

# AMERICAN CANALS

BULLETIN OF  
THE AMERICAN CANAL SOCIETY

BULLETIN NUMBER 58

Editorial Address — 809 Rathton Road, York, Pa. 17403

AUGUST 1986

## PRESIDENT'S MESSAGE

For a "retired" person, things have been busy since the last issue of AMERICAN CANALS. The month of June began with the annual meeting of the Virginia Canals and Navigations Society in Lynchburg. During that weekend we followed the first two days of the First Annual James River Bateau Festival, an 8-day, 140-mile "race" down the whitewater of the James to Richmond, shooting through sluices built by the James River Company two centuries ago. Ten counties and towns each built and entered a replica of a James River Bateau, 7 to 8 feet wide and 40 to 50 feet long, giving some 250 crew members (not all at the same time!) a memorable river experience and generating a lot of statewide newspaper publicity for rivers and canals. Now these communities are using their bateaux for more river trips and as impressive exhibits at events such as Lynchburg's bicentennial celebration, the state fair, and a field trip to the Upper Appomattox Canal. It's all great for our canal work.

The bateau festival was a downriver trip but Joe Ayers, organizer of the festival and current president of VC&NS, was eager to rediscover the techniques of poling back upstream. I was part of the 4-man crew which took his bateau, the MINNIE LEE, 50 miles upriver from Richmond to her home port of Columbia. It took us five days, at a speed a little more than one mile an hour! The MINNIE LEE was probably the first bateau to pole up this part of the river since 1824, when it was bypassed by the first major section of the James River & Kanawha Canal. We all emerged with a heart-felt appreciation of the skill and endurance of the old boatmen, and of the decided advantages of canal over river transport.

In the middle of June I met some of you at the Society for Industrial Archaeology meeting in Cleveland. The SIA meetings are always exciting for canal buffs, and this time Harry Valley was one of the organizers, so one of the field trips featured the Ohio and Erie Canal, introduced by Edith McNally, and a lunch atop at Akron's controversial Lock 2 Park. I'd say that Akron is fortunate to have a canal park (and not a parking lot) there in the middle of town, but whether the developers paid enough attention to

*(Continued on Page Three)*

## ROEBLING AQUEDUCT RESTORED



General view of the rebuilding of the old bridge floor.

*(We publish this detailed account of the complete rehabilitation of the important Roebling Aqueduct at Lackawaxen, the oldest surviving evidence of John Roebling's genius as a suspension bridge builder. This article was printed in the Spring 1986 Newsletter of the Society for Industrial Archaeology. The accompanying photos were made by ACS Vice President Bill McKelvey, Editor.)*

Last Oct. 8, a small group of construction workers gathered on the downstream side of the Pennsylvania abutment of John A. Roebling's Delaware Aqueduct. They uncorked a bottle of champagne and cheered as they witnessed completion of the total rewinding of the 137-year-old cables on the oldest surviving Roebling suspension structure.

His first suspension bridge, an aqueduct carrying the Pennsylvania Main Line Canal across the Allegheny River and into the heart of Pittsburgh, had been completed a few years earlier, in 1845. Despite fears about its strength, the seven-span structure was successful and led to a commission to build four others for the Delaware & Hudson Canal Co.

The D&H opened in 1828 and soon was busy floating boatloads of anthracite and other cargo from the Moosic Mts. to the

Hudson River. With the "improvement" of the canal in the late 1840s, the Delaware Aqueduct was one of four suspension structures erected by Roebling to increase the system's capacity and relieve bottlenecks. It was built to carry the canal over the Dealware River, doing away with haulage of the boats across the river by rope ferry. Roebling's design called for three piers instead of the five that would have been required for a conventional masonry and timber aqueduct, thereby allowing more clearance for ice floes and timber rafts.

The Delaware Aqueduct was completed in 1849 and operated for the next half century. Eventually the N.Y. & Erie Railroad cut into the canal profits and in 1898 the aqueduct was abandoned and sold to a timber dealer, who converted it to a roadway for his lumber wagons while collecting tolls from other users. For the next 82 years, through several owners, it remained a privately owned toll bridge, until the National Park Service acquired it in 1980.

In 1968, as part of the D&H Canal, the aqueduct was designated a National Historic Landmark and a year later it was recorded by HAER. In 1972 it was

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# American Canals

BULLETIN OF THE AMERICAN CANAL SOCIETY

"DEDICATED TO HISTORIC CANAL  
RESEARCH, PRESERVATION  
AND PARKS"

AMERICAN CANALS is issued quarterly by the American Canal Society, Incorporated. 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 minimum ACS dues payment of \$12.00. Individual copies may be purchased at \$3.00.

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Eric Zellin of Ann Arbor, Michigan, has just become our 52nd LIFE MEMBER in the American Canal Society! Anyone wishing to avoid any further ACS annual dues payments may contact Secretary Charlie Derr, with a check for \$150, and join this important group!

## NEW ACS SALESMAN



Keith W. Kroon, 2240 Ridgeway Avenue, Rochester, New York, 14626, has volunteered to become our new American Canal Society Sales Officer. Keith is an enthusiastic canal buff, lives in a house which backs up to the old Erie Canal channel, has traveled the English canals in a 40-foot narrow-boat, and has visited many of the historic canals in Pennsylvania, Ohio, Indiana, Illinois, Maryland and Virginia. He is a Life Member of the American Canal Society (since 1977), a member of the Canal Society of New York State and the Erie Canal Associates in Syracuse.

Keith spent his boyhood in Seward (near Lincoln) Nebraska and was graduated from the University of Nebraska with a B.S. degree in Chemical Engineering in 1964. He served in the U.S. Army Reserve from 1965 to 1971 and is presently (since 1984) in the Film Manufacturing Section of Eastman Kodak Company. He is Troop Committee Chairman of a local Boy Scout Troop, and active in the Rochester International Friendship Council, which hosts college students from countries outside the USA. He and his wife and two young sons have traveled in Europe and Kenya.

Keith will re-organize the ACS Sales Program, wherein we make back issues of American Canals, Canal Guides, reprints, indexes, Bests of American Canals, etc., available to all members. You will be hearing more from him shortly.

The Maritime Museum of the Great Lakes at Kingston (Ontario) this year celebrates its tenth anniversary. It has just issued a new and interesting magazine, 44 pages in length, called "Fresh Water". In it are articles describing many of the interesting vessels, past and present, which have been seen on the St. Lawrence in the Great Lakes over the past 100 years. Well illustrated. A \$20 individual membership entitles one to receive this fine publication quarterly. Address inquiries to Marine Museum of the Great Lakes at Kingston, 55 Ontario Street, Kingston, Ontario K7L 2Y2 Canada.

## From the Editor

This issue of AMERICAN CANALS is a bit later than usual, since I have been spending much time in the Syracuse area and on the phone, plus much letter-writing, to firm up details of our combined Spring Meeting and Field Trip with the Canadian Canal Society, May 15-17, 1987. I have had the full cooperation of the staff of the Erie Canal Museum in Syracuse, plus the services of ACS Life Member Keith Kroon of Rochester, who has volunteered to help. I have also been in close touch with Lou Cahill, our ACS Director in Canada, and Bill McLean, President of the Canadian Canal Society.

Things are shaping up well, nearly as we had planned them some time ago. Our headquarters will be the RAMADA INN in North Syracuse, where we will convene Friday evening for a wine and cheese party. Saturday we will spend several hours touring the renovated Erie Canal Museum, inspect their new canal boat, see a slide-tape show, and then be on our way for a bus-tour of the locks and levels on the little-known Oswego Canal, with lunch at the Canal Point Restaurant in Fulton. Saturday evening we will have a banquet at the RAMADA, with a talk by Don Wilson, Erie Canal Museum Curator, on the Erie Canal and entertainment by Dr. Bill Hullfish and his Canal String Ensemble.

Sunday we will spend in the Rome, New York area, where we will enjoy the facilities of the Erie Canal Village, ride their canal boat and narrow-gauge steam train, have lunch and spend the rest of the day at Fort Stanwix, or along the modern Erie Canal, hopefully passing through several of the locks by boat.

Bill Shank

## WATERWAYS LIBRARY

(From Jim Swift, Vice President of WATERWAYS JOURNAL, comes the following item:)

There is considerable printed material on canals in the new Herman T. Pott National Inland Waterways Library in St. Louis. Canals world-wide are represented in the collection, much of which is from the archives of "The Waterways Journal," weekly waterways newspaper published in St. Louis.

Some of the choice items are in a long run of the English magazine "Waterways World," which is devoted to canals of Great Britain.

The National Inland Waterways Library was established by the Journal in conjunction with the St. Louis Mercantile Library Association, an old privately-funded institution. The waterways library was later funded by the Herman T. Pott Foundation, established by the late well-known shipbuilder of St. Louis.

Located at 510 Locust Street in downtown St. Louis, the Waterways Library invites visitors. It is open Monday through Friday, 8:30 to 4:30. The phone number is 314, 621-0870.

