AMERICAN CANALS

BULLETIN OF
THE AMERICAN CANAL SOCIETY

BULLETIN NUMBER 68 Editorial Address—809 Rathton Road, York, Pa. 17403 **FEBRUARY 1989**

PRESIDENT'S MESSAGE

As a "bonus" to start out the new year all our members are being mailed a copy of the latest *American Canal Guide.* This series is the society's ongoing contribution to the American Bicentennial, an inventory of the country's historic canal resources for historians, park planners, environmentalists and canal enthusiasts. In another 200 years we'll do it again!

Part Four of the guide covers Kentucky, West Virginia, and the Ohio River, altogether 2,100 miles of 17 river navigations, and 241 locks and lock sites. Be sure to let me know of any errors and omissions.

We will be sending copies to agencies and individuals who helped with this guide. I also want to place some where they might help save a canal or lock or instigate a new park. If a copy of the guide can be put to good use, let me know or order a copy from Keith Kroon, our Sales Officer.

I'm now working on our guide to canals in Virginia, Maryland and Delaware. Outside of Virginia, we'll include the Chesapeake & Delaware, its lost feeder, and the Delmarva Intracoastal Waterway; and in Maryland, the C&O, Tiber, Antietam, Tidewater (S&T), and Old Susquehanna (Port Deposit) canals and the Nassawango Lock. Let me know soon of anything which might be overlooked. Has anyone plotted the exact locations of the Old Susquehanna Canal locks mentioned in the May 1977 bulletin?

Don't forget to reserve Memorial Day Weekend, May 26-29, for our meeting in Lowell, in cooperation with the Middlesex Canal Association. V-P Bill Gerber has worked up an exciting major event, focusing on the canals of New England. It will also be an opportunity for those ACS directors, officers, and other interested members who attend, to get together for a short meeting, so please make a note of any issues we should discuss or write to me about it. Bill Trout

Charlie Derr, ACS Secretary reports two new LIFE MEMBERS of the American Canal Society: **Lawrence H. Page** of Bradenton, Florida and **Agnes B. Sherman** of Princeton, New Jersey. Thanks to both of them for this indication of their special support for ACS.

CCS-ACS MEETING

Members of the American Canal Society have been invited by the Canadian Canal Society to join them in St. Catherines, Ontario September 29-October 1, 1989 for a celebration of the 160th year of the Welland Canals, plus a tour. More details will be announced in succeeding issues, but mark your calendar!

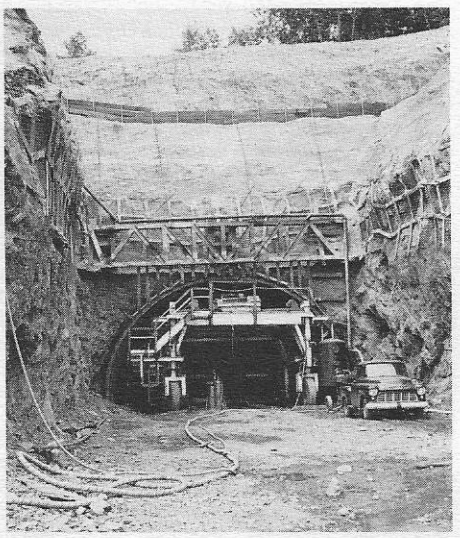
END OF A LEGEND

On December 12, 1988 we said a final "farewell" to the Senior Director of the American Canal Society, a man who has literally become a "legend in his own time". Robert S. Mayo of Lancaster, Pennsylvania was a professional engineer, a builder of canals, bridges and tunnels, a governmental consultant, an author, a lecturer, an inventor, a historian, and — a canal buff, and a heavy contributor to *AMERICAN CANALS.* A civil engineer, Bob Mayo had a hand in the building of the Illinois-Michigan Canal, the Jacks Run Bridge in Pittsburgh, the amazing Westinghouse Bridge in Wilkinsburg, the Holland Tunnel under the Hudson River at New York City and the Moffat Railroad Tunnel through the Rockies in Colorado, In the central Pennsylvania area he was well known for his part in building the world's longest multiple concrete arch bridge across the Susquehanna between Wrightsville and Columbia in 1930 - recently declared a National Historic Civil Engineering Landmark.

Bob Mayo moved to Lancaster 52 years ago and in 1937 he founded the Mayo Tunnel and Mine Equipment Co., which designed and manufactured special equipment for mining. In 1973, he sold the business, well known in the industry, to the Elgood Corp., which named it the Elgood-Mayo Corp.

On his retirement as the firm's chief engineer and vice president, he said: "I'm retiring, but I've still got a lot of engineering work lined up.

"It is an up and coming business," he added, "especially in the last 10 years. With more and more stuff going underground, it is a growing business."



Multiple-drill-head "Jumbos" of the type shown here were developed by Bob Mayo's firm to speed the digging of the double-tunnels on the Pennsylvania Turnpike in the 1960's.

Robert S. Mayo, P.E., 1900-1988

He continued working as a consultant for the business until his death.

"When they get in trouble, I find out what they should have done, and how the hell they're going to get out of it," he said in a 1984 newspaper interview.

Mayo earned a bachelor's degree from Illinois Tech in 1923 and did graduate work at the Michigan College of Mines.

Upon graduation, he went to work as a junior engineer on New York's Holland Tunnel project. A couple of years later he was a miner on the Moffat Tunnel in Colorado and joined the project again in 1931 as an engineer.

His expertise and equipment were used for such projects as the Pennsylvania Turnpike tunnels, subways in Philadelphia, Washington, Montreal, San Francisco, Chicago and New York, and underground sewers in cities all over the world.

Before establishing his company, he worked as a salesman for the Pittsburgh-based Blaw Knox tunnel equipment company. The company he later founded manufactured tunnel shields, mine cars, drill apparatus, air locks and other standard equipment still in use.

Mayo was a charter member and former sergeant-at-arms of the "Moles," an association of engineers and construction workers known as

(Concluded on Page Two)

American Canals

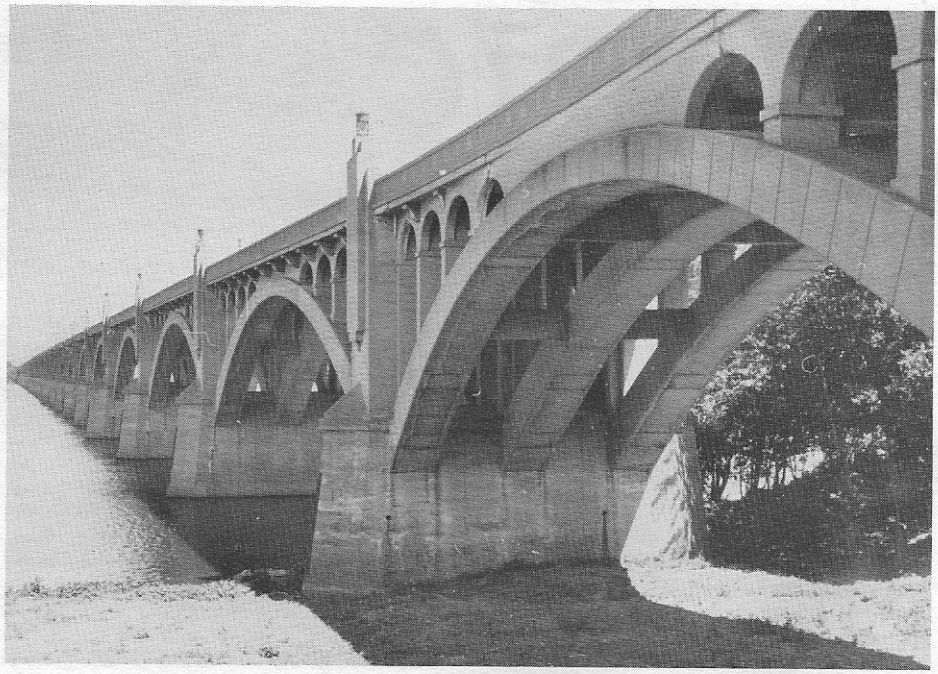
BULLETIN OF THE AMERICAN CANAL SOCIETY

"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.

END OF A LEGEND



One of the most enduring Pennsylvania monuments to Bob Mayo's engineering genius is this 1.26-mile long Columbia-Wrightsville Bridge across the Susquehanna River. Built in 1930, it is the world's longest multiple concrete arch bridge. It was recently repaired and has been declared a National Historic Civil Engineering Landmark by the American Society of Civil Engineers.

(Concluded from Page One)

"Tunnel Men," and he belonged to the group for 51 years.

Mayo was made an honorary member of the American Society of Civil Engineers in 1984, the profession's highest accolade. He was president of the Lincoln Chapter of the Pennsylvania Society of Professional Engineers from 1949-50. In 1981, he was honored as "Engineer of the Year" by that chapter and also the State P.S.P.E.

In 1973, he was named to the Underground Construction Research Council, affiliated with the American Society of Civil Engineers and the Institute of Mining Engineers.

Mayo was the author of four books on tunneling. These include the well known "Practical Tunnel Driving," which he and the late Harold Richardson published in 1941 and which he revised in 1975. He also published "Tunneling: The State of the Art" in 1968.

Also, much of the definition and history of tunneling in Encyclopedia Britannica was written by Bob Mayo.

During World War II, he served in the U.S. Marine Corps, becoming a captain. As head of an engineering battalion, he participated in the Okinawa landing, and his unit hastily built bridges and pontoons for advancing troops. He then served in the Marine Corps Reserve, retiring as a colonel in 1960.

Before that, Mayo was a member of the Illinois National Guard. He belonged to the American Military Engineers Society.

He was a life member of the Marine Corps Reserve Officers Association, serving as president of the Lancaster-York County branch as well as on the national council in the 1950s. He was also a commandant of the Lancaster County Detachment of the Marine Corps League. He also was a life member of Lancaster Lodge 134, BPOE.

Mayo spend some of his younger years in Cuba. As a young man, he "hoboed" across the West from Chicago to Seattle during his summer college vacations, sometimes hitching rides on trains and sleeping in the V-shaped "cow catchers" in the front.

"I liked seeing different places for nothing," he said. "I settled down here, but those were the good old days."

Mayo was a Director of the Pennsylvania Canal Society as well as an ACS Director. In 1959, he was named president of the Conestoga Chapter of the Society for Pennsylvania Archaeology.

Mayo was a registered engineer in Pennsylvania, Illinois and Washington, D.C.

He was a 35-year member of the American Institute of Mining, Metallurgical and Petroleum Engineers and a member of the Society for Industrial Archaeology, the National Trust for Historic Preservation and the Tourist Railway Association.

An avid sailor, he belonged to the Susquehanna Yacht Club.

Mayo was also a member of the Hamilton Club, the Lancaster Country Club and St. James' Episcopal Church.

He was the husband of Ruth Henderson Mayo.

Surviving, besides his wife, two sons, a daughter, nine grandchildren and one great-grandchild.

Boaters who ply the Barge Canal will find a new color scheme on their waterway this season.

