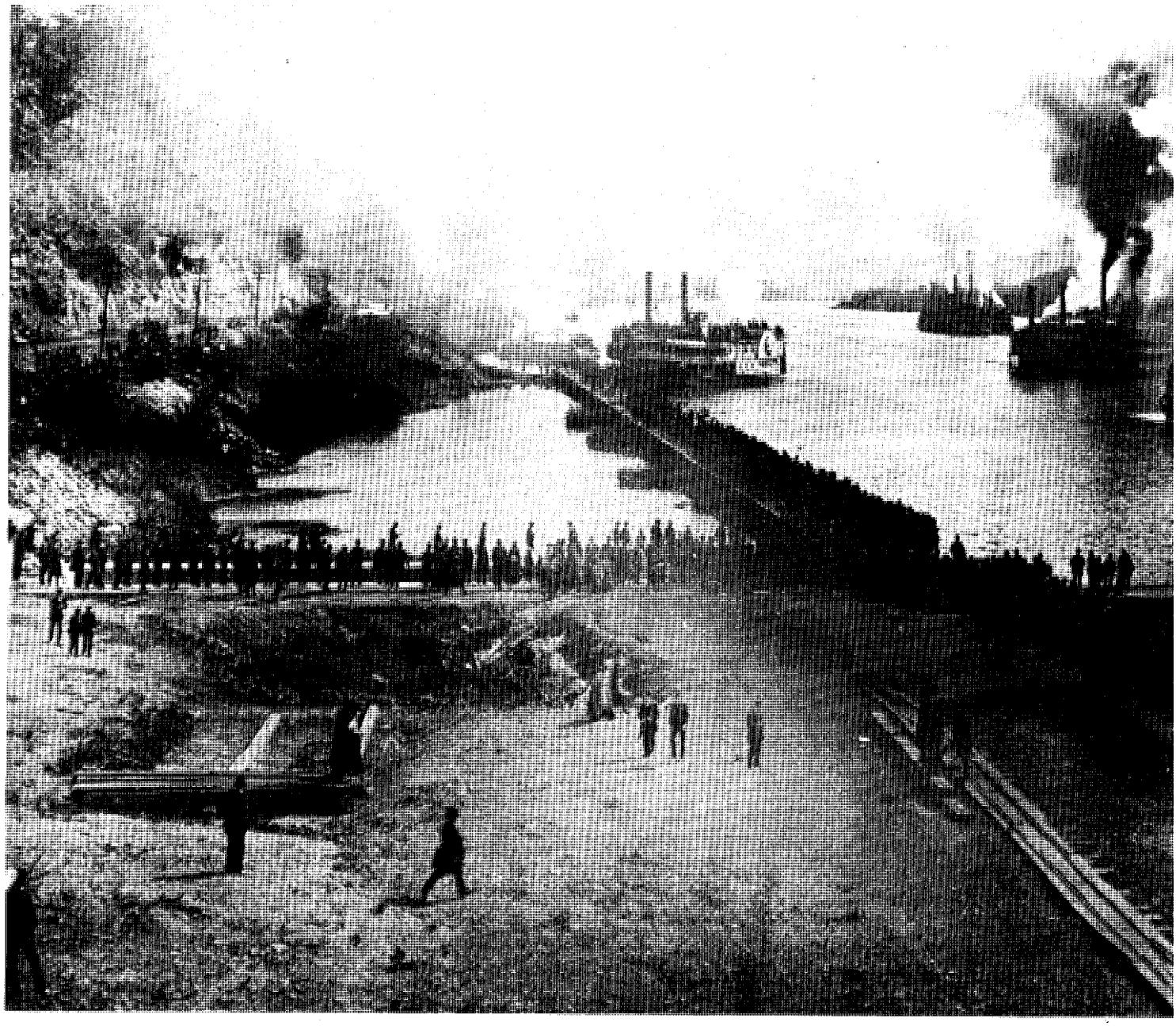


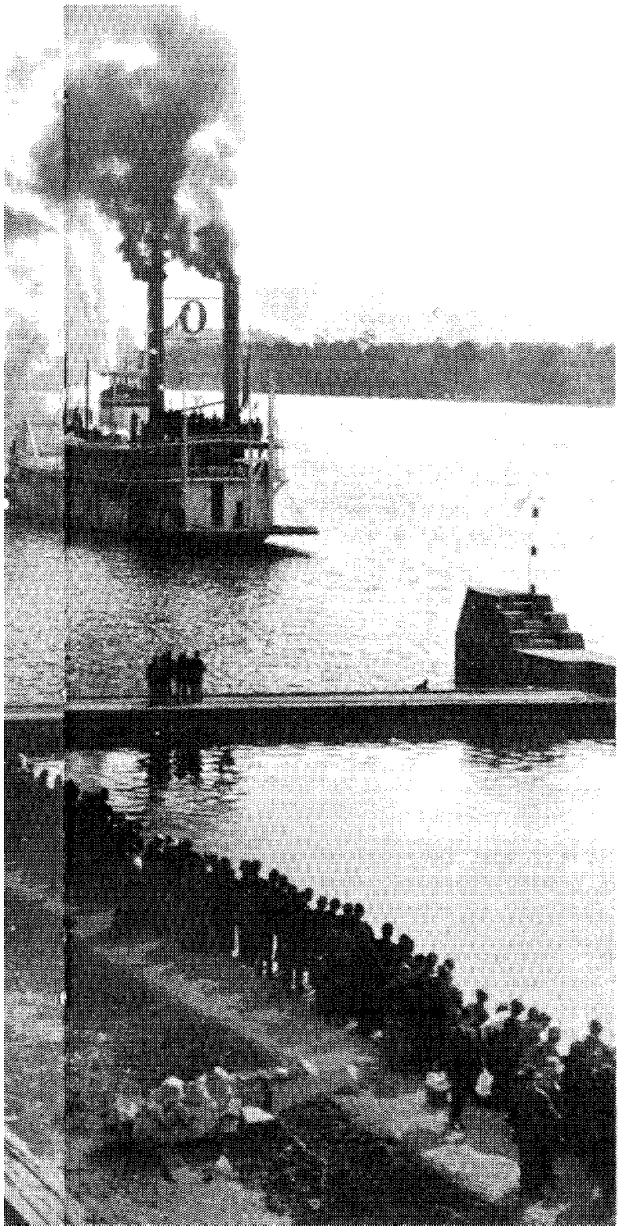
DAVIS ISLAND
LOCK AND DAM

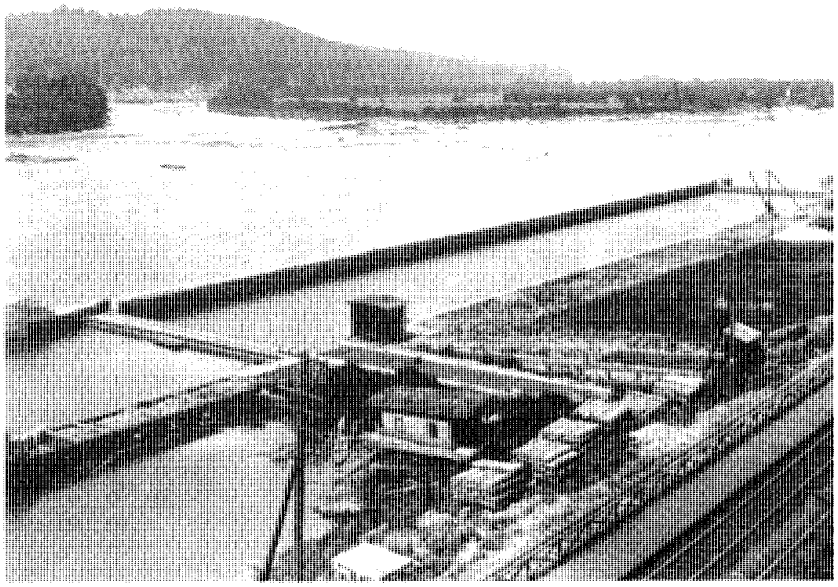
Chapter 9

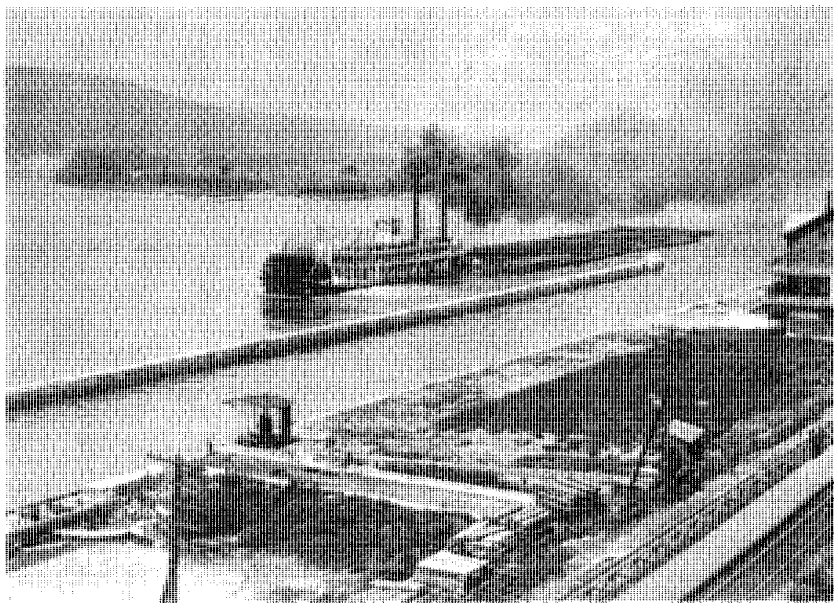
THE RADICAL PROJECTS

Raw October wind cutting through his uniform and chilling his old warwound made "Padre" Merrill squirm in his chair, but he suffered stoically while the interminable speeches continued. Captain Charles W. Batchelor had spoken first, followed by a line of others, and now Daniel Agnew, standing on the bow of the *Geneva*, was delivering a spreadeagle attack on railroads. "Rivers," Agnew shouted to the people crowded around Davis Island Lock, "take no taint of dictation from boards of directors, no corruptions from combinations, no discrimination, no favoritism, no rebates or drawbacks. How grand is this freedom from watered stock, bloated bonds, oligarchal control, arbitrary regulation, and insolent officialism!"