# ROEBLING AQUEDUCT RESTORED

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designated a National Historic Civil Engineering Landmark by the ASCE.

Despite the growing recognition, the bridge had reached a serious state of disrepair. Vandalism was increasing. These financial and structural problems coincided with the river valley's designation as part of the National Wild and Scenic Rivers system. The NPS bought the structure from the last private owner, Albert Kraft, in 1980.

Although Kraft had closed it in 1979, the NPS made a commitment to reopen it for vehicular use. The agency spent \$26,000 to replace the railings and 50% of the deck timbers and to repair the lighting system. When reopened in Oct. 1980, only pedestrian traffic was allowed because of serious structural support problems.

After a safety inspection by the Federal Highway Admin., consultation with engineers specializing in wire cable and historic bridges, and a rehabilitation study done by A. G. Lichtenstein (SIA) & Assoc. the historic cables were found to be sufficiently strong to proceed with the original rehab commitment. NPS funds were allocated for two engineering studies, one focusing on the cables and masonry, and the other on the superstructure and approaches.

Lichtenstein received the first award and prepared the technical specs for restoration of cables and masonry, and reconstruction of the timber icebreakers. Construction work was begun by Coastal Structures, Inc., of Manasquan, N.J., with a crew of 35 carpenters, masons, and laborers. They cut away the old cable wrapping wire and then sandblasted the accumulated layers of rust, dried lead paste, paint, and linseed oil off the cable wires. It took two four-man crews nearly all summer to rewrap the two cables with new galvanized steel wire. The rewrap process was slow — ten feet a day — because it was done entirely by hand using a system copied from Roebling's original designs. Meanwhile, nearly



Re-wrapping the old bundled wires with new, galvanized steel wire, a laborious process.



Blasting the accumulated dirt, rust and paint off the old cable wires before re-wrapping them. The "trombone" coils near the operator are the old floor support devices which had to be removed, and replaced as the cable cleaning and re-wrapping progressed.

12,000 linear feet of masonry joints on the three piers and two abutments were repaired.

Lichtenstein's divers located over 130 dimension stones that, over the years, had been dislodged from the piers by floods and ice. Where possible, the stones were salvaged from the river bottom, cleaned, and used to repair the upstream pier faces. Carpenters fabricated large icebreakers that were brought downriver and installed, filled with riprap, and armored with steel nosing plate. The entire system was tested — prematurely — when hurricane Gloria raised the river level nearly 12 ft. over normal summer low water. Much to everyone's relief all was intact when the waters receded.

The work now completed, the cables are restored to their original semigloss "Spanish Brown," selected by paint-chip analysis and historical research. The NPS has contracted with architects and engineers to develop the specs for the design of a new road deck and approaches, with construction planned for this summer and reopening scheduled for the fall.

## OHIO CANAL DISPLAYS

The Piqua Historical Museum, along the old Miami and Erie Canal, is filled with numerous exhibits and displays to bring back the town's past as an important stop on the old canal. The Museum is housed in the old Schmidlapp Building, 507 Main Street in Piqua, Ohio (From "Cry of the Crane", bulletin of the Great Miami River Corridor Committee).

## PRESIDENT'S MESSAGE

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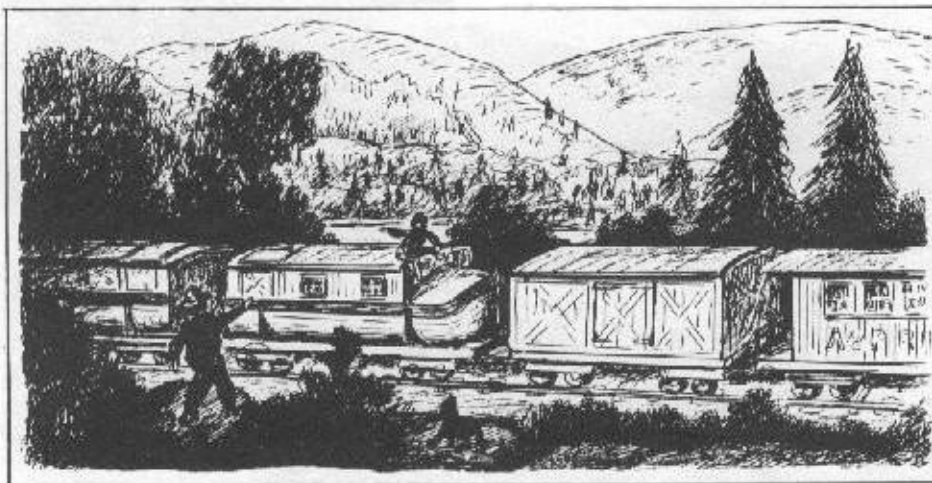
us canal buffs, I don't know. We've discussed this lock in bulletins 49 and 50, but if anyone has comments to make about lessons to be learned from this (or other) canal parks, let us hear from you.

Driving to and from Cleveland, I had a good time touring the old and new lock sites on the Monongahela and along 500 miles of the Ohio River for the next American Canal Guide. I was impressed both by the variety and number of old lockhouses left along these rivers, and by how fast they are disappearing. If an architectural historian wants to study them, he'd better move fast. Along the way I visited Terry Woods, our energetic Director and Canal Index Chairman; Captain Fred Way Jr., of steamboating fame and the spirit behind the Sons and Daughters of Pioneer Rivermen and their impressive publication, the S&D REFLECTOR; Dorothy Davis and Jack Sandy Anderson, historians of the Monongahela River's ill-fated West Fork Navigation; and Ernie Gabler and Sammy Deject of the Mon River Buffs, who showed me around the new quarters of the Mon River Museum, now in Monongahela City, Pennsylvania. One of the exhibits which I hope will be set up again is Ernie Gabler's huge working model of a lock, complete with radio-controlled towboats.

Last but not least, I am pleased to present our new Sales Officer, Keith W. Kroon, 2240 Ridgeway Avenue, Rochester, NY 14626. Write him when you need back issues, American Canal Guides, and other sales items. Welcome aboard, Keith!

Bill Trout

# EVOLUTION OF THE CANAL INCLINED PLANE



Pennsylvania Sectional Canal Boats being transported over Allegheny Mountain between planes of the Portage Railroad. (Hoffman drawing.)

By Charles Hadfield

In our study of canals in North America and abroad we frequently find that inclined planes are substituted for locks in lifting canal boats from one level to another. Our own Robert Fulton, while in England, invented several inclined plane devices for canal boats. Charles Hadfield of England, world-wide canal authority, has sent us this article for possible use in AMERICAN CANALS. It was originally published in RACHS JOURNAL, September 1979. With some editing (apologies to Charles) we publish it here, virtually complete. (Editor.)

An inclined plane is a sloping structure, using little or no water, by means of which a boat can be transferred from one canal level to another. It is therefore an alternative to a lock flight, and in fact goes back further into canal history than does the pound-lock itself. For whereas the first known pound-lock (in China) dates from 984, double inclines are known there from at least 348, themselves perhaps deriving from spillway construction. A dam was built across a waterway with inclined ramps, probably cobbled, on each side. Boats were then hauled up and over the summit by ox-powered capstans, to be lowered again into the water on the other side.

And, in the 1790s, little had changed in China except the motive power:

... a dam is made across the extremity of the upper canal, by means of a ... wall, the top of which is level with the surface of the upper water. A beam of wood is laid on the upper edge of the wall, which is rounded off towards the water. Beyond the wall a sloping plane, of stone work, extends to the lower canal ... with an inclination of about forty-five degrees, and descending near ten feet in perpendicular depth ...

Operation was by man-powered capstans on each side of the slope. A rope from these passed round the boat's stern

when hauling up. Going down, it was hauled over the cross-beam and then slid down under gravity.

Flanders in the early Middle Ages had its parallel to the Chinese planes. These *overdraghe*, known from the twelfth century, were wooden slipways set into river dams, and over which water ran constantly. Boats, lashed fore and aft to a cable, could be slid down them, or hauled up by a windlass, horse-gin, or water-wheel. A modern equivalent is, perhaps, the canoe flume that by-passes some Continental locks.

## In the Netherlands

Similar structures to the Chinese planes were then built on canals, and improved by being fitted with rollers. Probably the first European canal to have one — here called the *overtoom* — was that cut in the fifteenth century between Amsterdam and Haarlem. The very early Ypres-Yser canal had four, three being double-track and seemingly both counter-balanced and waterwheel-powered, the fourth being single-tracked and powered by two man-treadmills. The tracks were fitted with rollers. A similar plane existed at Watten on the Colme until it was destroyed at the siege of Saint-Omer in 1638.

Similar single-track planes were seen by John Smeaton in the Netherlands in 1755:

'I saw what they call a Windlass, for drawing Small Vessels over a Dyke, from one canal to another. The difference of Level of the 2 Canals was about 4 feet; the obliquity of the inclined plains being about 8 to one ... The Axis of the Windlass was placed about 10 feet ... above the highest part of the Dam, and the dam reached about 8 or 10 inches ... above the ... water in the higher canal, and equally sloped both ways; the Top of the dam was not an obtuse Angle ... but a little rounded; the plains were smooth planked and the vessels were drawn upon moveable rollers of about 5 Inches Diamr'.