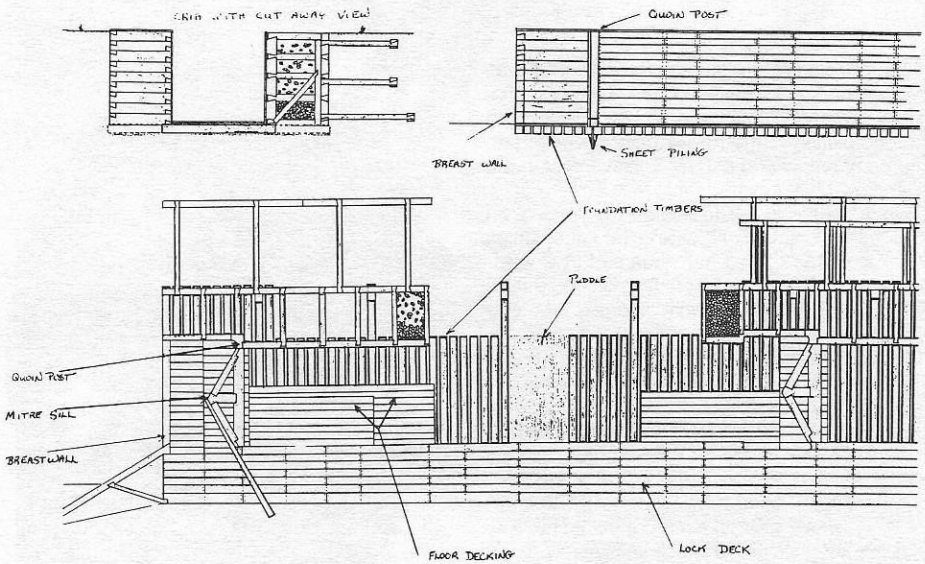
The state Department of Transportation will change the former white-colored buoys to green to conform with those found in international waters.

The international colors, also adopted by the rest of the United States, have always been red and green — red on the right side of a vessel returning upstream from the ocean and green (or black) on the right going toward the ocean. The New York canal system has used white and red since the system was founded more than a century ago. *Waldo Nielsen*

ENGINEERING NOTES ON WOODEN LOCKS

By Stanley A. Schmitt

One of the most essential structures on any navigable canal is the lift lock. On most 19th century locks the chambers were formed by massive masonry walls. In mid-western canals of the period, timber was often used as a substitute for stone. The use of wood in lock construction came about for several reasons, the most important being the need to reduce construction expenses. As the nation's 19th century canal craze moved westward, states without the necessary funding became involved in their construction. In these areas timber was cheap and readily available while stone was obtainable only at great cost. In addition, stone of suitable building quality was often hard to find and had to be transported long distances from quarries to lock sites. In some instances wooden locks were built with the intent of bringing in suitable stone for rebuilding after the canal's completion. Labor costs for masonry locks were also higher as masons were few and far between. For most timber lock construction common carpenters could be used. Although wooden locks were initially cheaper, their walls and frames needed continual repair and replacement as they rotted from exposure to air.



Wooden Crib Lock. The lower drawing is a plan view; upper right, elevation; upper left, a right-angle cross-section.

Wooden lock construction occurred in at least two forms - the "frame lock" and the "crib lock". The former required less timber and was apparently more common. It also required more precise carpentry work. On the northern part of Indiana's Wabash & Erie Canal, frame construction was widely used. On the southern part (south of Terre Haute), where cost was of special concern, only crib construction was used on wooden locks. In at least some crib locks, and possibly frame ones, the walls were filled with earth and stone for stability. The construction of both lock types were analogous to 19th century wooden house construction. The frame lock was not unlike the frame and clapboard house of the period, and the crib lock that of the log and sided house.

In frame construction, a frame work of horizontal and vertical timbers was set up to form the interior and exterior walls of the lock chamber. This framework was set up on cross timbers laid horizontally cross-wise in the lock pit or a combination of cross timbers and longitudinal mud running the length of the pit. These foundation timbers served to level the bottom of the lock and provided the points for securing the vertical frames of the lock. To provide additional support, braces and cross-ties connected the frames to each other and to the foundation timbers. All frame work was jointed and spiked to secure it. Upon completion of the frame work the entire structure, both floor and walls, were planked with three and two inch plank respectively. Depending upon the canal, oak or pine plank was used. Wall frames were planked on both the interior and exterior sides. Hollow quoin posts and miter sills attached to the wall frames and floor foundation, served the purpose of holding the lock gates.

Crib construction began with the same foundation timbers as the frame lock. Upon these timbers a crib consisting of a front and back wall connected by round ties was raised. Timbers used to form the crib needed only to be hewn on three sides. Each course of wall timber was to be secured to the next one below by 20 inch nails. At regular intervals, vertical timbers were set up against the back wall and supported by braces footing into the foundation behind the front wall. This, and cross-ties connecting the front and back walls, tended to make the crib more rigid and prevented the walls from settling inward. The floor of the lock was covered with one or two layers of closely jointed oak plank. The upper and lower mitre-sills were secured to the foundation timbers by 18-27 inch spikes. The cribs were faced with two inch plank to create a smooth and water tight lock chamber. In at least some instances the cribs were filled with earth and stone before being planked over. To further prevent inward settling, round ties running the entire length of the lock were secured to the rear wall by ties of 12 or 16 feet in length.

Whether due to a lack of stone or as an economy move, many locks of both timber types were constructed. Mechanically they functioned no different than their masonry counterparts.

Report of the Canal Commissioners, 1835, State of Indiana Documentary Journal, Indianapolis.

Board of Trustees of the Wabash and Erie Canal, Report of the Chief Engineer, 1847 and 1853, State of Indiana Documentary Journal, Indianapolis.

Specifications of a Wooden Lock-North Branch Canal, n.d., Pennsylvania Historical and Museum Commission, Division of Archives and Manuscripts.

Specifications: Wood Locks, Rules and Specifications relating to the extension of the Miami Canal north of the Deep Cut, 1843, Sixth Annual Report of the Board of Public Works.

Specification for building a Crib lock, n.d., Indiana Commission on Public Records, Archives Division.

CAP'T SHERMAN'S GUIDE TO HUGH MOORE PARK — A 60-page paperback published by the Center for Canal History and Technology, which is more than just a guide-book. It contains a complete history of transportation - river, canal and railroad - in the important three-canal junction center of Easton, Pa. The Lehigh Coal and Navigation, the Morris Canal and the Delaware Canal and the railroads all get their share of space in this interesting little book — also the local industries spawned by this important transportation center. Price: $4.25, postage and handling included. Write Hugh Moore Historical Park & Museums, P.O. Box 877, Easton, Pa. 18044.

TREETOP CANAL!

By Bill Dzombak

Construction of the Rideau Canal was begun in 1826, under the direction of Colonial By, of the Royal Engineers. At the request of the British Government, John McTaggart submitted to Col. By a report on the works, and included in that report the following proposal for construction of canal across a swampy area:

"I proceed to explain the method which seems to me the most practicable for crossing the swamp, although in so doing I may incur a little ridicule. The plan so far as I am aware is new, and has never been tried before, but the situation of the place and many other circumstances justify the method proposed.

"At first view one would suppose that a mound of earth might be formed to carry the canal over, or that an embankment of thirty-four feet, with another smaller one at the ridge of the swamp of sixteen feet, would answer well and form an extensive sheet of water for boats to rest, and pass one another between them; but after considering a little we find that to raise such embankments would be no easy matter, and would consume much money.

"An aqueduct of wood would be much better, and an aqueduct of wood I propose. Instead, however, of supporting them on piles or arches, as is the case commonly, I propose that the heads of the cedar trees, which grow as thickly in the swamp as they possibly can grow, and average fourteen inches thick, and seventy feet high, be sawn off to the proper level, on the route of the canal, so as to form props for the bottom, sides, and towing path upon this foundation, with clay, puddle, and planking. I consider there can be little difficulty in carrying the canal over, as is shewn in the design. A cedar tree, when cut down, will remain fresh for fifty years; and surely a tree standing on and fixed by its roots is a stronger and steadier support for an aqueduct than any pile of the height requisite, be it done in the best manner possible. Nevertheless, the idea of carrying a canal over the trees in Canada may raise the laugh against us."

HISTORY OF THE PANAMA CANAL (Part 1)

By William H. Shank, P.E.

The opening of the Panama Canal in 1914 was the fruition of a dream of the Spanish Conquistadors exactly four hundred years earlier, and the completion of the most significant engineering, commercial and military achievement in the History of Mankind.

Since Vasco Nunes de Balboa first set eyes on the Pacific Ocean, after crossing the Panamanian Isthmus in 1513, men had dreamed of a water connection here between the Atlantic and Pacific which would immeasurably shorten the long journey around Cape Horn on the tip of South America. First the Spanish used an isthmus crossing to consolidate their conquests in Central and South America, searching without success for a river which might make a connection between the seas. In 1630 a band of English Puritans gained a brief toe-hold on islands off the cost of Panama, only to be driven into the sea by the Spanish eleven years later. Sir Henry Morgan and his Buccaneers soon afterward attacked Panama, made friends with the Indians and investigated a possible route across the Isthmus via the San Juan River to Lake Nicaragua. Other English expeditons over the next century or more attempted unsuccessfully to colonize Nicaragua as the best overland route to the Pacific.

Spanish control and influence in the Americas gradually came to an end in the early 1800's, and the Dutch, Germans and British sent exploratory parties into the interior of Central America with the idea of building a canal between the two oceans. A German geologist, Alexander von Humboldt, after a visit to the area, wrote a treatise entitled "Political Essay on New Spain" which discussed the many international advantages of a canal across Central America and traced nine possible routes, including Tehuantepec, Nicaragua, Panama and Darien.

Goeth Comments

The great German writer, Johan Wolfgang von Goeth (author of "Faust") read Humboldt's Essay about 1825 and made these comments: "If a project of this kind succeeds in enabling ships of all sizes and lading to go through a canal from the Gulf of Mexico to the Pacific Ocean, incalculable benefits will accrue to the whole of civilized and uncivilized humanity.

"It would surpise me, however, if the United States allowed such an opportunity to slip from their hands. We may expect this youthful power, which already possesses a tendency to move westward, to occupy and settle the vast areas of land beyond the Rocky Mountains in thirty or forty years. Further, we may expect that along the whole length of the Pacific Coast where nature has already provided them with the largest and safest harbors, there will soon arise commercial cities of the utmost importance, with trade flowing out from the United States to China and the East Indies. And if this happens, then it becomes desirable and almost necessary that merchantmen and warships should have rapid passage between the east and west costs of North America — much easier than the wearisome, disagreeable and expensive journey around the Cape.

"I repeat then, it is absolutely indispensible for the United States to effect a passage from the Gulf of Mexico to the Pacific Ocean, and I am certain they will do it."

