giving rise to so great a sense of insecurity among the boatmen as to induce many of them to decline loading.

Happily, through the instrumentality of Col. Alfred Spates, the energetic president of the company, who labored so indefatigably to effect a speedy repair of the injuries sustained by the work at the time of the rebel invasion, the War Department has assured the most ample protection.

Valley News Echo, Vol. 4, No. 8, page 4, Hagerstown, August 1863.

MIDDLESEX CANAL BOOK

As part of its purpose to disseminate information about the canal, the Middlesex Canal Association has now procured hard covered copies of *The Middlesex Canal, 1793 - 1860* by Christopher Roberts which was originally published by the Harvard University press in 1938. This book is 252 pages long and includes several appendices and an extensive bibliography. The book includes chapters on Massachusetts history before the canal, the construction of the canal, the Merrimack River canals, and other related matters.

Copies will be available at the price of \$50.00 each plus a \$2 charge for postage. For mail orders, please send a check for \$52.00, payable to the Middlesex Canal Association, to David Barber, 16 Ballou Road, Hopedale, MA 01747-1833.

MORE CIVIL WAR HISTORY ON THE C&O

By John C. Frye

The history of the C&O Canal during the Civil War (1861-65) will be featured in a series of walks and talks along the historic waterway on a weekly basis beginning Sunday, June 12, 1994.

The events will be held every Sunday afternoon, with the exception of July 3 and September 18, beginning at 2 p.m. Various locations along the entire canal from Cumberland, Md. to Georgetown, D.C. will be covered in the series. Park Rangers will outline Civil War action at each point and discuss historical facts relating to both the history of the canal and the war.

The canal was constructed along the north bank of the Potomac River from Georgetown to Cumberland beginning in 1828. Twenty-two years later, October 1850, construction was completed to Cumberland and full operation began. Thus upon the outbreak of the Civil War, the canal was just through 11 years of operation, much on a limited basis.

The Civil War period was extremely hard on the canal operation due to its location on the border between the two warring nations. It was subjected to much damage from both sides during the four-year war period. Confederate raids were many across the Potomac River from Virginia and much damage was done during the three invasions of Maryland by the Confederate Army.

War damage to the canal and flooding nearly closed the waterway for good in 1861 when just \$70,566 in tolls were collected, the lowest since the canal had opened to Cumberland in 1850. However, with protection from the Federal Army, tolls increased to \$346,165 by 1865, the last year of the war.

The dates and location of the walks: June 12, Cumberland; June 19, Oldtown; June 26, Paw Paw; July 10, Hancock; July 17, Fort Frederick; July 24, Dam 5; July 31, Williamsport; Aug. 7, Ferry Hill; Aug. 14, Packhorse Ford; Aug. 21, Harpers Ferry; Aug. 28, Weverton; Sept. 4, Point of Rocks; Sept. 11, Monocacy Aqueduct; Sept. 25, Whites Ferry; Oct. 2, Edwards Ferry; Oct. 9, Seneca; Oct. 16, Great Falls; and Oct. 23, Georgetown.

Additional information and a full schedule of the Civil War series may be secured by writing P.O. Box 4, Sharpsburg, Md. 21782, or by calling 301/739-4200, 739-6179, and 299-3613.

BLACKSTONE CANAL CONSERVANCY

A new canal group, the Blackstone Canal Conservancy, Inc., a non-profit corporation, has been organized to publicize the Blackstone Canal and promote its preservation, study, use, and restoration. The canal ran for 45 miles between Providence, RI, and Worcester, MA, and from 1828 to 1848 was the principal transportation artery of the Blackstone Valley, the "Birthplace of the American Industrial Revolution". The canal was closed in 1848 when replaced by the parallel Providence and Worcester Railroad. Due to the mostly rural route, much of the canal remains.