Power was derived from two 10 ft. diameter spoked wheels, one on each side of the plane, applied to a roller round which the rope was wound and unwound.

Davis Ducart tried to build three such primitive single-tracked roller planes on the Tyrone Canal in Ireland in the 1770s, and failed, though the Amsterdam *overtoom* survived until the nineteenth century. Such planes can still be seen today, for instance to launch lifeboats or to transfer small pleasure craft round locks.

## Major Advance in Italy

But, in Italy, a major technological advance had been made. As far back as 1437, a plane enabled boats to get over the dam at Fusina between the Brenta river and the Venetian lagoons. Originally a slide, at some time before 1593 it was given a cradle upon which boats could be carried. A contemporary traveller wrote:

'Over it the boat is taken on a great sledge with rollers, made for the purpose, by means of a clever traction with horses, as far as the sea'.

The plane is illustrated in Vittorio Zonca's *Nuovo Teatro di Machine ed Edifici*, 1607, and shows the cradle carried on wheels running in channelled rails, and powered by a horse-gin. It also shows it as double-track (Zonca thought it should be) and not single-track, as it was.

On the Ypres-Yser canal, as we have seen, one major advance has been made, the double track. With this, boats could be counter-balanced, thereby reducing the necessary power. At Fusina boats were put on a cradle, so lessening friction, power required and strain on hulls.

The inclined plane remained at these several stages of development until the 1770s, while engineering inventiveness went into improving the pound-lock. But in that decade another step forward took place. In *William Jessop, Engineer*, Professor A. W. Skempton and I have suggested that it may have been Jessop who, perhaps basing himself upon Zonca's picture of Fusina, recommended how Ducart's Tyrone Canal planes should be rebuilt. By 1777, in any case, Ducart had:

'a cradle or frame with four wheels, brought under his boats; upon which, over a double railway, they alternately ascended ... he made use of a horse-gin to draw his boats upon the ridge terminating the upper level'.

Here two older ideas are first combined: counterbalance on double tracks, and cradles running on rails.

## First Canal Plane in England

From the Tyrone Canal we move to Shropshire, where in 1788 William Reynolds opened England's first canal plane, that at Ketley. Whereas on the Tyrone as reconstructed, boats passing each incline had had to be hauled out of the upper pound and over the ridge by

horse-gin, before being dropped down the main plane, at Ketley the summit was avoided by taking a boat into a lock where, as the water was drained, it settled upon its cradle to be lashed to it preparatory to the descent. Coming upwards, the filling of the lock lifted the boat off the cradle. Ketley is also the first plane where boats are known to have been carried down while remaining horizontal (the cradle having large wheels at one end and small at the other) and where a brake acting on the rope barrel is mentioned.

The idea of using twin locks at the top of a plane had some descendants: in England an underground plane at Worsley, which dated from 1797, had them; so did the first plane to be built in the United States, that by Benjamin Prescott at South Hadley Falls on the Connecticut river, opened in 1795. Thirdly, they were found for a time on the Morris Canal (see later).

However, the three inclines built near Ketley on the Shropshire Canal between 1788 and 1791 had summits. Each cradle had rear wheels larger than the front ones so as to keep the boat nearly level while travelling up the main slope. When it passed over the summit and began to fall to the canal's upper pound, however, a pair of larger wheels set outside and on the same axle as the leading small wheels picked up a special set of rails at a higher level. So the cradle was kept nearly level.

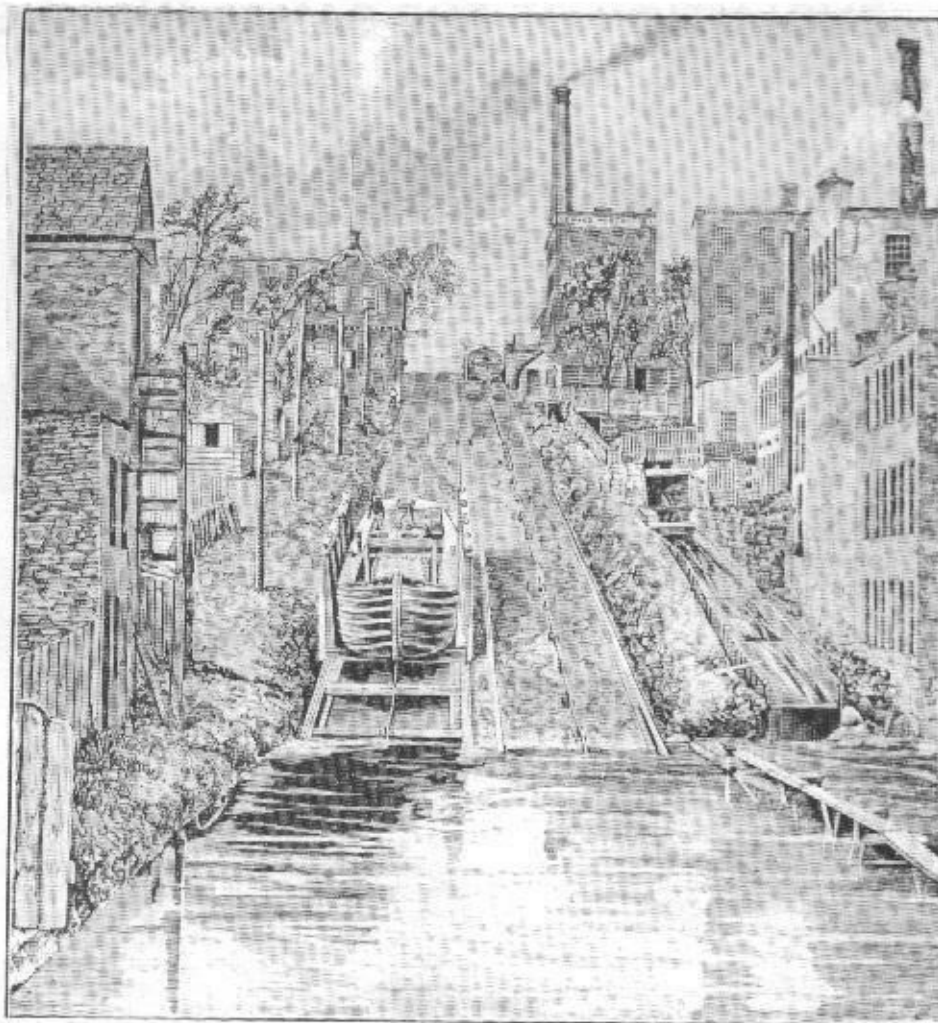
On these inclines, too, for the first time stationary steam engines replaced men, horses or water to provide whatever power was needed additional to that given by counterbalance.

We now have the standard upon which most English inclines of the Industrial Revolution period were built: counter-balanced, braked, cradles running on rails and kept roughly level as they passed the summits, powered by steam engines or waterwheels.

#### In Europe

On the Continent this type, counter-balanced and powered by waterwheels, first appeared on four planes built in East Prussia on the Oberland Canal between 1844 and 1860, with a fifth added about 1880. These planes, the only European survivors of their type, still carry trip boats, though the canal is now called the Elblag and is in Poland.

The Oberland planes were followed by one at Beauval near Meaux in France, opened in the early 1880s, which joined the Marne to the Canal de l'Ourcq. The single 78½ ft. long cradle, able to take barges of up to 75 tons, ran on two 4-wheeled bogies that could adjust to differences of slope. Instead of the turbine-powered cable directly hauling the cradle, it was used at first to drive a sprocket wheel engaging with a chain laid on the gentle 1 in 25 slope. This not answering well, in 1888 the drive was altered to a cogwheel working on a rack laid beneath the cradle. Beauval incline worked until 1922.



One of the Morris Canal Inclined Planes. (Newark, N.J.)

#### Inclined Planes in America

Across the Atlantic cradle planes were the rule. First came that remarkable transport line, the Morris Canal in New Jersey, 102 miles long, with a summit level of 914 ft. opened in 1831. It had 23 planes, all single track as built, up which 25-ton boats were hauled on cradles by the power of water turbines. No effort was made to keep the barges level on slopes that varied from 1 in 10 to 1 in 12. Originally, some of the inclines were built with a lock at the upper end, others with a summit.

Because longer boats needed to use the canal, in 1835 — 6 all summit planes were converted to the lock type. Then in 1845 it was decided to enlarge the whole canal for bigger barges. The locks were now done away with, and bigger timber-framed 16-wheel cradles introduced that were hinged in the middle to pass easily over the summits. So were the longer section boats now introduced to the canal. These were really two separate boats, hinged at the junction, and jointly carrying up to 100 tons. Some planes were also now double-tracked to increase capacity. Each cradle had its own brakeman in case of failure of the winding rope. An interesting gadget was the geared indicator in the turbine house to show the operator the position of the cradle in foggy weather.