However, the United States appeared uninterested in such a venture until the War with Mexico gave them California in 1848, with the almost immediate discovery of gold in that new territory. This led to a rush of fortune-seekers from the east coast to the west coast, and most travelers sought a sea route rather than the long and arduous route across the western plains. Ship service was established to Panama from both east and west coasts, where only fifty miles of land travel over the Isthmus was necessary; but difficult.

The need for a better means of transport across the Panamanian Isthmus became immediately apparent. A railroad appeared the best short-term solution and American interests in New York State sponsored the formation of the Panama Railroad Company in 1849. This railroad was built across the swamps and bogs in the tropical wilderness of Panama with Chinese as well as black and Irish labor, many of whom sickened and died on the job as a result of yellow fever and typhoid. The Americans were not immune to the tremendous hardships of the route or to the local diseases and many of them perished before the job was finished and the first locomotive chugged its way over the forty-five mile route between the seas in 1855. The railway had cost $8,000,000 and 835 lives.

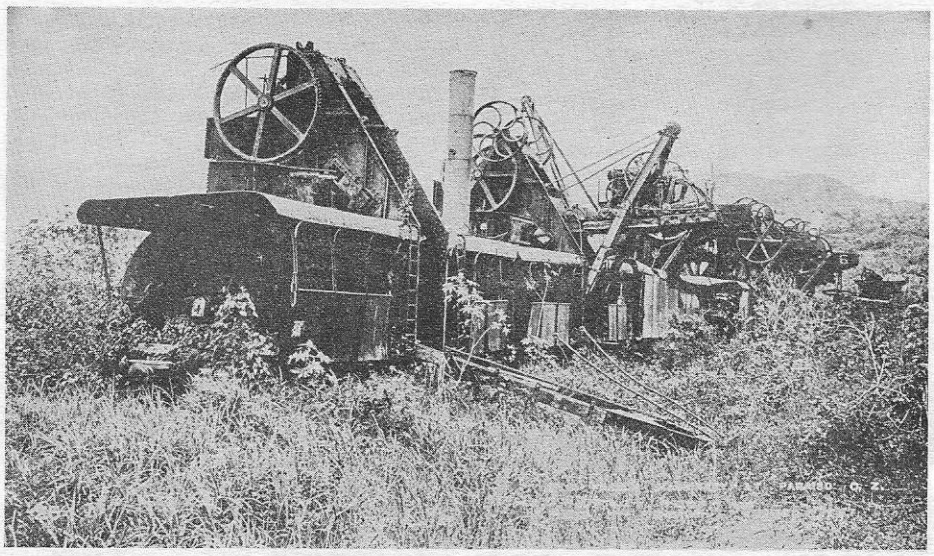
Count Ferdinand de Lesseps in 1879. He was the successful builder of the Suez Canal in earlier years, but the architect of the French failure in Panama. (From "Panama Gateway" by Bishop.)

As a result of a dispute over the use of Nicaragua as a canal site, the United States and Great Britain in 1850 entered into an agreement for the avowed purpose of hastening the construction of a ship canal across the Isthmus, known as the Clayton-Bulwer Treaty. This treaty indicated that they would give "their support and encouragement" to all efforts in that direction, and would extend their joint protection over any canal or railway that might be constructed. They agreed that neither of them would exercise exclusive control over an Isthmian Canal, but that they would mutually guarantee its neutrality and security and would invite other nations to co-operate in protecting it.

Essentially this agreement blocked the United States from taking the initiative in the building of the canal, for the next fifty years, but opened the way for a third power — France — to do so.

The French Canal

With the completion of the Suez Canal (1859-1869) Ferdinand de Lesseps, of France, the architect of this sea-level canal, became a sort of international hero, and the world "expert" on canal building. When, in 1878, French diplomats obtained a charter from the Columbian government to build a Panama Canal, the name "de Lesseps" was on everyone's lips to lead the enterprise. And so he did. At age seventy-five — and with unfailing confidence, de Lesseps announced that there



Old French machinery rusting in the Panama jungle about 1900, a mute reminder of the colosal failure of the French canal, under the direction of de Lesseps. ("Story of the Panama Canal" - Marshall.)

would be no great problem building a sea-level canal across Panama, just as he had done across Egypt. Engineers, sent later to examine the route of the canal, recommended that a lock-canal might be better, but de Lesseps brushed all these reports aside and insisted that a sea-level canal was the only way of doing the job. In 1879, La Compagnie Universelle du Canal Interoceanique de Panama was formed, more generally known in America as the "Panama Canal Company." Company stock was sold primarily in France.

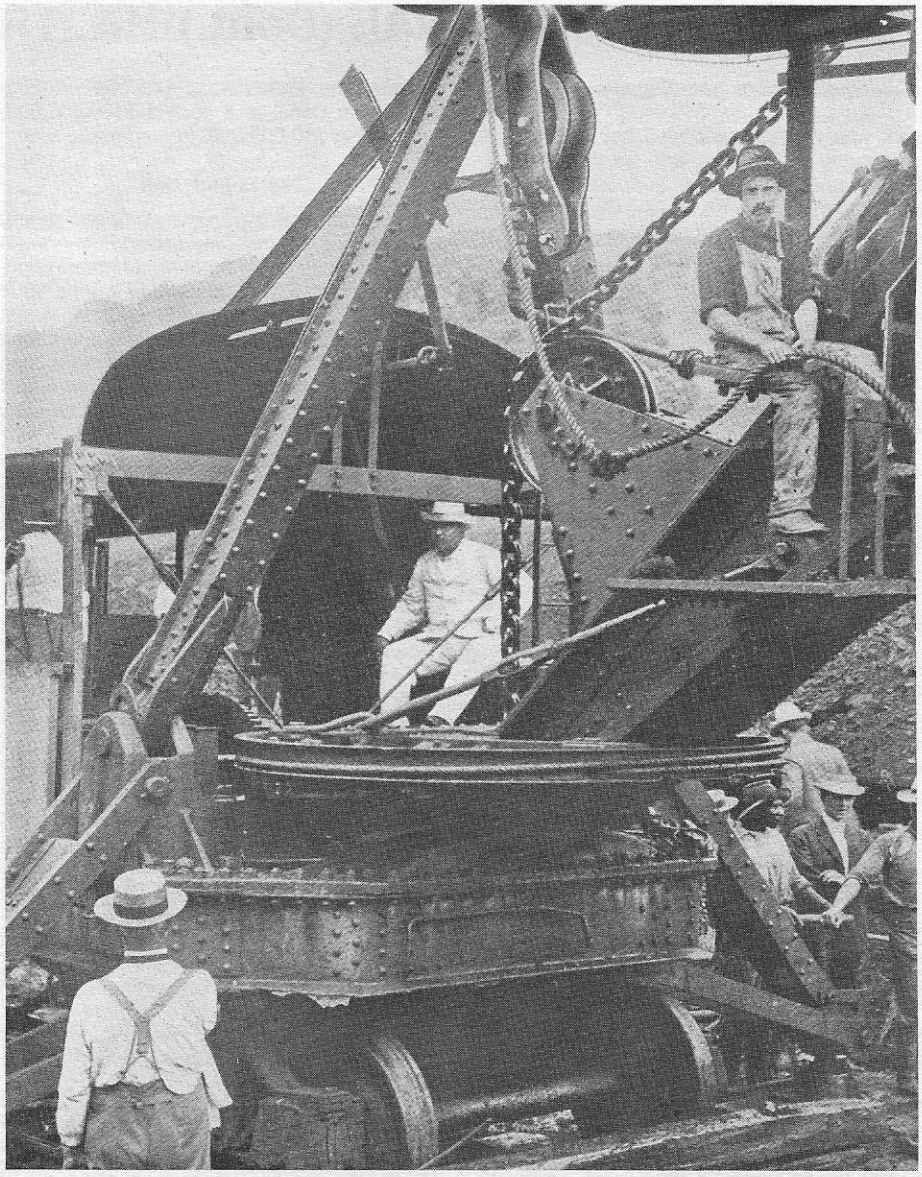
United States, ham-strung by its treaty with Great Britain, and anxious to see a canal built, cooperated by offering to sell the French the Panama Railroad as an important instrument in building the canal — at a figure of $14,000,000. De Lesseps, perhaps thinking he could get a better price, declined the offer, but the following year, after the stock of the railroad had climbed from $200 to $250 per share, changed his mind. By this time however, the American interests had decided to retain 25% of the stock to keep the charter alive, selling the Panama Canal Company the other 75%.

The first work force arrived in Panama in January 1881, but due to political manipulations and contractor problems (which characterized the entire operation) actual construction did not begin until 1882, and on an increasing scale in 1883, 1884 and 1885. De Lesseps appears to have spent much of his time the first several years (when he was presumably supervising construction) in triumphal meetings with local officials in Panama and the United States, and in public relations campaigns to try to sell his company stock abroad.

Major Troubles Develop

As with the Panama Railroad, the French Company had not anticipated the tremendous difficulty of attempting to maintain a vast labor force in the jungles and swamps of Panama without extraordinary attention to sanitation and health problems. Nearly half their laborers developed yellow fever, malaria, or other tropical diseases. Many of them died. They were further plagued by an insurrection in March of 1885, during which the city of Colon was burned to the ground and the city of Panama threatened. Order was restored only on the intervention of President Cleveland of the United States, who sent three war ships and five hundred marines, thus saving the city of Panama from destruction, and further damage to canal property — not to mention serious interruption to the construction work.

Early in 1885 it became apparent that the Panama Canal Company was in financial difficulty. The cost of the work had grown considerably beyond the estimates, and new investment money was not available. De Lesseps asked the French government for permission to issue lottery bonds for a loan of $210,000,000 and then left on a triumphal campaign through Panama to renew his image as the world's foremost canal-builder. French wine and a series of dinners for the local dignitaries kept them convinced that all was well. De Lesseps' dramatic performances apparently convinced the populace at home that the project was still progressing and they poured additional funds into stock purchases. However, general mismanagement, unbelievable extravagances in the purchase of local facilities — not to mention political manipulations in Paris, were all at work,to bring the Panama Canal Company down to ignominious failure in several more years. Notwithstanding all this, a great deal of meaningful work was actually completed by the courageous French engineers and their work forces, under almost impossible working conditions. By 1888, the Company had spent $262,684,000, had excavated 70,565,793 cubic yards of earth, had lost some 22,000 workers' and principals' lives in the process, had run out of funds and had gone bankrupt. It had become an international disaster which shook the entire financial world and was a matter of intense embarrassment to the French government for years.



President Theodore Roosevelt enjoys a ride on one of the gigantic, track-mounted steam shovels used in digging the canal for which he was largely responsible. ("Panama and the Canal" - Abbot.)

A new canal company was formed by the receivers in 1889, who were finally obliged to suspend work on the project in May of that year, and whose later efforts were devoted to trying to sell what was left of their assets to the United States.

Theodore Roosevelt

Like De Witt Clinton with the Erie Canal, Theodore Roosevelt was the man most responsible for pushing the Panama Canal through to completion. In his position as President of the United States, he had the necessary power to do so, and he did not hesitate to exercise it, in the right places and at the right time.