Membership in the Conservancy for 1994 is \$7 for students, \$10 for individuals, \$15 for families, and \$25 for organizations. Applications and fees, payable to the Blackstone Canal Conservancy, should be sent to, Richard T. Kleber, Blackstone River Valley National Heritage Corridor, One Depot Square, Woonsocket, RI 02895. Dave Barber

CANAL CALENDAR

June 11, 1994.

Blackstone Canal (MA) Second Annual Canalfest Contact: Val (401) 334-7773.

June 18-25, 1994.

James River (VA) Batteau Festival Contact: Sue Pechmann (804) 947-6105.

June 18, 1994.

Old Market Day along the Lehigh Canal sponsored by The Old Fremansburg Association, Activities led by Charles Derr.

June 18, 25, July 2 & 9, 1994.

Canal Walk 1994. Walks on different sections of the Delaware Canal (PA) Contact: (215) 862-2021.

June 25, July 16 & August 13, 1994.

Evening Lock Ride on the Lehigh Canal, Easton, PA. For reservations Contact: (610) 250-6700.

June 26, 1994.

Canal Day at Schuylkill Canal Recreation Area (PA).

July 9, 1994.

Annual Lehigh Canal Festival (PA). Tours and Canal Boat rides. Contact: (610) 250-6700.

July 9 & 10, 1994.

Cumberland Canal Boat Festival (MD) Contact: John Millar (301) 729-3136.

July 16, 1994.

Canoe the Potomac River from Brunswick to Monocacy Contact: Carl Linden (301) 229-2398.

July 24, 1994.

Follow the route of the Morris Canal boats across Lake Hopatcong. Historical Interpreter: Marty Kane.

July 30 & 31, 1994.

"Canal Days" - Civic Holiday weekend at Port Colborne, Ontario, Canada Contact: (905) 834-7604.

August 19, 20 & 21, 1994.

The Coshocton Canal Festival (OH). The 1994 Roscoe Village Calendar of Events is now available. Contact: (800) 877-1830.

August 27 & 28, 1994.

Williamsport (MD) C&O Canal Days Contact: Tom Perry (301) 223-7010.

ERIE CANAL TOLLS RETURN

From Edith McNally we publish the following from the Cleveland Plain Dealer for April 20, 1994:

Lockport, NY: Tolls are back on the historic Erie Canal for the first time in more than a century.

The New York Thruway Authority, which operates the canal celebrated in folk tales and songs, approved fees last week for traveling through the waterway's 35 locks. The canal will open for the season May 2.

The idea is to bring in money to help revitalize the crumbling old canal, opened in 1825 for barges pulled by mules plodding along tow paths.

The canal connected the Hudson River at Albany, N.Y., to the Niagara River at Buffalo.

Tolls were abolished in 1882 to help the canal remain competitive with railroads.

Pleasure boaters will pay \$25 to \$100 for lock passes this season, depending on the size of their vessels. Daily lock passes will be available for \$5 to \$20.

THE CORPS OF ENGINEERS & WEST POINT

By Larry Turner

George Washington, a 16 year old orphan, was employed in 1748 by Lord Fairfax as a surveyor, and was fully licensed in Williamsburg, Va. at the age of 19. He was tutored in military engineering (there was no civil engineering schools at the time) and he soon put his training to work. President Hoover, also an engineer, wrote of Washington's feats:

"A much neglected side of his character is Washington as an engineer. His countrymen have not realized how modern he was in his engineering operations — as reclainer of the Dismal Swamp; as the first advocate of a combined highway and waterway from the Atlantic Coast to the Ohio River; as one of the first Americans to recognize the possibilities of power transportation by water—".