In this form the canal was for many years a successful coal-carrier. Thereafter it declined against railway competition, the last boat moving over a plane in 1924.

In 1834 the Pennsylvania Main Line opened, part-railway, part-canal, between Philadelphia and Pittsburgh, perhaps the most astonishing technical achievement of the American canal age. To cross Allegheny Mountain and link two ends of canal at Hollidaysburg on the east and Johnstown on the west, the 37-mile Portage Railroad was built, with ten steam-powered counterbalanced inclines and a summit of 2,291 ft. At first, all goods and passengers were transhipped to railway trucks and carriages at each end, but soon after opening a boat was carried, following which sectional boats were developed, craft that could be divided into three or four sections for carriage over the railroad. Therefore these planes, too, can be considered as cradle inclines, though ordinary trucks continued to be worked as well. Here, incidentally, we have the highest level to which canal boats have ever been carried.

The Morris Canal planes, as reconstructed, were patterns for the two little-known planes of the Shubenacadie Canal in Nova Scotia, Canada, one built in 1855,

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# EVOLUTION OF THE CANAL INCLINED PLANE (Cont.)

(Continued from Page Five)

the other in 1961, and also for the two on the Biwako Canal running from lake Biwa to Kyoto in Japan. On the latter canal, the planes were double track with 8-wheeled cradles, powered, perhaps for the first time, by electricity generated by canal water. The first was built between 1885 and 1890, the second about 1894. Remains can, I am told, still be seen.

## On the Trent-Severn

In the twentieth century the last of the New World's cradle planes was built, the single-track marine railways put in to carry pleasure craft on the Trent-Severn Waterway in Canada at Swift Rapids and Big Chute when lock construction stopped during World War I. The former was replaced by a lock in 1965, but the latter, electrically powered, has just been given a much bigger cradle running, unlike the old ones, on rails set at different elevations, and able to take craft 100 ft x 24 ft x 6 ft. In Siberia, however, a comparatively new incline carries small boats and timber rafts over the dam of the Boguchany hydroelectric plant on the Angara river. The cradle, on the same principle as the Morris's later ones, is built in three hinged sections each 22m. long, to pass easily from the lower slope on to the flat top of the dam and off again. It is, however, electrically self-propelled and does not use a cradle.

## Robert Fulton's Inventions

Let us now return to the canal age in Britain, when two alternatives to the cradle were tried: one, the wheeled boat, died out; the second, the wheeled caisson or tank in which a boat was carried floating, has become embodied in modern standard practice.

The wheeled boat was one of Robert Fulton's many bright ideas. It was adopted on the Bude and Torrington Canals but, to my knowledge, nowhere else. Standard-sized tub-boats used on these canals were fitted with four wheels each, and so ran directly on to the six planes without needing cradles. But they could not, of course, be kept level. Another of Fulton's ideas, to provide power by filling with water two large buckets which then alternately sank down and rose up a well, so drawing boats up the plane, was only installed on the Bude's Hobbacott Down plane, though it was also tried, and failed, at Wellisford on the Grand Western Canal.

To carry a boat floating in a caisson rather than dry on a cradle has several advantages: that, provided the water level remains constant, so does the combined weight of caisson, water, cargo and boat; that the weight of the carriage is evenly distributed; and that any size or shape of boat that can enter the caisson can be carried level at all times, and need not be lashed for fear that it will slip. Disadvantages are greater weight and, with big caissons, troubles with water surging in the tanks.

Perhaps derivative from the years 1797 to 1801, when Fulton was in France; the French engineer Francois-Gabriel de Solages in 1808 suggested an inclined plane instead of eight locks near Etreux on the Canal de l'Oise a la Sambre, then being built. Instead of a cradle, he proposed to use a 10-wheeled wooden caisson with, as counterbalances, two stone and water-filled 6-wheeled trucks. Here we have the first worked-out plan for using a caisson, and also for using counterbalance weights other than a second caisson or cradle. However, it was not built.

## First Caisson Planes

The first caisson planes seem to have been those built at Thornfalcon, Wrantage and Ilminster on the Chard Canal in Somerset, the first tow opening in 1841, the third in 1842. These were double-tracked, counterbalanced, and used water for power. The idea perhaps derived from the vertical lifts of the nearby Grand Western Canal, where boats entered tanks to be transferred; they in turn derived from the earlier experimental lifts of the turn of the century. But why caissons were chosen I do not know; especially as the fourth and last incline on the canal, at Chard Common, was quite different; single-tracked, using a cradle, and powered by a water turbine, it may have been influenced by the Morris Canal planes. In one respect the Chard Common plane can be awarded a tentative first: it was using wire rope in 1842, a year before it was introduced to the Portage Railroad in Pennsylvania.

When the caisson replaced the cradle, the old summit or hump of the plane disappeared. Instead, the top pounds of the canal were shut off by moveable gates. The caissons also had moveable gates.

After the gate on the caisson had come together with that on the canal, the two were lifted or slid aside, and the boat

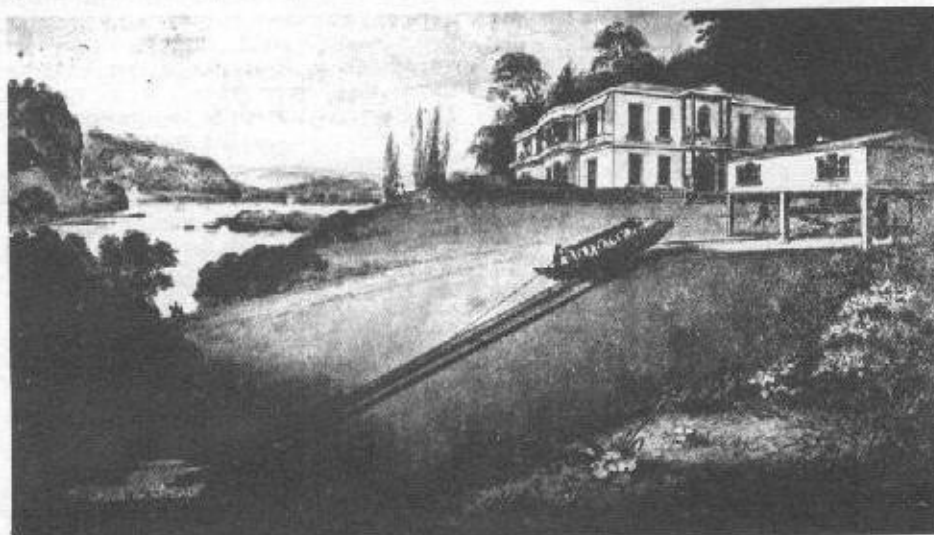
moved in or out. The use of this technique on the Chard Canal would also have been taken from the Grand Western lifts.

There followed the first of the big modern caisson planes, that at Blackhill on the Monkland Canal in Scotland, opened in 1850. It was in one respect an oddity, for the existing flight of locks was kept open to work loaded barges, the plane being intended to carry those returning empty, and therefore having abnormally shallow caissons, 70 ft x 13 ft 4 in x only 2 ft 9 in, which kept down the weight on the rails. The double-tracked incline, though counterbalanced, also had two 25 hp steam engines, for use when the descending caisson began to enter the lower pound and so lost effective weight. The 20-wheeled caissons ran down a 1 in 10 slope. Hydraulic gates closed the upper ends of caisson and canal. In case of accident to the wire ropes, each caisson had beneath it a pawl intended to engage in a rack and so prevent a runaway. Blackhill worked until 1887.

## Georgetown Plane — C. & O. Canal

Next came the Georgetown incline built to enable barges off the Chesapeake & Ohio Canal to reach Potomac river wharves. The Morris and Blackhill planes had become widely known, and in 1874 the company's engineer, W. H. Hutton, began to design an incline able to take 250-ton boats — much bigger than the then biggest, the reconstructed Morris planes. He designed a single-tracked incline using a caisson 112 ft x 16 ft 9 in x 7 ft 10 in, carried on three bogies each having 12 wheels running on four rails down a slope of 1 in 12.

Four 16-wheeled waggons loaded with stone were provided as counterweights; they ran in pairs on rails laid on each side of the incline, but set at a slope of 1 in 10. Wire ropes ran from the caisson to two pairs of winding pulleys, one on each side; each rope made 2½ turns round its



A drawing by Robert Fulton showing one of his ideas, developed in England, for lifting small canal boats from one level to another. In 1794 he obtained British Patent #1988 for an inclined plane system similar to that now in use on various French canals. (New York Historical Society, Randall J. LeBoeuf, Jr. collection.)

pulley, was then taken down to a sheave on the counterweight and back to an anchor on the masonry headwall of the incline. The travel of each counterweight was thus half that of the caisson. Power came from a water turbine, and both pawl and ratchet and automatic friction brakes were provided.