As the Twenty-Sixth President of the United States, who moved into the presidency September 14th, 1901 as a result of the assassination of President William McKinley, "Teddy" Roosevelt was one of the youngest presidents (43) and certainly the most colorful personality to occupy the "White House" (his own name for it) in the previous history of the United State.

Rancher, hunter, explorer, author, former Mayor of New York, former Governor of New York State, former under-secretary of the U.S. Navy, former Vice President and hero of the Spanish-American War (he led the famous charge up Kettle Hill in Cuba in 1898), the new President brought with him a life-style and a reputation for "getting things done" which had not been seen in Washington since the days of Andrew Jackson. He was the ideal man to cut national and international political "red tape" and get the long-debated Canal underway.

Ever since the failure of the French canal it was becoming increasingly obvious that if an Isthmian Canal was ever to be built, it would have to be done by the United States.

A private firm, the Maritime Canal Company, had begun work on a Nicaraguan Canal in 1890, and had spent $6,000,000 on actual construction

(Continued on Page Six)

PANAMA CANAL (Cont.)

(Continued from Page Five)

work, which in 1892 exhausted their funds. There were many in Congress who felt that the U.S. Government should have supported and encouraged this enterprise, but the Clayton-Bulwer Treaty still prevented official recognition of the operation.

The Spanish-American War of 1898 made it crystal-clear that a canal cross Central America was a war-time necessity. The Warship "Oregon," caught in the Pacific during the blockade of Cuba, made a full-steam run around from San Francisco through the Straights of Magellan to Key West, which took from March 19th to May 26th. The sinking of the Spanish fleet had to be postponed until the "Oregon" arrived!

Shortly after Roosevelt took office, and after considerable wrangling between the British and Americans, a treaty was finally negotiated between Secretary of State John Hay and the British Ambassador to the United States, Lord Pauncefote, and ratified in December of 1901, which specifically abrogated the Clayton-Bulwer Treaty. The Hay-Pauncefoe Treaty gave the United States the right to exclusive ownership of an Isthmian Canal, permitting fortification of the Canal and its approaches, and omitting the former requirement that the canal should be kept open to all nations in both time of war and peace.

Nicaragua Vs. Panama

In anticipation of the signing of the new treaty, Congress had been arguing for years, not about the building of the canal, but about the route to be followed. There was extremely strong support for a Nicaraguan Canal, using some of the work already done by the Maritime Canal Company. Even though the Panama route had been discredited by the failure of the French, there were still those in Congress who argued strongly that the holdings of the old French company, now known as the "New Panama Canal Company" should be acquired by the United States, to salvage what work had already been done there. Debate continued, often with great animosity, between the two factions, until economic considerations and the action of President Roosevelt, resolved the issue in favor of the Panamanian route.

Details of the final decision were as follows: On March 3, 1899, President McKinley had appointed a Commission of nine members, headed by Rear-Admiral J.G. Walker to investigate all possible canal routes across the Isthmus — particularly those at Nicaragua and Panama — to be "under the control, management and ownership of the United States." The commission estimated that a Canal at Nicaragua would cost $189,864,062 and a Canal at Panama, $144,233,000. The Commission also negotiated with the New Panama Canal Company in France for acquisition of all rights, franchises and property of their partially-completed route in Panama, for a consideration of $109,141,500 — bringing the cost of a Panama Canal route to a total of $253,374,500.

While the Commission felt that the real worth of the French holdings was only $40,000,000 the price that the French were asking ruled out the Panama route, and they therefore recommended, in their report of November 16, 1901, that the "most practical and feasible route" was by way of Niacaragua. This report was accepted by President Roosevelt and transmitted to Congress on December 4, 1901. On January 8, 1902, the House of Representatives voted 225 to 25 to authorize the President to proceed with the Nicaraguan Canal at a cost of $180,000,000, apropriating $10,000,000, for immediate use.

The French Sell

In the meantime, the French company, seeing its last chance slipping away, cabled Rear-Admiral Walker that they would sell at his estimated valuation figure of $40,000,000. On January 18, 1902 the Walker Commission gave President Roosevelt a supplementary report, and the recommendation (in view of the changed conditions) that Panama was now the "most practical and feasible route." This new report threw Congress into complete confusion.

By this time the Nicaraguan Bill had gone to the Senate, and after long and heated debate, and an amendment by Senator Spooner changing the route to Panama, passed the Senate by a vote of 67 to 6 on June 19. It then went back to the House where it passed on June 26th by a vote of 259 to 8. The Spooner Bill was signed into law by President Roosevelt on June 28, 1902, committing the United States to build a canal through Panama, after first acquiring the holdings of the new (French) Panama Canal Company.

Next came negotiations with the Columbian government, conducted by Secretary of State John Hay, offering that government $10,000,000 in gold initially and $250,000 in gold annual rental after nine years (the estimated time for construction of the canal). The Columbian government, holding out for more money, refused the proposal in August of 1903. The State of Panama, urgently desiring the Canal, had threatened to revolt from the Columbian government if they did not accept the proposal of the United States. Understandably, President Roosevelt did nothing to prevent such a development — as a matter of fact sent warships to Panama to protect the American consultate there during the impending revolution.

Panamanian Revolution

Under the watchful eye of the American naval forces, the Panamanian Revolution took place as a sort of political formality on November 4, 1903, with only one casualty, when a Columbian ship fired on Colon, killing a Chinaman. The Republic of Panama was officially recognized by Secretary John Hay on November 6, 1903. A subsequent treaty with Panama was approved by President Roosevelt on February 26, 1904, guaranteeing the independence of the Republic of Panama and paying them $10,000,000 initially and $250,000 annually beginning nine years later. In return, Panama granted the United States, in perpetuity, a strip of land ten miles wide, and extending three marine miles into the oceans at either terminal, for the purpose of building and maintaining the new canal.

(To Be Continued)

NEW CANAL BOOK

THE BEST FROM AMERICAN CANALS, Number Four. This new 88-page paperback joins the other three "BESTS" previously sponsored by the American Canal Society. It covers selected articles published in *AMERICAN CANALS* from August of 1986 through November of 1988. It also includes a fairly complete section of detailed canal maps in northeastern United States in the 1800's. Like the other three books, which it matches in size and format, this book sells for $6.00, plus $1.00 for mailing. Write the publisher: American Canal and Transportation Center, 809 Rathton Road, York, Pa. 17403.

TRIALS AND TRIBULATIONS

By Bill McKelvey

From Cases in the Supreme Court of New York, April 29, 1842.) ADSIT and others *vs.* BRADY.

Action on the case against the defendant for neglecting his duty as superintendent of repairs on the Erie canal, in consequence of which the plaintiffs sustained an injury. The first count alleged that the defendant, on the 29th of April, 1842, was, and ever since has been, a superintendent of repairs of the Erie canal, having section number one of the canal committed to his charge; and as such superintendent of repairs it was his duty to keep said section of the canal in good repair, and to remove therefrom all obstructions to the convenient and safe navigation thereof, so that boats and vessels usually navigating the canal might safely and conveniently, and without damage, pass upon and navigate the section. That the plaintiffs were the owners of the canal boat named Angelica, used in navigating the canal for the transportation of goods &c. That a certain other canal boat was, on the said 29th of April, sunk in the waters of the canal in the section thereof under the defendant's charge, to wit, at Watervliet, in such a position and in such a manner as to obstruct the navigation of the canal, and render the navigation unsafe and dangerous, of all which the defendant had notice; and thereupon it became and was the duty of the defendant, as such superintendent, to remove the sunken boat. Yet the defendant, not regarding his duty &c., did not remove the sunken boat, but negligently and carelessly, and contrary to his duty in that behalf, suffered the boat to remain and continue sunk in the canal from the said 29th of April until the 15th of May in the year aforesaid, obstructing and rendering dangerous the navigation &c. By reasn whereof the plaintiffs' boat Angelica, on the 6th of May in the year aforesaid, the boat being then laden with goods, wares &c., of great value, in navigating and passing along the canal at the place aforesaid, ran against and upon the sunken boat and was thereby greatly damaged, as were also the goods with which the plaintiffs' boat was laden, and the plaintiffs' boat and goods were sunk in the waters of the canal.

The defendant demurred to the declaration, assigning the following causes: 1. It is not alleged that the defendant was directed by the canal commissioners, or either of them, to make repairs on his section, or to remove the sunken boat; 2. It is not alleged that the defendant had any moneys in his hands for the purpose of making repairs or removing obstructions; 3. It is not alleged that the plaintiffs' loss was occasioned by the malicious or wilful neglect of the defendant; 4. The defendant, being an agent of the state, is not personally liable to the plaintiffs; and 5. The defendant being a subofficer and bound to act under the direction of the canal commissioners, or one of them, he is not liable to the plaintiffs in this action.

Final Judgement

It is said that the defendant had a discretion as to what repairs were needed, and consequently that his neglect should have been charged to be wilful and malicious. But clearly the defendant had no discretion to leave this dangerous obstruction in the canal. On the facts stated in the declaration, it was his duty to remove the nuisance without any unnecessary delay.

Judgement for the plaintiffs

LOUISVILLE-PORTLAND CANAL DESCRIBED, 1837

by William Dzombak

General William Smith, who was a passenger on a steamboat travelling down the Ohio River in 1837, left the following description of the condition of the canal, at Louisville, that went around the waterfall in the Ohio River at that point:

"July 25th. At eight o'clock this morning, the city of Louisville is in sight about five miles from us. The approach is beautiful - the low shores on both sides of the river, under luxuriant cultivation, the fine sweep of the Ohio in front, terminating with the elegant buildings of Louisville on the left, and the town of Jeffersonville on the right, together with the numerous steamboats and other river craft, all form a most delightful picture.

"We are here detained the whole of this day in taking in new cargo and discharging old. The falls of the Ohio are at certain times impassable for large craft, and a canal has been cut on the Kentucky side around the falls by a chartered company. This canal is 80 feet on the surface, 10 feet deep, and two and a half miles in length. It is, however, a poor concern, considering the importance of a canal at this place. Two boats cannot pass in it, and the rough material taken out of the canal, generally large masses of limestone, is heaped up on the sloping banks, so that the canal is daily receiving debris which will impede the navigation. Add to this circumstance of there being no means of draining or emptying the canal, and no guard at the entrance of the Ohio to prevent the accumulation of deposition at times of high water, this work may be considered a failure. Indeed, it is difficult to avoid grounding every time a boat enters, and when in, if she proceeds even half-way, and another boat is met, one or the other must back out. Add to this the tortuous winding of the canal, and the danger a large boat is always in of having injury done to her on account of the narrowness of the passage, and the work may well be pronounced a complete failure.