The British and French were the best canal engineers at this time and both countries were reluctant to invest capital funds to such a yet unsettled frontier. Due to the conflicts of the 1776 Revolution, the French were turned to for technical assistance. On the date of birth of the Corps of Engineers, June 16, 1775, George named Colonial Richard Gridley, formerly an officer in the British Colonial Army, as Chief Engineer, a day before the Battle of Breed's Hill. Gridley's initial corps consisted of a few frontier surveyors and a "handful of trained Frenchmen." Few soldiers were more important to George than French Lt. Colonel Louis Duportail, who commanded the Engineers in the Continental Army; from the construction of the Delaware River Forts, which almost starved the British out of Philadelphia, to the bastion at West Point to control the Hudson, to the siege of Yorktown, Duportail and his little corps of specialists were the technicians of the American Revolutionary War effort. In 1778, George moved his engineer school from Valley Forge to West Point on the Hudson River and the Continental Congress formally recognized the school in 1779.

In 1780 Albert Gallatin arrived in Massachusetts from Geneva at the age of 19, and George got a break from military life long enough to establish the Patowmack Company in 1785 to render the river more navigable by a series of "skirting" canals that carried boats around dangerous waterfalls and rapids of the Upper Patowmack River. He also had enough leisure time to raft down the Ohio River, see the potential of that yet uncontrolled watercourse, claim a vast land holding in Ohio, and venture back to Mt. Vernon, his home, by way of the yet to be constructed Chesapeake and Ohio Canal Company route.

By 1795, Etienne Rochenfontain, a Frenchman, was appointed as the head of the "Corps of Artillery and Engineering, and a year later, military engineering, as we know it today, began at West Point. Politics and the economy have always been a factor. Pinckney's Treaty with Spain in 1795 had given the U.S. the rights to navigate the Mississippi River from its source to the sea and to deposit its goods at New Orleans to be loaded onto ocean going vessels. Around 1797 our relationship with France began to assume a more hostile character because they thought we would side with them in Europe, while we attempted to stay neutral. They started outfitting ships in our country against the British and even took some of our vessels to use against their longtime adversaries. By 1798, the President recommended the enlargement of the U.S. Navy from 12 to 20 ships and instructed our Navy to capture any French ships found on our coastlines.

A relationship began between Jefferson and Lafayette in the midst of the British invasion of

Virginia. Jefferson admired the French Revolution because it was done in the image of the American Cause and he and Lafayette became lifelong friends. By 1800, Napoleon came into power, ending their Revolution, and changing our treaties with France. In October of 1802, Napoleon, not Spain, closed the Port of New Orleans, British sea power kept France from occupying its new holdings, and conflict between England and France continued in Canada and Europe.

President Jefferson appointed Albert Gallatin in 1801 as Secretary of the Treasury, and at this point military and civilian objectives began to mesh. Jefferson gave him orders to open the "West" (Ohio River to the West) and to make it safe. Gallatin did his job with gusto. In 1802 Jefferson ordered "a Corps of 5 officers and 10 cadets" to be stationed at West Point, whereby they studied French engineering, using French text books. This was one of the reasons that the Ohio and Mississippi River systems took on such great importance at this time in history—all goods from the "West" had to be floated down our internal river systems, to Louisiana, for shipment to France and the rest of the world, free of British intervention.

Early in 1802, West Point had only two professors, Cpt. William Amherst Barron, a British graduate schooled in Artillery, and Jared Mansfield who taught mathematics and "Natural and Experimental Philosophy" better known today as Physics; by Fall, Francis De Masson arrived to teach French (in order to read technical text books from France) and topographical Drawings. Jefferson persuaded Jonathan Williams, a relative of Benjamin Franklin and one of the nation's outstanding scientific figures, to head the school. Williams preferred building fortifications to running a school whereby he left control to Cpt. Joseph G. Swift, the first graduate of the "new academy".

Gallatin had to figure out how to finance much needed improvements while the Nation was yet young and poor. He wished to apply 10% of the proceeds from land sales and his annual Treasury report of 1806-07 began to stress the advantages of internal improvements to strengthen the bonds of union. Jefferson was no less supportive. He had supported the Potomac Canal, studied engineering in England and France, and urged George "to consider building a canal far to the Northwest, between the Beaver River and the Cuyahoga in Ohio and Pennsylvania (the modern and final link, still being studied by the Corps), which flowed North to Lake Erie. Thomas traversed the whole of the Languedoc Canal in France and sent notes to Washington describing this longest Canal in Europe (at the time).