The Georgetown incline opened in 1876. Unfortunately, not only had the need for it lessened with a fall in canal traffic, but Hutton had seriously underestimated the effect of the caisson's weight (some 400 tons) on his roadbed. He had therefore to make major changes, one of which was to carry loaded boats downwards in a dry caisson, and empty craft upwards in 20 in. of water. The plane ceased to be used in 1879.

Foxton incline on the then Grand Junction Canal in England, opened in 1900, was smaller than either Blackhill or Georgetown. Double-tracked, with steam-engine assistance to counterbalanced tanks and without counterweights, and with a slope of 1 in 4, it was in one respect innovative, for the caissons travelled transversely instead of lengthwise, because of the steep ascent. Each moved on eight sets of wheels running on four pairs of rails. Too expensive to maintain for the traffic offering, it was taken out of use in 1910 and dismantled in 1926.



Benjamin Prescott's Inclined Canal Plane, as shown on the South Hadley company seal. This was the first such device in the United States.

One side effect of its failure was to discourage the many schemes then being discussed for building a big ship railway across the isthmus of Tehuantepec in Mexico, feeling being that if 400 tons caused such roadbed problems, ships of 10,000 or 20,000 tons would create others that might well be insoluble.

#### Ronquieres Incline - Belgium

More than fifty years later, we have the gigantic leap in scale of the Ronquieres incline in Belgium, opened in 1968. Descendant of Blackhill and Georgetown in using longitudinal caissons, and of de Solages' plan of 1808 and of Georgetown in its counterweights, Ronquieres introduces an innovation. Though double-tracked, each caisson is independently operated, its counterweight being assisted

by electrical power generated on site. Otherwise its remarkability is in its size. Almost a mile long, with a 1 in 20 slope, its caissons each weigh 5,700 tonnes and have 236 wheels running on four rails. They can take a 1,350 ton barge. The counterweights weigh 5,200 tonnes, and travel in troughs beneath the caissons. In a faint shadowing of troubles at Georgetown, after eight years the original chair-mounted rails began to develop waviness, and had to be replaced by those born on longitudinal concrete supports.

The smaller (350-ton) Arzwiller Saint Louis plane on the Canal de la Marne au Rhin in France was opened in 1969. It is single-tracked (though providing for a second track) and because of the very steep slope of 41%, the 32-wheeled caisson runs transversely, as at Foxton. Two 450-ton counterweights running in a trough balance most of the weight.

#### The Montech "Water Slope"

Last in development are two inclines each very much out of the ordinary, the Montech water slope and the Krasnoyarsk double incline.

In the south of France, near Montauban, opened in 1974, we have a water slope, a modernized version of the old slipway. A concrete flume with a gradient of some 3% runs from the lower to the upper pound, the latter being held back by a falling gate. Two locomotives, running one on each side of the flume, hold between them a curved steel shield almost of the flume's dimensions, which can be raised or lowered. A barge having entered the bottom of the flume, the shield is lowered behind it and the stern of the barge fastened to a horizontal fender. The locomotives then push the shield, the barge and the wedge of water on which it floats up the flume until, the water pressure having equalized, the top gate falls and enables the barge to move out.

#### Siberian Double Incline

Finally, Krasnoyarsk on the Yenisey river in Siberia. Here the problem was to get large barges over the dam of a hydro-electric plant, where the difference in water levels was 331 ft. Therefore one plane was required from the lower level to the top of the dam and, owing to ground configuration, another at a different angle down to the water of the dam, which might itself vary in height by up to 43 ft. The answer was to provide a caisson that, having risen on the 1 in 10 slope from the lower level to the dam's top, there runs on to a 348 ft. diameter turntable. This turns it through 142° before it descends to the dam level.

The caisson, with an inner width of 39-1/3 ft. and depth of 29 1/2 ft. runs on 156 wheels, electricity powering the hydraulic drive to rack rails for propulsion and braking. The incline therefore has no cables.

We have come a long way in technological development from Chinese boat slipways to Montech and Krasnoyarsk. But the end is not yet, for water transport, oldest of all modes, is prolific of new ideas.

## ROBERT FULTON — CANAL BUFF



Robert Fulton (self portrait).

Well-known as the inventor of one of the first successful steam boats in America, most historians are unaware of Robert Fulton's contribution to the early development of canals.

Born in Lancaster County, Pennsylvania, in 1765, Fulton started his career as an artist in Philadelphia, where he met Benjamin Franklin. Taken by the young artist's talents and genial personality, Franklin sent Fulton to London in 1786 with a personal letter of recommendation to another American artist, who had established an excellent reputation there, Benjamin West. West took Fulton into his own household and introduced him into the art circles of England, where the young man soon became a popular painter, making portraits and copies of the art treasures of the British nobility.

Early in his career in England, he had the good fortune to meet the Duke of Bridgewater and the Earl of Stanhope. He became engrossed in canal-building with the former, and steam navigation with the latter. He made a number of inventions for use on the canals of Europe, and in 1796 published a "Treatise on Canal Navigation", sending copies to both George Washington, then President of the United States, and Governor Mifflin of Pennsylvania, urging their consideration of the great advantages which would accrue from the use of canals in America.

Brian Lamb, ASC Member of Manchester, England, has done some recent research on Robert Fulton's canal activities while in England and has sent us the following information:

Robert Fulton entered into a contract with Charles McNiven to cut a length of the Peak Forest Canal. McNiven owned

(Continued on Page Nine)

## NIGHT LIFE ON A CANAL PACKET BOAT



Canal packet sleeping berths were hung from the cabin ceiling in tiers.

*We are indebted to ACS member Monro Will of Rochester, New York for these gems of night travel on the historic canals of New York and Pennsylvania, as preserved by the Rochester Historical Society. The illustrations are by the late Phillip Hoffmann.*

When he was eighty-seven years of age, the late William H. Wallace, formerly a resident of Rochester, wrote his recollections of his first trip in the Erie Canal in 1846, when he was a small boy, as follows:

"My father left us at Albany after we had come up in the night boat from New York. In the way of traveling everything interested me; used to ships and steamboats, the canal boat was exciting.

"I preferred the deck, when I was allowed to sit there, watching the passing of the beautiful farm mansions and the pleasing cobblestone barns; or the gliding up to the landing place of some small village where passengers got on, or off, the boat, and where people stood offering strawberries and cherries, or cake.

"Almost every one was sent up on deck when the dinner table was being set. We were called to dinner, I suppose, about one o'clock. The table was set down the whole length of the cabin or 'saloon,' between the table and berths there was



A packet boat traveling at night. Light for the towing team was provided by "Night Hawkers" — large kerosene lamps, with reflective mirrors on each side.

no room for waiters. It was just like a family dinner. The boat captain sat at the head and did the carving and distribution of the meats; the vegetables were arranged so that the diners could help themselves.

"After dinner, I went again on deck and was much surprised at seeing some passengers leave the boat and walk along the towpath, being taken into the boat again, about an hour later.

"Another excitement to me, were the locks. When we entered the first one, I asked what it was; a gentleman standing by told me it was the end of the canal. I soon learned about them however, and was delighted with the roaring of the water, and the boats sinking down between the stone walls, or coming up to the surface again. I was not worried by the cry 'low bridge,' and watched the people duck and double up; most of the bridges were far above my head.

"Supper or tea was something like dinner. About nine o'clock the men were either divided off by a curtain, or sent up on deck, while the women and children went to bed. I recall being highly indignant because I was put to bed in a top berth with a little girl of about my own age. However I did not go to sleep for a long time, for a company of negro minstrels stationed themselves on deck, it seemed right over my head, and danced and sang for an hour. I think these musical entertainments were not allowed to last long. I cannot recall what time it was when we arrived at Rochester the next day, but we were only one night on the packet.

"The most pleasant memory of the canal, is of our return voyage to Albany. The trip was made in a freight boat which was owned by its captain, a friend and patient of my uncle, Dr. Parson G. Shipman, who arranged the passage for us. We were the only passengers, and had the whole boat to ourselves. There was a sort of cabin in which were two state-rooms. There was also a small saloon

where we ate. The fittings of the boat were plain and simple. There were no damask curtains or gilded cornices, but both my mother and aunt spoke of the boat and cooking as being extremely clean and nice. The captain's wife was aboard and did the cooking, making the beds, etc. This boat was their home, at least in the summer and freighting season. Perhaps they went down the Hudson in it to New York. We all greatly enjoyed the return trip, as we had freedom and comfort on the boat quite different from the crowded packet. It was, however, much slower and our table was not so varied; also, there were no negro minstrels. Our voyage ended at Albany, where we had just time to catch the night boat to New York."

Richard C. Ellsworth in his account of a trip "From Canton to Rochester," quotes Alvin Harlow in his "Old Towpaths," for a detailed description of canal travel. "The packet boats resembled a small Noah's Ark, a house-boat whose only deck was the roof. They were all of similar design. In the bow, cut off from the rest of the boat, was a tiny cuddy for the crew. Next back of this came the ladies' dressing room and cabin, sometimes separate, sometimes cut off from the main cabin only by a red curtain.



Drawing lots for sleeping berths on a canal packet boat.