"July 26th. We did not get off last night, and here, at nine in the morning, our captain finds that his boat is the only one descending, and that the passengers are at his mercy. He will detain as long as there is a prospect of a box, a barrel, a board or a passenger to go on board. However, we have told him that if he does not start he will be sued by several of the passengers for detention. At ten o'clock we are just entering the canal, nearly sticking in the mud, proceeding a few rods, bumping against the rocky sides, creeping on in consequence of the windings. We discover an ascending steamboat, and we are compelled to back out; no signal, no telegraph, no information of a boat being in the canal is thought necessary. We are delayed an hour, and we again enter this pitiful concern. About half-way there is a splendid bridge of stone over the canal, with an arch about 60 feet over the water. About noon we enter the upper lock chamber. The stonework is splendid, and the whole appointment of the three locks which we pass in immediate succession is creditable to the company. On getting into the Ohio again, we find Shippingport a new village at the canal's mouth, and several first-class steamboats laid up here."

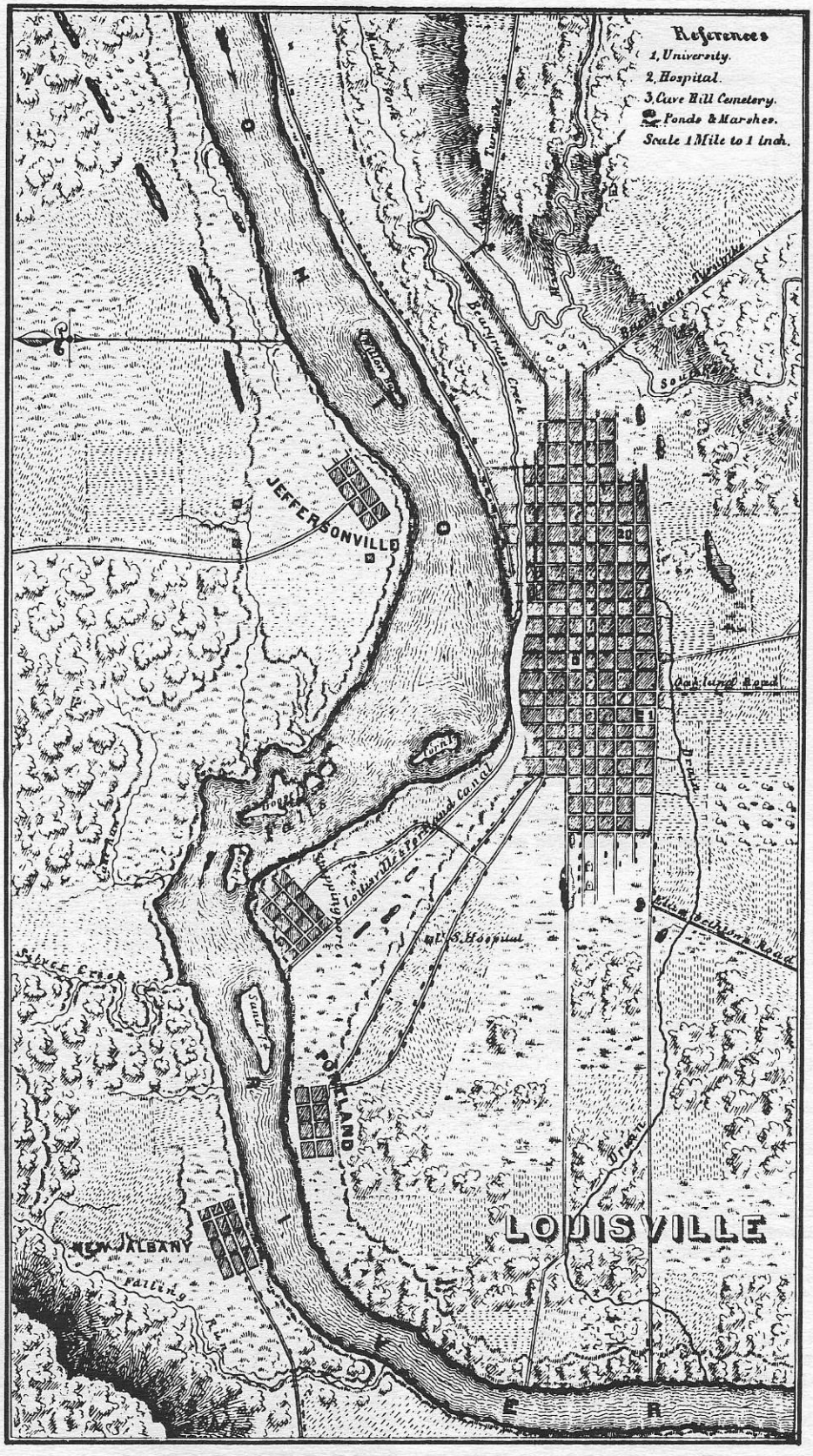
Another description of the canal, with a location map, and a picture of the hazard that necessitated the canal, can be found in the monumental work of Dr. Daniel Drake, of Cincinnati.

Louisville and the Falls of the Ohio.

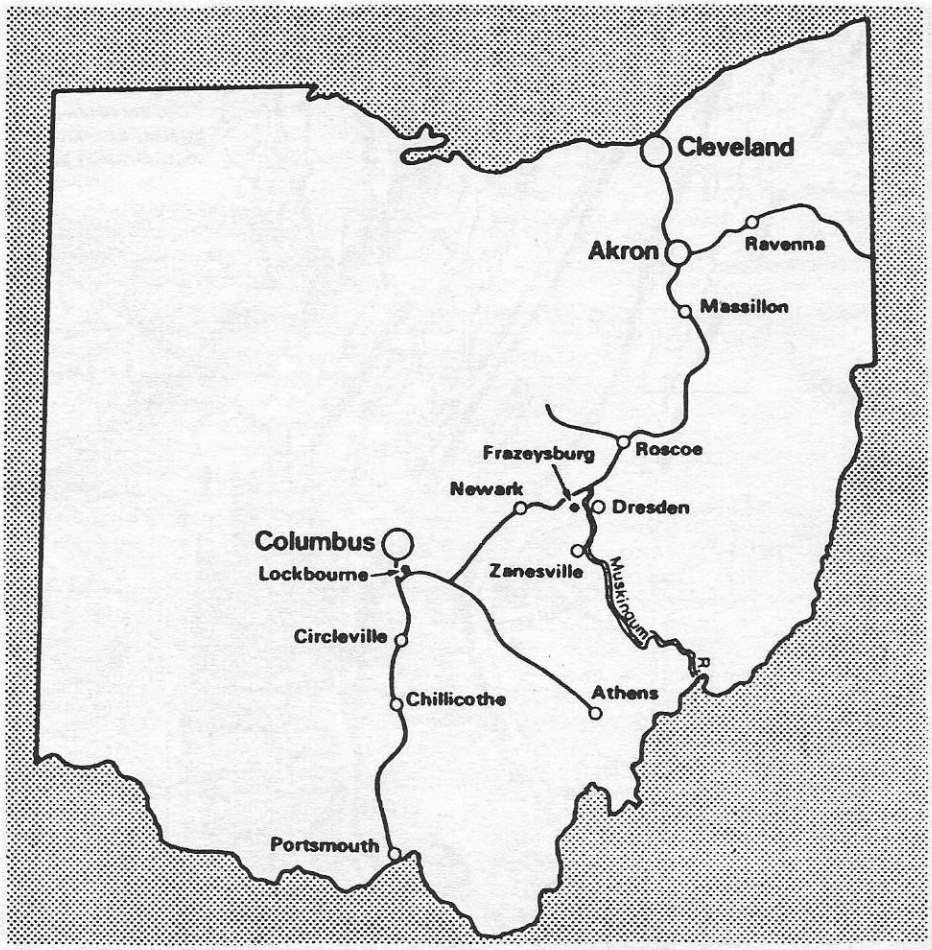
"A Quarter of a mile from the mouth of Beargrass [creek], opposite the lower part of the city, is the head of the Louisville and Portland Canal, which, after running two miles, enters the Ohio below the Falls. The bed of the canal is in solid rocks, the removal of which has given it high and stony banks; but on each side, and especially between it and the river, after the first mile from its head, the bottom is so low as to be subject to annual inundation.

"The entire fall at this time is twenty-five feet nine inches. Above the rapids, the extreme rise of the river, from low water to high water, is forty feet two inches; below, sixty-four feet five inches."

Those wide fluctuations in the depth of the river explain why, at times of flood, it was possible for large steam boats to float "over the falls".



CANAL BOATS TYPES ON THE OHIO & ERIE



Map of the old Ohio and Erie Canal and its connecting waterways.

By Terry K. Woods

The Ohio & Erie Canal was officially opened after a gala ceremony just south of the village of Cleveland on July 4, 1827. Craft that had been lined up at the operating termini of Cleveland and Akron immediately shuttled back and forth to move 1,811 tons of freight and run 6,020 passenger miles before ice shut down boating around Christmas that year.

Nearly all the freight carried on early Ohio & Erie boats was packaged in barrels or baskets. Even the first amounts of coal shipped north to Cleveland from Portage and Stark County mines in the early 30's were counted in bushels. Therefore, nearly everything shipped aboard the early canal boats needed a roof over its head. Almost all the early Ohio & Erie boats, then, were of one major type. This was a craft about 13 1/2′ to 14′ wide, 70′ to 75′ long, constructed of the 'balloon' or framed method and carrying a long, continuous cabin from just a few feet aft of the bow to five feet or so short of the stern on the lower deck. This cabin was 6′ to 8′ high. Its floor, the main deck, was constructed within the hull, about a foot above the boat's flat bottom. A number of large openings on each side of the cabin, with provisions to shutter them against the elements, provided entry and exit for the cargo. Crew members could traverse the top of the cabin, or upper deck, from bow to stern. Hatches near the bow and stern gave the crew access to cargo on the lower deck via ladders below the hatches. There was a bit of secondary deck at the stern near the rudder and some up by the bow. But basically these craft had two decks, the top of the cabin and the bottom of the cargo hold. These boats, then, were two deckers, or since they were run mainly by the various freight lines then operating on the canal, they were often called Line Boats.

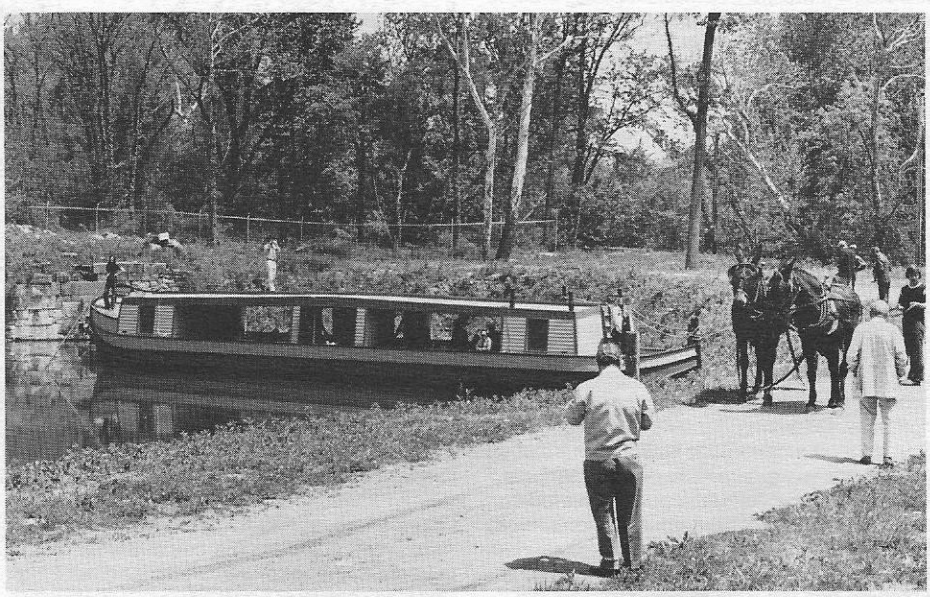
Many of these two-deckers were also fitted up with rather nice bow and stern cabins to carry passengers. Those boats were called Packets by their owners, though they bore little noticeable differences from the majority of the Line Boats. For the first ten years of operation on the Ohio & Erie, even the Packets carried freight, in the long, center space between the passenger cabins. In 1837, actual Express Passenger Packets began operating on regular schedules between Cleveland and Portsmouth. Though these craft no longer had provision for freight, outwardly, their lines differed little from the combination boats except in the size and coverings of their side openings.