By 1808, Gallatin was ready to issue his findings titled "Report of the Treasury on the Subject of Roads and Canals". The Louisiana Purchase was instrumented by Albert and had doubled the size of our nation under Jefferson. Gallatin was aware that the Treasury had a good plan, but needed military assistance to bring it to fruition. He fostered the Lewis and Clark Expedition to determine how much land had been purchased from the French, and how much revenue could be generated. For all of this, he had to turn to the military and West Point.

Cadet Sylvester Thayer arrived at the Point after 4 years at Dartmouth where he graduated first in his class, and in 1808 was commissioned a 2nd Lt. in the Corps of Engineers. He ruled the school with discipline and scientific study, and transferred it into the foremost Engineering School in the nation. Congress was slow to release funds and internal improvements were little. Prior to the War of 1812, it took 24 days to get a letter from Washington, DC to New Orleans, if it got there at

all. The Law of 1812 expanded West Point facilities with war looming on the horizon with England and the Cadet numbers were increased to 250 students—but a little too late.

ROBERT FULTON

(Concluded from Page Five)

- A counter weight, suspended from the opposite side of the drum wheel, and weighing more than the empty tub.

- Two balance chains, equal in length to the depth of the pit. These chains must be of equal weight; are suspended from the drum wheel; support the counter weight, and are fastened to the bottom of the tub. See plate 5.

- A wheel mounted horizontally over the lower canal at the bottom of the plane. A similar wheel is mounted over the top of the plane, inclined to the angle of the plane. These wheels are eight feet in diameter, and support the leading chain, permitting a continuous rotary action. These wheels have a depth of 10 inches, and are equipped with flanges. See plate 5. "...To keep the chain on the wheel round the rim, strong pins, or teeth, must be fixed, on which the links of the chain catch promiscuously, to prevent them slipping; the best mode of forming this will be by segments of iron cast with the flanges, and a row of holes in the center and end of each, and across the segment, at about one inch distance from each other. In fastening the segments to the wood, the screw-heads may be left pointed, and projecting about one inch, which will answer the purpose of catching the links". Only the upper wheel is equipped with a cast bevel gear.

- A lying (horizontal) shaft, permitting "multiplied movement" to drive the leading chain.

- A small wheel (gear) "receiving motion from the back of the inclined wheel, in order to draw the boat out of the upper canal(onto) the bridge of the plane".

- A stopper, near the top of the plane, to retain a boat "till the man is ready".

- A two-bladed centrifugal fan to act as a governor, driven by a "lying shaft", and geared to the inclined wheel.

- A building to cover and support the works, including control levels.

PRESIDENT'S MESSAGE

(Concluded from Page One)

Be sure to check Robert H. Smith's two-volume *Naval Institute Guide to Maritime Museums of North America with Selected Lighthouse, Canal and Canal Lock Museums* to make sure your favorite canal museums and societies are in there. These are great guidebooks to carry when you travel so you won't miss something important. The second volume, called the *Supplement*, has an additional 241 museums, making a total of 551, and lists 39 entries in the index under "locks and canals" - some of them are there through the help of ACS. The books are for sale in maritime museums and from "C" Books, P.O. Box 176, Del Mar, CA 92014-0176.

Did you know that when FDR was Governor of New York State in the 1920s he made "good-will" trips along the Barge Canal? He wrote "I would rather see [the state]...while being seated...on the deck of a boat going at a speed of six or seven miles an hour than I would from the most luxurious automobile ever made." All this and more is in an illustrated full-issue article by ACS member Bill Orzell in the latest *Bottoming Out*, the magazine of the Canal Society of New York State, 311 Montgomery St., Syracuse NY 13202. Bill Trout