Next was the main cabin, thirty-six to forty-five feet long, which was saloon and dining room by day, and men's dormitory by night. Back of this was the bar, and finally, at the very stern, was the kitchen, almost always presided over by a negro cook, who was usually the bartender also. The other members of the crew were the captain, two drivers and two steersmen, one each for the night and day tricks. At nine o'clock in the evening two or three members of the crew began carrying adjustable berths, sheets, pillows, curtains and so forth, into the main cabin and the passengers must go out on the deck, or huddle in the center of the room, while the berths were being made up. Each berth was a narrow wooden or metal frame with a strip of canvas fastened over it. It was held in position at one side, by two projecting iron rods which fitted into two holes in the wall of the cabin, and on the other, or front side, by two ropes attached to the edge of the frame and suspended from hooks in the ceiling. There were at least three beds in a tier, one above another, sometimes four; and





The passengers often provided their own entertainment, particularly if there was a piano on board.

all were fastened to the same rope. The mattress was a thin, flat, lumpy pad of straw, wrapped in blue canvas, and this was used on the best packets. The tiers were set as closely together as possible all around the cabin which thus furnished alleged beds for from thirty-six to forty-two people. But the boats were frequently overcrowded, seventy-five or even one hundred or more people being jammed into a single cabin."

Charles Dickens visited America, in 1842, and in his *American Notes*, published later, he made many caustic comments on the manners and customs in America. Describing his first trip on a Pennsylvania canal packet boat, he said:

"I have mentioned my having been in some uncertainty and doubt, at first, relative to the sleeping arrangements on board this boat. I remained in the same vague state of mind until ten o'clock or thereabouts, when going below, I found suspended on either side of the cabin, three long tiers of hanging bookshelves, designed apparently for volumes of the small octavo size. Looking with greater attention at these contrivances (wondering to find such literary preparations in such a place), I descried on each shelf a sort of microscopic sheet and blanket; then I began dimly to comprehend that the passengers were the library, and that they

were to be arranged edge-wise, on these shelves until morning.

"I was assisted to this conclusion by seeing some of them gather around the master of the boat, at one of the tables, drawing lots with all the anxieties and passions of gamblers depicted on their countenances; while others with small pieces of cardboard in their hands were groping among the shelves in search of numbers corresponding with those they had drawn. As soon as any gentleman found his number, he took possession of it by immediately undressing himself and crawling into bed. The rapidity with which an agitated gambler subsided into a snoring slumberer, was one of the most singular effects I have ever witnessed."

## CANAL CALENDAR

**October 17-18, 1986** — Fall Tour of the Canal Society of Ohio, Holiday Inn, Perrysburg, Ohio. Bus tour of the Miami and Erie Canal from Maumee to Grand Rapids. Contact: Elsie F. Perch, 434 Forest Drive, Rossford, OH 43460.

**October 18-19, 1986** — Fall Tour of the Canal Society of Indiana, out of Delphi, Indiana. For details contact: Thomas Meek 7029 Adams Central Road, Fort Wayne, IN 46816.

**October 24-25, 1986** — Fall Foliage Boat Ride of the Pennsylvania Canal Society on the "Gateway Clipper", Morgantown, to Fairmont, WV, on the Monongahela. Contact: David Wright, 221 Fawcett Church Road, Bridgeville, PA 15017.

**November 21, 1986** — Meeting of the Canal Society of New Jersey, Allied Signal Auditorium, Morristown, NJ. Film by George Meyer on his travels along the Gota Canal in Sweden.

## ROBERT FULTON

(Continued from Page Seven)

some plots of land near the canal basin of the Duke of Bridgewater in Manchester, and was also a Civil Engineer. The contract work consisted primarily of "woods-cutting," just south of the Butterhouse Green Tunnel at Woodley, Cheshire. The partnership foundered and Fulton was left holding the responsibility for completing the work. The Canal Company extended the contract time, but later finished the required work with their own labor force.

However, Robert Fulton was evidently retained by the Canal Company and gave them considerable advice regarding the Marple Flight of Locks (which rose 209 feet, via 16 locks, in a mile and a quarter). At this time Fulton wrote his "Treatise" on canals, and also a paper on tub-boats and inclined planes at the request of the company canal committee. He was awarded one hundred guineas for his ideas and suggestions on the building of the Marple Aqueduct.

About 1799 Fulton offered the British Admiralty plans for a submarine. They thought the idea unsporting, so Fulton took his plans to the French, who were interested but never activated the plans. Out of favor in England, as a result of his overtures to the French, Fulton shortly afterward returned to the United States where he developed the "Clermont" — a steam-driven vessel which made its first voyage up the Hudson in 1807. As they say: "The rest is History!"

While in England, Fulton resided, for the most part, at Worsley Old Hall, near the Duke's underground canals and the Barton Aqueduct. During World War II, Worsley Old Hall and its grounds became "home" for an American Tank Unit.

## BOAT TRIPS

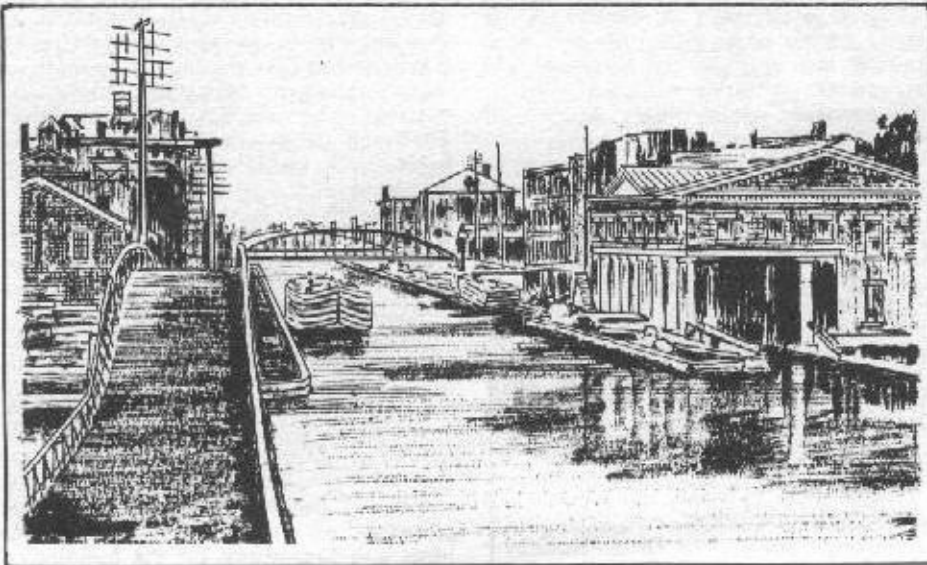
Walter Meseck tells us about a new boat service offering trips on the upper Hudson, Champlain Canal and Lake Champlain. — Champlain Gateway Cruises out of Whitehall, New York. This past summer they were offering tours between Whitehall and Albany, Albany and West Point, and a special three-day tour to the Statue of Liberty celebration. For full information, and brochure, write: Champlain Gateway Cruises, P.O. Box 201, Whitehall, New York 12887, or phone (518) 499-1600.

The organization originally known as the Lock 60 Committee of the Schuylkill Greenway Association has changed its name to the SCHUYLKILL CANAL ASSOCIATION. It is concerned with the operation and maintenance of the restored section of the Schuylkill Navigation, known as the Oakes Canal, located in Mont Clare, Pa. It is a non-profit organization with an annual membership fee of \$5.00. Address: Schuylkill Canal Association, 1301 Black Rock Road, Box G, Oaks, Pa. 17456.



Dinner on board a canal packet boat.

# THE OSWEGO CANAL



This old etching shows the Oswego Canal joining the old Erie Canal in downtown Syracuse. On the left is the raised towpath crossing over the Oswego entrance. The Erie Canal (now Erie Boulevard) disappears in the distance under the "Lock and Mulberry Street Bridge." The old Weighlock Building (now a museum) is at the right.

by Debbie J. Stack

The Erie Canal might have extended from Albany to Oswego rather than Albany to Buffalo, had politicians from Oswego had enough voting power to control the waterway's route. Although western New York's growing communities eventually won the battle to extend the Erie west from Syracuse to Buffalo, the Oswego interests refused to give up, petitioning the state legislature throughout the construction of the Erie to connect Oswego with the soon-to-be famous canal.

Their persistence was rewarded. In 1819 the Canal Commissioners recommended that a one mile side-cut be constructed from the Erie Canal in Syracuse north to the salt-making operations at Salina. This move in Oswego's direction was followed by authorization, in 1822, to extend the side-cut to Onondaga Lake and eventually to dig a water connection between Onondaga Lake and the Seneca River.

Things looked very promising when, in 1823, the Oswego Canal Company was chartered to build a canal to Oswego. Progress was slow, however, and in 1825 New York State appropriated \$160,000 for the Oswego Canal and took over the company's work.