Forty five boats were registered on the Ohio & Erie in 1831, two years before the canal was completely opened from Lake to river. It is estimated that approximately 150 craft were operating on the canal by the late 1830's. Most of these were probably Line Boats, either set up just for freight, or for both freight and passengers. It is doubtful if more than a dozen Express Passenger Packets ever ran on this canal at any one time.

At first few, if any, of the Ohio & Erie boats carried their animals on board. Most of the freight and passenger lines maintained way stations where towing animals could be changed periodically. The Financial Panic of 1837 put such a strain on the economy, though, that many of the freight and passenger lines went bankrupt. By the early 40's, those Lines that had survived found it much more economical to carry a change of towing animals in a center cabin right on board. By 1843, even the fanciest of the Express packets carried a stable amidships!

It was probably during the late 1840's or early 1850's that the single deck canal boat made a strong appearance on the Ohio & Erie. Only five boat loads of coal entered the port of Cleveland during the entire boating season of 1831. This number had swelled to 740 by 1847 and 2,299 boat loads by 1852.

It was much easier, and cheaper, to load and unload coal in bulk. A number of Line Boats had their upper decks ripped off to expose the bottom deck and make bulk cargo loading and unloading



The "General Harrison", shown here on a re-watered section of the Miami and Erie Canal at Piqua is a replica of the old three-cabin Ohio freight boat. A roof has been added for the comfort of the 20th-Century passengers.

A 19th-Century photo of an Ohio Packet Boat in the foreground, with a three-cabin freighter tied up just behind it.

possible. Then the boat yards began turning out craft designed specifically to carry bulk cargo on an open deck. Some bit of enclosed cabin was still required, of course. The center stable was, by then, a fixture on any long-run boat. A small cabin at the stern housed the Captain and his cook or any family members he may have carried along. And a smaller cabin in the bow allowed any roustabouts or crew-members to have a dry place to sleep. These boats became known as Three-Cabin Freighters, and because of their open deck and somewhat fuller lines, were able to carry 80 tons of cargo instead of the 50 to 60 tons of the Line Boats. The Line Boat type remained on the canal, but was more commonly referred to as a 'Grain Boat' as that commodity still required a roof over its head.

The Ohio & Erie canal was able to support as many as 1,500 registered boats in the early 60's, but the Civil War years saw that canal's last real importance as a major transportation artery. Practically no canal boats for general use were constructed after the Civil War.

Within 12 years of the end of that War, the canal boat lines on the Ohio & Erie were a thing of the past, driven out of business by fierce railroad competition. Packet boats left the northern division of the canal after 1851, though packets were still running on the southern division between Columbus, Chillicothe and Portsmouth as late as 1874.

Bulk freight traffic remained, though the total number of boats had dropped to 300 by 1878. By now, though, everything was handled entirely by individual owner-captains, running their own boats and operations. The captain would strike a deal with a canal-side industry, usually a coal mine, to run a cargo north. Often a Captain would buy a cargo, to be paid for from receipts obtained when it was sold. The boatmen would then try to peddle his cargo as close to the source as possible, at the paper mills in Massillon, or Akron, or Cleveland. A boatman generally preferred many trips at a smaller profit than a longer trip to Cleveland. If none of the industries along the lower canal needed coal, the Lake Steamers always did, but that meant a long trip to Cleveland and entering the dreaded and dangerous Cuyahoga River. If a load of lumber or paint could be picked up in Cleveland to go south, the longer trip was often worth it. Otherwise a boatman would have to make the return run 'light', or empty.

The Line Boats held sway on the southern division for a few years after the war, shuttling grain to the various mills or the Penitentiary at Columbus. Many of these were converted into three-cabin freighters during the 80's, though the ex-packet, WAVE, was photographed in the 90's in Columbus still as a two-decker.

After the State regained control of the canal system in the late 80's, the ever-present State Boat could be seen, attempting to halt the general decline of the Ohio canal. These were little more than sturdily-built single deckers, complete with small bow and stern cabins, but, since these craft operated close to home port, there was no need to carry a center stable.

During the attempted rebuild of the canal system that really began in earnest around 1907, many of the boatmen scuttled their craft in the existing basins with the goal to raise them when operations could be resumed. For many, this time never came. A few freighters were raised, the cargo space roofed over and they became cook and barracks boats on a slow journey down the canal behind a dredge in the years 1907, 08 and 09. A small number of older, Line Boats and Freighters were converted into Excursion Boats by the addition of a high, long cabin. These, then, carried Sunday School picnickers and Union Group revellers to shady, isolated groves which sprang up at various points along the canal during the 80's and 90's.

A few of the more ingenious mechanics along the canal built small steam launches and made the northern division of the Ohio & Erie their playground.

But for all practical purposes, the canal was dead by the beginning of the 20th century, and the boats remaining, be they Three-Cabin Freighters, Line Boats or ancient Packets, were left to rot into oblivion.

WOODS SPEAKS IN PITTSBURGH

Terry Woods, Chairman of the ACS Engineering Design Committee, spoke this past October before the Committee on Pittsburgh Archaeology and History at the Buhl Science Center in Allegheny Center and before the Maritime Department of the National Trust for Historic Preservation at the Convention Center in Cincinnati.

Terry presented a brief overview of the initiation, construction and operation of Ohio's canal system and then described a number of canal preservation and restoration projects within the state. Terry emphasized how important knowledge of proper canal engineering practices and techniques of the period is in ensuring a better looking, better working and more authentic artifact, structure, or site.

Terry Woods has been asked by the National Trust for Historic Preservation to add a chapter on historic canal preservation to the Trust's 1988 report, "Maritime America: A Legacy At Risk". He would welcome any suggestion or input of any kind from the members of this organization.

NEW CANAL BOAT SLATED FOR WHITEWATER CANAL

An article in the December, 1988 issue of *Outdoor Indiana* by Gary Eldridge, of the Canal Society of Indiana, and Lisa Hoffman, publications assistant at the Indiana State Museum revealed that a new canal boat will replace the old Ben Franklin. She also will be named the "Ben Franklin."

"The red, white and blue canal boat's new design is in the style of the impressive Line Boats that carried cargo and travelers. The boat's superstructure, will be wooden, in keeping with the design popular in the 1800's. The hull of the 74-foot long boat will be fiberglass to improve durability. The new Ben Franklin will hold 80 people."

(From Newsletter of the Canal Society of Indiana)

ERIE CANAL BICYCLE TOUR

Classic Bicycle Tours of Clarkson, New York is offering a bicycle tour along the Erie Canal August 6 - 13, 1989. The tour will begin in Rome, New York at the exact spot where the first shovel full of earth was turned by Governor DeWitt Clinton on July 4, 1817.

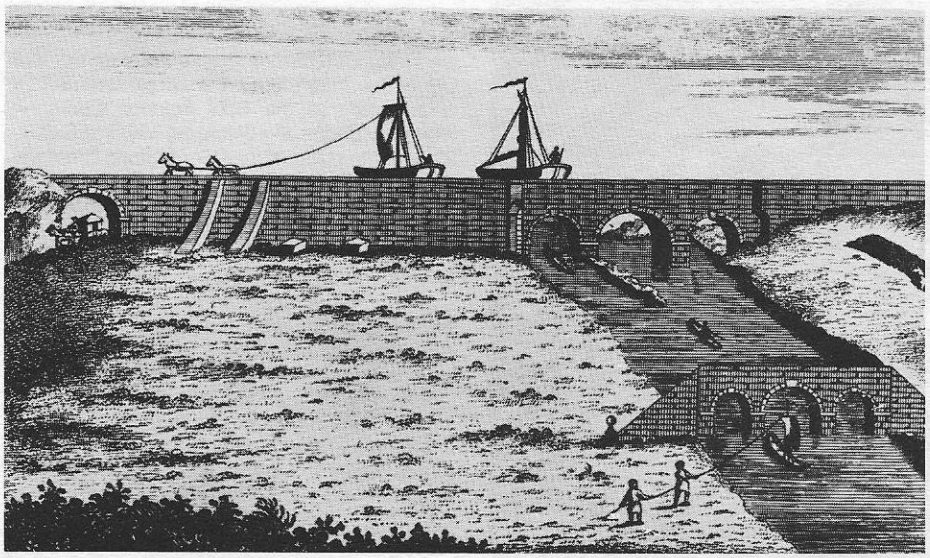
After a visit to the Erie Canal Village and a ride on a horsedrawn canalboat, the bicyclists will follow the Old Erie down to Syracuse. From Syracuse, the tour will continue westward and finish in Lockport, New York with a dinner cruise through the famous Lockport locks.

The tour is billed as a family trip with wonderful educational attractions, level terrain, low daily mileage (30 miles or less) and over half the trip is on canal paths separate from road traffic.

Cost of the tour is $629 (exclusive of travel to Rome, NY). This cost includes accommodations, breakfasts, welcoming and farewell dinners, entrance fees to museums, boat rides on the canal, a support vehicle that carries all luggage, and experienced guides and bicycle mechanics.

For more information write or call (toll free): Classic Bicycle Tours, P.O. Box 668, Clarkson, New York 14430; 1-800-777-8090 or (716)-637-5970.

THE BARTON SWING AQUEDUCT



Brindley's original Barton Aqueduct, completed in 1761, first structure of its kind in England.

By Bruce Russell

The story of the Barton Swing Aqueduct begins in the 1760s with the digging of the Bridgewater Canal in England from Worsley and its coal mines to industrial Manchester. The DUKE OF BRIDGEWATER was determined to earn money by selling the coal from his mines to the foundries and hearths situated 35 miles away. While mules and pack horses could move his "Black Diamonds", the need for transporting ever increasing volumes necessitated a more practical approach. Using his own financial resources the Duke, a well traveled man known for his eccentric and unpredictable lifestyle, ordered that a canal be dug. Thanks to his journeys on the Continent where he had seen France's CANAL DU MIDI built a century earlier by Louis 14th, he had a preconceived notion of how to excavate his own waterway and construct its locks. Furthermore he was endowed with good enough sense to hire JAMES BRINDLEY, a self taught engineer of considerable reputation, to oversee the practical aspects of the design work. The first shovelful of earth was turned in 1759 following receipt of the Royal Assent or charter from Parliment. Soon over 2,000 laborers - mostly Irish immigrants - were removing tons of dirt, rock, and debris. Meanwhile a fleet of wooden canal boats was being built in preparation for the carriage of the Duke's coal.

At Barton the first major obstacle was encountered. Here the Bridgewater Canal would intersect the River Irwell at right angles. The Irwell had been made navigable in the 1600s for small flat bottomed boats, and in conjunction with the River Mersey formed an all water route from Manchester to the port of Liverpool on the Irish Sea. A means had to be found of allowing the Bridgewater Canal to pass over the river. Initially Brindley had proposed the erection of guard locks on either side of the Irwell. After exiting the canal through one set the boats would be pulled to the opposite bank by means of a rope mechanism. Here they would reenter the canal through another guard lock. However the number of coals boats on the Duke's canal was expected to be substantial, and use of the aforementioned guard lock-rope ferry system might result in disruptions to the flow of navigation. Consequently the bold decision was made to erect an aqueduct over the River Irwell at Barton.

Based on the design of similar structures on France's CANAL DU MIDI, the first Barton Aqueduct was finished in 1761. Consisting of three stone arches, it was 600 feet long and 36 feet wide which meant that two vessels could pass one another while on it. Innovative methods were used to sink the foundation piers, and when done it stood 40 feet over the Irwell, thus giving river-boats below ample clearance. The aqueduct at Barton was an instant tourist attraction and people came from great distances to view the sight of one boat passing over another on two distinct bodies of water - one natural and one man-made.

For over a century the Bridgewater Canal and its aqueduct at Barton served as a conduit for the economical movement of substantial quantities of coal plus other assorted commodities. Long after other aqueducts such as Pontesyllte and Marple in Wales surpassed it in size and height it remained a regional attraction. Little maintenance was required on the aqueduct, so sturdy had been its construction. From time to time its sandstone blocks were repointed and the inner trough relined to prevent leakage of water into the structure below.

As the 19th Century drew to a close the economic rivalry between Liverpool and Manchester intensified. Liverpool had the advantage because of its proximity to the sea, while Manchester was 26 miles inland. Manchester merchants had to absorb the cost of shipping their finished goods to the former city by rail. However some of them conceived of a scheme to remedy their plight.

A narrow-boat transits the closed Aqueduct on the old Bridgewater Canal. (Bruce Russell photo.)

What the Manchester merchants had in mind was a complete reconstruction of the shallow IRWELL & MERSEY NAVIGATION so that ocean going ships could utilize it. Most of the improvements would be concentrated on the Irwell. By the 1880s the technology to embark upon such an ambitious project was in existence. The building of the canal across the Isthmus of Suez proved that machines were capable of excavating millions of tons of earth to create a waterfilled channel deep enough for the world's largest ocean going vessels. All that was required was sufficient capital, and in the case of Manchester this was forthcoming.

In 1880 the MANCHESTER SHIP CANAL COMPANY was formed. Under the direction of EDWARD LEADER WILLIAMS, designer of the boat lift at Anderton, the last canal to be built in the British Isles gradually began to take shape. Williams, one of the foremost civil engineers of the late Victorian epoch, recruited a veritable army of laborers primarily from Ireland. These men toiled beside giant steam powered shovels and excavating devices to carve out the channel of the MANCHESTER SHIP CANAL. Much of the bed of the River Irwell was utilized. Williams and his associates widened, deepened, and straightened this natural stream. Concrete rather than trational sandstone blocks were used to form retaining walls and locks so that gradually the River Irwell came to resemble a man-made creation rather than a normal watercourse. In many locations an entirely new channel was constructed, and the original bed of the river was filled in.

The major obstacle standing in the way of creating a deep water canal straight through to Manchester was the BRIDGEWATER CANAL whose aqueduct at Barton had only a 40 foot clearance. All of the improvements to the River Irwell would come to naught if Brindley's 1761 three-arch structure wasn't removed. There was no thought of abandoning the BRIDGEWATER CANAL, which in the 1880s still carried enormous amounts of coal. Instead the only solution was to completely rebuild the aqueduct so that waterbourne commerce could flow on both canals.

During the 1800s, thanks to the Industrial Revolution, technological and engineering advancement had occurred on both sides of the Atlantic. Williams was familiar with Roebling's suspension aqueduct which carried the DELAWARE & HUDSON canal across the Delaware River at Lackawaxen, Pa. Initially he flirted with the notion of erecting a similar structure at Barton to carry the Bridgewater Canal over the newly built, much wider Manchester Ship Canal at a height sufficient to permit passage of large seagoing ships with their tall masts and funnels. Unfortunately the problem with this solution was that it necessitated the building of a steep flight of locks on either side of the suspension bridge to gain for sufficient elevation.

After studying the situation for several additional months Williams arrived at an ingenious solution never previously attempted in Britain or anyplace else. What he proposed to the MANCHESTER SHIP CANAL COMPANY was a MOVABLE water filled aqueduct which would carry the Bridgewater Canal and its narrow boat traffic over the MAN-

CHESTER SHIP CANAL at grade at times when there was nothing passing beneath. When an ocean-going ship appeared on the lower canal, the aqueduct would swing open to form two wide channels on either side of a central pier. In this fashion even the largest and tallest freighters could pass through Barton without having to worry about clearance problems. Williams first built a small working model of his proposed rotating, water filled aqueduct, and it met with unanimous approval.

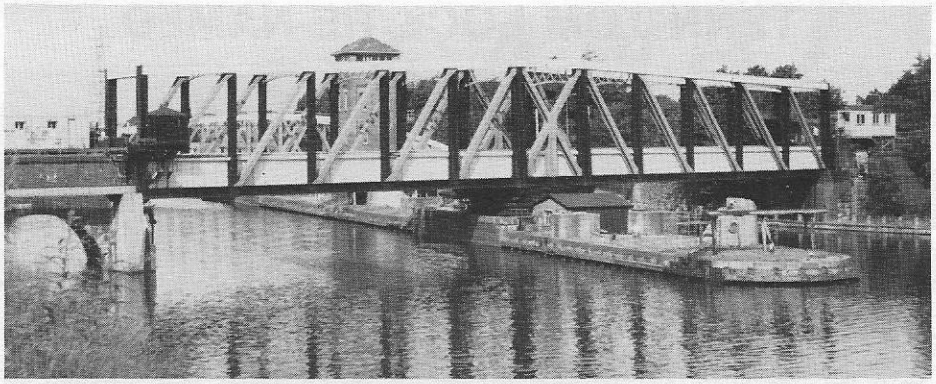
Initially it was thought that whenever the structure was going to be pivoted the water in the movable trough would have to be drained in order to reduce its weight. Instead Williams designed his BARTON SWING AQUEDUCT, as it soon came to be called, in such a fashion that it would retain its supply of water irrespective of its position. Thus while it was intended to pivot 90 degrees to create an unobstructed path for the Manchester Ship CANAL, it would retain 800 tons of water.

In 1884 final plans for the swing aqueduct were approved, and construction commenced. At this juncture the 1761 stone aqueduct was removed since it occupied the exact location where its successor would stand. The next step involved creation of an artificial island in the middle of the MANCHESTER SHIP CANAL which would contain the base of the rotating superstructure of the aqueduct. The trough and supporting beams were made of wrought iron rather than steel because the Bessemer process had not yet come to Britain. However this material was deemed adequate to support the great weight involved. Also on this island was a control tower where an operator could observe both waterways simultaneously.

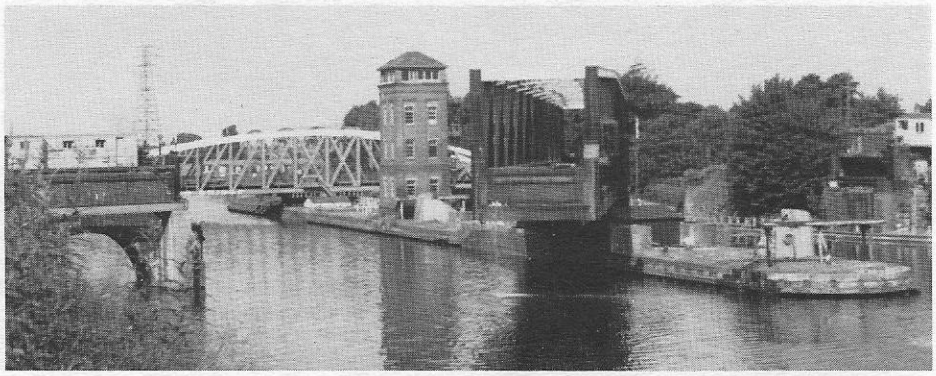
After nearly 10 years of work the Barton Swing Aqueduct was dedicated in 1894 and was immediately hailed as one of the outstanding engineering accomplishments of the late 19th Century. Equally amazing was the fact that during the construction phase traffic was able to continue almost uninterrupted on the Bridgewater Canal by means of temporary channels and locks plus other arrangements now forgotten. The three coldest months of the year when canal traffic ordinarily stopped also provided an opportunity to accomplish a large amount of work. Once the Swing Aqueduct began operations it became a tourist attraction much as its predessor 130 years earlier.

How does the Barton Swing Aqueduct manage to retain its 800 tons of water each time it is opened? A system of watertight gates close the ends of the tank (or trough) as well as the two abutting ends of the Bridgewater Canal. When the great aqueduct is to be repositioned the operator in the control tower activates hydraulic machinery which shuts these water tight gates, and the water filled trough (234 feet long, 19 feet wide, 6 feet deep) slowly rotates so that it assumes a position in line with the ship canal. When the moving structure, weighing 1450 tons (including 800 tons of water), is repositioned into its original alignment the small gaps between the Bridgewater Canal and the trough are sealed by giant U shaped rubber faced wedges forced into position by powerful rams. Were it not for these sealing devices the gaps between the Bridgewater Canal and the movable trough would be continuously leaking water. However without these gaps the structure couldn't be moved. The application by Williams of the principles of hydraulics is one of the more impressive aspects of the 94 year old Barton Swing Aqueduct.

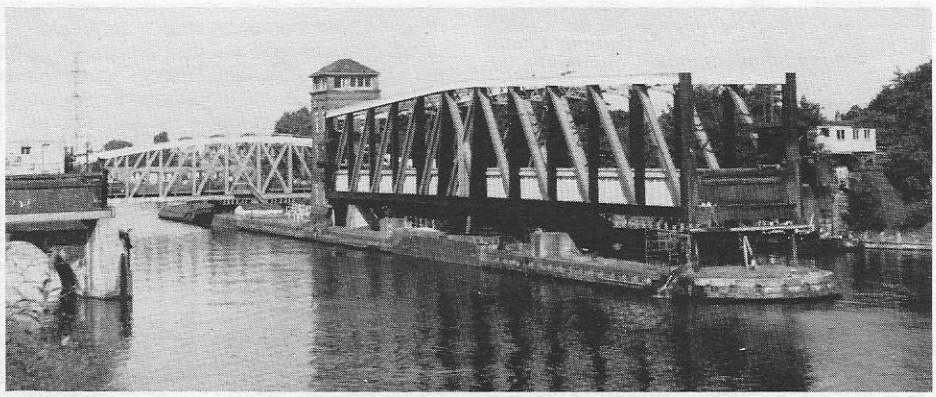
Hydraulic machinery likewise does the labor of turning the trough which revolves on 64 gargantuan roller bearings situated on the central island. When in movement these rollers are relieved, by some 900 tons, of the great weight of the superstructure by the upward thrust of a central hydraulic press.