On July 4, 1826, the 50th anniversary of the signing of the Declaration of Independence, a ground-breaking ceremony was held in Fulton, New York to celebrate the initiation of construction of the final section of the Oswego Canal, the 12 miles from Oswego Falls to the Oswego Harbor. The 18 pound cannon used to mark the occasion exploded prematurely, but caused no injuries.

A fever epidemic among diggers delayed the work, but the Oswego Canal was completed in December, 1828, and on

April 28, 1829 opened to navigation throughout its 38 mile expanse. The 4 foot deep and 40 foot wide Oswego Canal was constructed at a cost of \$565,437.35, more than twice the original estimated cost of \$227,568.33.

According to Noble Whiteford in his *History of the Canal System in the State of New York*, 19.7 miles of the Oswego Canal were independent canals connected with the Oswego River by locks and dams, with the remaining 18.56 miles consisting of slack water river navigation accommodated with a towpath along its bank. A total of 22 bridges, 14 locks, 1 aqueduct, 8 dams, 7 culverts, and 2 waste weirs were constructed on the canal, providing for a total descent to Lake Ontario of 155 feet, from Syracuse.

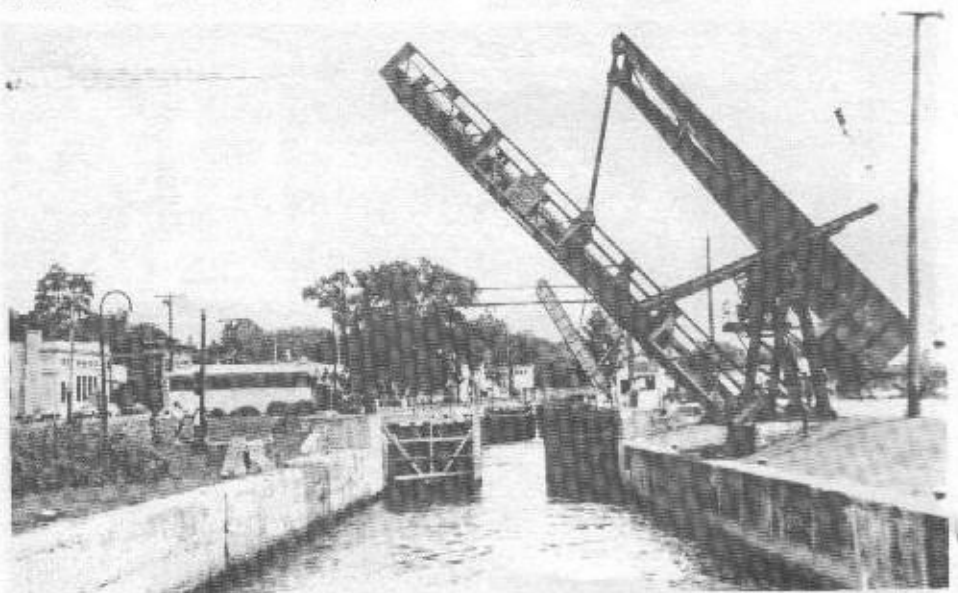
Competition between Oswego and Buffalo rose anew. With the completion of the Oswego Canal boats could, at Syracuse, either take the Oswego Canal to the port of Oswego and transfer cargo to lake boats for travel on Lake Ontario and the Welland Canal to Buffalo Harbor, or continue on the Erie Canal to Buffalo. The Erie route was more costly. The Oswego Canal offered savings in both tolls and time. There were no tolls levied for travel on Lake Ontario and the time delays encountered at the Erie's 22 locks between Syracuse and Buffalo were significantly cut on the Oswego Canal. Boats taking the Oswego route saved approximately two days over the Erie route.

By 1850 the Oswego Canal was more profitable per mile than the Erie and in 1862 it was enlarged to 7 foot deep and 70 foot wide. The traffic jam of boats waiting to be weighed at the Syracuse Weighlock, located at the junction of the Erie and Oswego canals, was so great that it was decided that two Erie-bound boats should be weighed for every one Oswego-bound vessel. This did not significantly reduce the jam, however, so in 1866 an Oswego Weighlock was built.

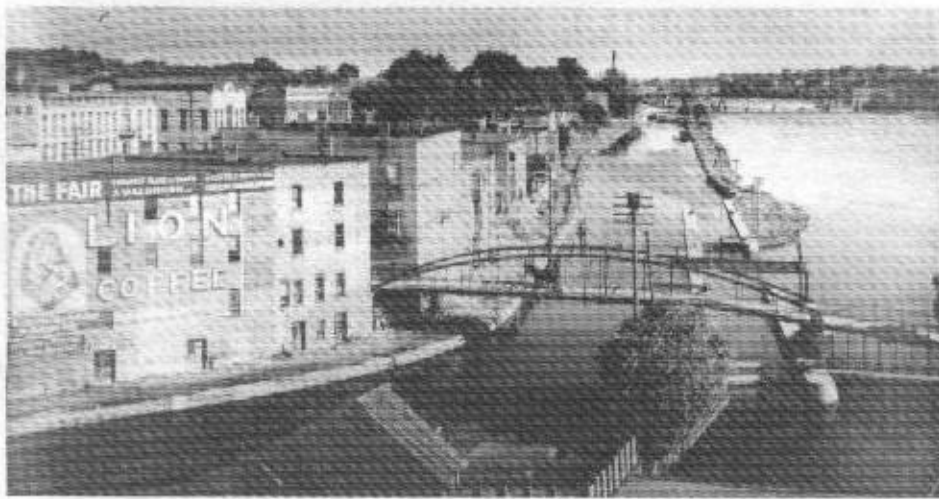
Boats travelling west from Oswego were laden with salt, manufactured goods, lime, gypsum, iron, timber, and coal. Those travelling east from Oswego carried cargos of agricultural products, including grain, flour, cheese, butter, lard, wool, and pork.

The Oswego Canal, like the Erie, was adversely affected by railroad competition. In addition, after the 1883 abolishment of canal tolls, the Oswego Canal's financial competitive edge over the Erie Canal was also reduced, thus cutting traffic even further on the Oswego Canal.

With the opening of the state's Barge Canal System in 1918, the route of the



An array of draw-bridges greets the voyager at Lock Number One on the Oswego Canal at Phoenix. This will be the first stop on our tour of the Oswego in May of 1987. (Photo by Bill Shank)



An old photo of the Oswego Canal at Fulton, New York, showing Locks Number Two and Three. (Courtesy Erie Canal Museum, Syracuse, New York.)

Erie Canal moved northward, utilizing Oneida Lake and other natural waterways. The Oswego portion of the Barge Canal System began at Three Rivers Point, the junction of the Oneida, Seneca, and Oswego Rivers (rather than at Erie Boulevard and Oswego Street in downtown Syracuse.) It travelled north (approximately 25 miles) following the Oswego River, and terminated at Oswego Harbor. There are presently seven locks, overcoming a total drop of 118.5 feet. The Oswego Canal became second only to the Erie Canal in terms of usage.

*Debbie Stack is Public Relations Coordinator for the Erie Canal Museum in Syracuse.*

## TENN-TOM SPECIAL AWARD

*(as published in Waterways Journal, May 5, 1986)*

The Tennessee-Tombigbee Waterway has been named winner of the 1986 American Society of Civil Engineers' (ASCE) Special Achievement Award. It competed with 13 other projects across the nation, the ASCE reports.

The project utilized comprehensive program management and was cited for its creative solutions to engineering and environmental problems never before encountered on such a massive scale in a public project.

The largest civil works project ever undertaken by the U.S. Engineers, the waterway is five times longer than the Panama Canal, was constructed with enough concrete (2.2 million cubic yards) to build a 120-story building covering a football field, and enough steel (33,000 tons) to make a one-half inch diameter rod that would reach across the United States eight times.

The 234-mile-long project connects the 16,000 miles of inland waterway in the eastern United States with the Gulf of Mexico. The Mobile and Nashville Engineer districts were involved in the project. The idea for the waterway goes back as far as the 1700s when Sieur de Bienville, founder of Mobile, suggested it.

## TENN-TOM ASSESSMENT

Walter Meseck, one of several of our ACS members present at the opening of the TENNESSEE-TOMBIGBEE WATERWAY in 1985, has been keeping us supplied with a steady flow of clippings about the Tenn-Tom from such varied sources as the New York Times, the Wall Street Journal, the Canandaigua (N.Y.) Daily Messenger, the Waterways Journal (St. Louis) and the National Geographic Magazine. The reaction of these various publications, now that the Tenn Tom has been in operation for more than a year and a half, runs from "Poor" to "Fair" to "Wait and See".

Admittedly, the Tenn Tom has not handled the 27 million tons of cargo predicted by the Corps of Engineers study in 1976. Figures for the first 12 months of operation are closer to 1.7 million. Supporters of the Tenn Tom argue that the new Waterway caught everyone by surprise by opening about six months early, and also that the anticipated large shipments of coal did not come because of the sudden drop in oil prices.