The Barton Swing Aqueduct in the closed position, allowing boat traffic to proceed on the Bridgewater Canal. On the left can be seen a surviving arch of the old 1761 aqueduct, built by James Brindley. (Bruce Russell photo.)



The Aqueduct is shown turning on its pivot on the island in the center of the Manchester Ship Canal. Note water-tight gate facing the camera. The control tower is clearly visible on the island. (Bruce Russell photo.)

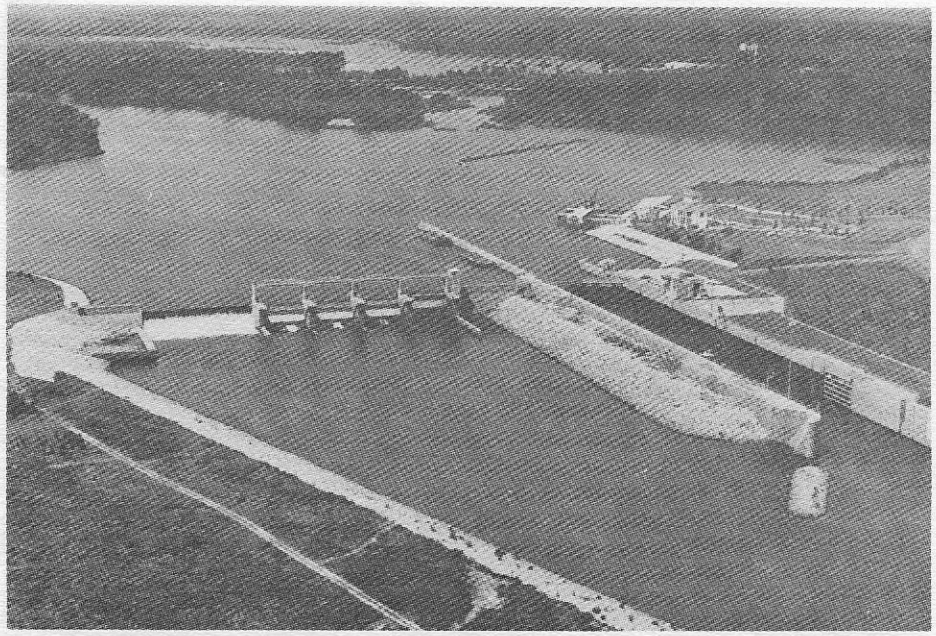


Here the Aqueduct is shown in its full open position to permit ocean-going ship traffic to pass through the Manchester Ship Canal below. The road bridge shown in the background also pivots. The tower controls both bridges. (Bruce Russell photo.)

During its first five decades the Barton Swing Aqueduct was extremely busy, with narrowboat traffic on the Bridgewater Canal passing over it on an almost uninterrupted basis. Meanwhile Manchester achieved its long-sought ambition of becoming a major inland port for seagoing vessels. Openings and closings were a frequent occurrence during the course of the day. After World War II coal declined as a fuel, highway transportation improved, and use of the Bridgewater Canal for commercial traffic became nil. Fortunately loss of the coal carrying narrow boat traffic was partially compensated for by increases in pleasure travel. Many itineraries of vacationers included passage over the aqueduct at Barton.

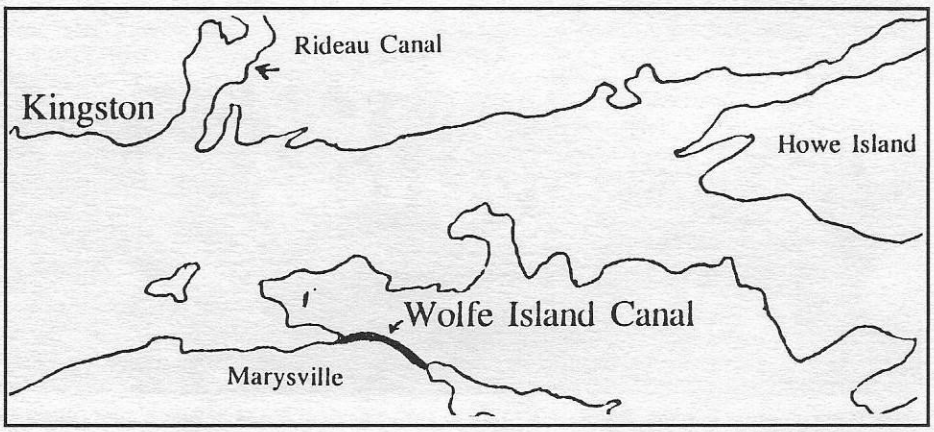
In addition to the reduced usage of the narrowboat canals such as the Bridgewater, commercial traffic on the Manchester Ship Canal is also evaporating. A combination of Britain's retrenchment in many spheres, the loss of Empire, the rise of Liverpool as a container port, and various other factors have mitigated against the once great ship channel. By 1980 traffic had fallen to such an extent that abandonment was being discussed as a practical means of saving on maintenance expenses. Were this to occur, the rotating machinery would be removed and the giant trough permanently bolted into place. Of course business would continue uninterrupted on the Bridgewater Canal, but it would no longer be possible for a seagoing vessel to reach Manchester. As part of the dismantling of the Manchester Ship Canal, all of its locks would either be closed or converted into spillways.

TENN-TOM LOCK RE-NAMED



At ceremonies April 9, 1988, the Aliceville Lock and Dam of the Tennessee-Tombigbee Waterway was re-named the Bevill Lock and Dam in honor of Alabama Congressman Tom Bevill. Bevill has represented Alabama's Fourth Congressional District since 1967 and is Chairman of the House Energy and Water Resources Subcommittee. The Bevill facility is one of ten locks and dams on the 234-mile Tenn-Tom Waterway, which was opened to traffic in early 1985.

RESTORATION OF WOLFE ISLAND CANAL



From the 1780s onwards, the mile and a quarter portage between Barrett Bay and Bayfield Bay was used as a short-cut from Carleton Island and Cape Vincent to Kingston. A petition, asking for a canal across the isthmus of Wolfe Island, was sent to Upper Canada in February 1834. In 1851, an Act to incorporate the Wolfe Island Railway and Canal Company was passed. Work on the canal began in 1852 and was completed in 1857.

The canal was originally designed for barge traffic carrying such items as timber, and hay for the horses pulling the New York City street cars. A wooden swing bridge was built to link the easterly and westerly sections of the island. The canal was becoming a busy commerce route and by 1868 there was a regular ferry service by the steamer "Wren". Between 1868 and 1870, the canal was deepened from a four to a seven foot draft to accommodate large steamers. In 1872, Henry Folger increased ferry service by purchasing the steamers "Pierrepont", "Maude" and "Geneva". These ships provided transportation between Kingston, Wolfe Island, Garden Island and Cape Vincent. The steamer "Maude", with a length of 153 feet and a capacity of 650 passengers, was one of the largest steamers to pass through the canal.

The canal was kept open until 1892. With the decline of the "steamboat era" by the turn of the century, the canal fell into disrepair, although still used by small craft. In the 1930s, the bridge was replaced by culverts which effectively stopped boat travel. If the Wolfe Island Canal is reopened, it will provide safe passage for fishermen and boaters, and promote tourism in the area.

(Friends of the Trent-Severn Waterway)

CANAL CALENDAR

March 18, 1989 — Eighth Annual Canal History and Technology Symposium, Kunkel Hall, Lafayette College, Easton, Pa. Contact Canal Museum, P.O. Box 877, Easton, Pa. 18044.

April 14-16, 1989 — Annual meeting and tour of the Virginia Canals and Navigations Society in Buchanan, Virginia. Tours from Buchanan to Eagle Rock - two days. Write: Sylvia Brugh, Route 5, Box 132, Troutville, Virginia 24175.

May 6-7, 1989 — Spring Tour of the Canal Society of Ohio. The Whitewater Canal and its extension in southwestern Ohio. Tour headquarters will probably be Harrison, Ohio. Contact: David A. Neuhardt, P.O. Box 1817, Dayton, Ohio 45401.

May 6-7, 1989 — Spring Field Trip of the Canal Society of New Jersey, Pennsylvania canals in the Susquehanna Valley, Bob Keintz, tour guide. Contact: Bill Moss, P.O. Box 127, Fanwood, NJ 07023.

May 19-21, 1989 — Canal Society of New York State Spring Field Trip and meeting. Cayuga and Seneca Canals from Geneva to Montezuma. Contact: Waldo Nielsen, 343 Eaton Rd., Rochester, NY 14617

May 20-21, 1989 — Canal Society of Indiana Annual Meeting celebrating eight years since founding. Ft. Wayne, Ind.

May 26-29, 1989 — American Canal Society Tour of the Canals of New England in cooperation with the Middlesex Canal Assn. Tour headquarters, the new Hilton Hotel, Lowell, Mass. Contact: Bill Gerber, 16 Princess Ave., Chelmsford, Mass. 01863.

June 1-4, 1989 — 18th Conference of the Society for Industrial Archeology, Quebec City, Canada. Write Conference Committee, 12 Rue Sainte-Anne, Quebec, G1R 3X2, Canada.

August 6-13, 1989 — Bicycle Tour along the old Erie Canal. Write: Classic Bicycle Tours, P.O. Box 668, Clarkson, NY 14430.

NEW VISITORS' CENTER OPENS

On Tuesday, September 27, formally invited dignitaries and guests attended dedication ceremonies for the new Visitors' Center Building and its parking area and access road. The facilities were built by the Parks Department construction staff in its first phase of new development in the D&H Canal Park, as announced by Graham M. Skea, Commissioner of the Orange County (NY) Department of Parks, Recreation and Conservation.

The new handsome structure is close to the buildings that house the Neversink Valley Area Museum, in Cuddebackville, NY.

Mr. James F. Smith, Chairman and Chief Executive Officer of Orange and Rockland Utilities, Inc., presented to Orange County a deed to a nine-mile stretch of the D&H Canal towpath. This segment, which runs from Port Jervis to Westbrookville, is planned for hiking and bicycling uses, and will connect with State and Sullivan County property to create a "Greenway." Ultimately, this outdoor facility may reach all the way to Kingston.

A highlight in the new center will be the exhibit of a model of Roebling's Neversink Aqueduct, which has been built to scale by Museum member Jim Bennett. In the future, the center will be available for public use by permit.