One development that was not anticipated is the popularity of the new route for pleasure boating, for vessels large and small. Yacht owners like the scenic Tenn-Tom much better than the industrialized Mississippi River. "Yachties" is what the lock tenders call them. The waterway is currently locking through between 100 to 125 of the 40 to 80-foot boats each month and the number is rising. In 1985 at the Aberdeen Lock and Dam 2,382 vessels were locked through; 1280 pleasure boats and 433 commercial. Special marinas and shore facilities are rapidly developing along the route to further woo the pleasure-boat owners.

Another plus for the Tenn-Tom is the fact that they have been given a special award by National ASCE. The account is published separately in this issue.

Basis for the award is an engineering project that demonstrates the greatest contribution to civil engineering progress and mankind.

## RIDEAU HIRE-BOATS

If you are a Rideau Canal enthusiast and are looking for a family-size boat to rent for travel along the canal, try Summer Magic Houseboats, Port Hope Ontario (416) 885-9603. They advertise 40-foot houseboats only, berthed in Westport, Ontario on Big Rideau Lake. If you want something a bit smaller, try Big Rideau Rentals, Rideau Ferry, Ontario (613) 825-3317, who advertise 32-foot boats, berthed in Rideau Ferry between big Rideau and Lower Rideau Lakes. (Information provided by Walter Meseck.)

## NEW CANAL BOOKS

**THE DEATH OF A GREAT COMPANY** — W. Julian Parton. This 160-page, well-illustrated, paper back, traces the history of one of the oldest companies in the United States — the Lehigh Coal and Navigation Company — from its formation in 1820 to 1969. Fold-out map of all company and associated company operations at the rear of the book. Sponsored and published by the Center for Canal History and Technology it is a book which all persons interested in coal mining, canals and railroads in Eastern Pennsylvania and Western New Jersey will want for their libraries. Write: Center for Canal History and Technology, Canal Museum, P.O. Box 877, Easton, Pa. 17044. Price: \$9.96, plus \$1 shipping (and 60¢ tax in Pa.).

**BEST FROM AMERICAN CANALS, Number III** — Produced by the American Canal Society. This 8½" x 11" paperback, with its five-color cover, 88 pages and 135 illustrations includes all major feature articles published by ACS members from November of 1983 through May of 1986. Dr. Roger Squires of England has made this comment about the new book: "I must congratulate you on a superb production! You excel at converting material into a well-ordered and indexed outline of canals the world around. You have done a first class job — Number III if better than the first two, and they were first class. The color cover is a great innovation. It must be an essential book for all canal enthusiasts' bookshelves, as well as for libraries as a book of reference." Price: \$6.00, shipping included. (Add 36¢ tax for Pennsylvanians.) American Canal and Transportation Center, 809 Rathton Road, York, Pa. 17403.

For those inclined to exercise their French, Bob Mayo has called our attention to an article in the April 1986 International Journal of HISTORY AND TECHNOLOGY entitled "Le Canal de Lachine Jusqu'en 1870: Origine et Fonction d'un Canal Hydraulique". It is a twenty-page, well-illustrated article by John Willis of Parcs Canada, Quebec, all in French. Write: Document Delivery Service, Harwood Academic Publishers, 1 Bedford Street, London WC2E, United Kingdom.

# TOUR OF THE SCHUYLKILL NAVIGATION



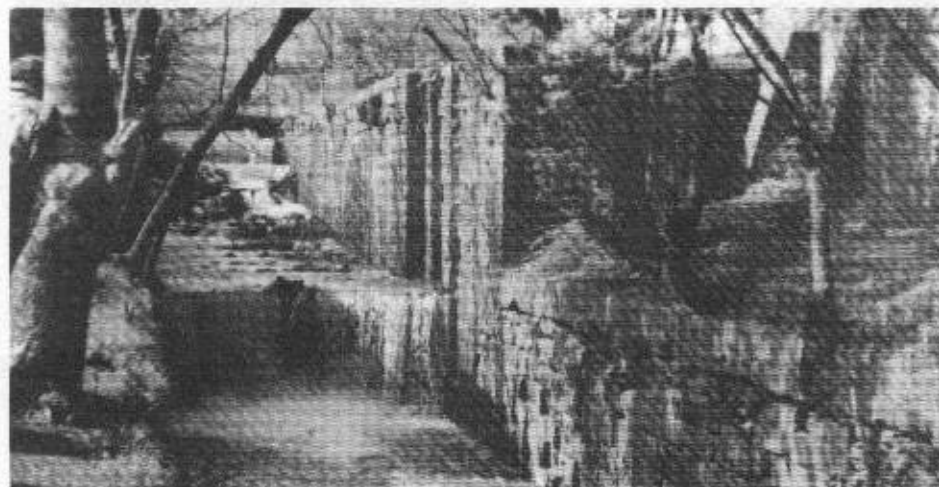
Allegheny Creek Aqueduct, south of Reading. The Schuylkill Greenway Association is cooperating with the Berks County Parks Authority to stabilize the old aqueduct and make it part of a canal park. (Bruce Russell photo.)

*By Bruce Russell*

During the weekend of April 19 and 20, 1986 approximately 35 members of the CANAL SOCIETY of NEW JERSEY made a trip over the major portions of what remains of the Schuylkill Navigation, a waterway system in eastern Pennsylvania which combined sections of man-made canals with slackwater pools in the Schuylkill River. Begun in 1816, this man-made navigational system was completed in 1825, and extended from Port Carbon, in the midst of the Pennsylvania's coal fields, 104 miles southeast to Philadelphia. Enlarged several times, the Schuylkill Navigation at its peak year of 1859 consisted of 62 miles of man-made canals and 42 miles of slack water in the river created by 25 dams with locks for entering and leaving. Other necessary structures were 17 arched aqueducts, 1 tunnel (later reduced to an open cut) and hundreds of sturdy bridges.

In 1859, there were 1,400 canal boats in service, and over 1,700,000 tons of

anthracite coal were carried. After 1834 coal from points on the Schuylkill Navigation was transported to Philadelphia in canal boats of 60 ton capacity and were then towed by steam tugs to Bordentown, N.J. where they were sent through the Delaware and Raritan Canal to the New York area. This through route for coal made the Schuylkill Navigation extremely important, both for Philadelphia as well as New York City. Unfortunately by the early 1860s the railroads began to eclipse canals all over the United States, and each year witnessed declines in traffic. In 1898 the upper portion of the canal above Port Clinton was abandoned, and by 1910 all commercial carrying had ceased on the remaining portion. From 1870 the canal had been owned by the Reading Railroad, and in 1928 it was officially abandoned. Portions were immediately filled in, other parts survived for longer periods, and a few remnants still contain water and look much as they did when the entire waterway was operational. As with all American canals, many of the best



Locks 69 and 70 at the south end of the restored Manayunk Canal (part of Philadelphia). These are the last two locks of the Schuylkill Navigation north of the tidal lock and dam at Fairmount Water Works. (Bruce Russell photo.)

preserved portions and structures can be found in rural and unpopulated locations where the remains have not been disturbed by land development schemes or other factors.

Our Springfield trip over the Schuylkill Navigation utilized a chartered bus which departed Saturday morning from Chester, N.J. The preliminary work was done by society member BILL MOSS, with assistance from BILL McKELVEY and LARRY E. WHYTE, who has published considerable material on this fascinating Pennsylvania waterway. An interesting and informative packet of materials pertaining to the canal was given to each tour participant, and during both days BILL MOSS and LARRY WHYTE alternated in giving a running commentary on the Schuylkill, delving into its early history, the reason for building it, the life of a boatman, the rise of the railroads as competitive carriers of Pennsylvania anthracite, and the final years of the decline.

In order to really appreciate a field trip such as this, the participant must utilize his imagination to create a mental image of what a particular scene was like a century or more ago. To be shown a baseball field and then be told that here was a canal basin requires that you make the mental effort to envision water in that spot and canal boats loading and unloading. Likewise to climb atop a lock structure with crumbling walls calls for use of one's imagination to recreate another scene and visualize a time when vessels were passing through in almost a continuous procession. Most of what survives America's canal era is in deplorable condition, and only very recently has any effort been made to restore the crumbling and caved in (or sometimes buried) lock chambers, aqueducts, wing dams, and other artifacts which often have remained untouched since official abandonment.

On this field trip we often had to hike a considerable distance in order to view portions of the Schuylkill Navigation or one of its structures. Although there was more to see than could be fit into a weekend "survey", BILL MOSS, BILL McKELVEY, and LARRY WHYTE managed to show the tour participants much of the best of what still remains. The accompanying photographs highlight some of the most significant remains of the Schuylkill Navigation, a vital link in America's transportation system, 1825 until 1928.

During one segment of the tour we left our chartered bus and boarded a train of the BLUE MOUNTAIN & READING RR, a steam tourist line, for a 14 mile trip from Hamburg to Temple, Pa. From this train we could see much of what survives of the Schuylkill Navigation which paralleled the railroad. Beyond the canal bed was the Schuylkill River. There are somewhat vague plans to restore this segment of the canal, perhaps including a working lock.