Colonel Merrill lost interest in the speech. He had waited fifteen years for this day, but though clouds parted, rains ended, and the sun brightened the dedication day pageant, October 7, 1885, had been a miserable day for him. At 11:00 that morning, when the 39 flag-bedecked packets and towboats with whistle cords tied down had set off from the Monongahela wharf, with fifty thousand people lining the river bluffs to watch, Merrill had heard the booming salutes from artillery on the bank suddenly stop and shrieks come from the crowd. A cannon had fired prematurely while a gunner was ramming a powderbag down the barrel; the ramrod severed the gunner's hands at the wrists and its splinters spiked into the crowd of spectators. Most people crowded aboard the steamboats were unaware of the accident, however, and the celebration of completion of







The dedication
Dr. Leland R. Johnson

Above: Normal operation
Below: Flood stage

Louisville District

Davis Island Lock and Dam, No. 1 on the Ohio River, continued.

The mayor, the city council, local congressmen, and every civic and business organization in Pittsburgh were aboard the steamboat flotilla, except the Pittsburgh Coal Exchange whose opposition to the project had not ended. Merrill traveled aboard the flagship *Geneva* with Captain Batchelor and the Chamber of Commerce. He stood at the rail and watched closely as the boat crossed Glasshouse Ripple, the riverman's nemesis at Brunot Island that had ripped the bottom from a thousand boats. The *Geneva* and the steamers that followed, some drawing more than five feet of water, passed across the ripple without scraping, and Merrill was then certain the obstruction was gone forever.

The fleet finished its five-mile trip at noon, moored above Davis Island Dam, which had been raised a few days before, and William Martin, resident engineer at the dam, boarded the *Geneva* and took Merrill off to the side, alone.

"Colonel, we won't be able to lock you through," Martin said in a near whisper.

The Colonel's face flushed red. "What!" he exploded, and then lowered his voice when people turned to stare. "Why don't you have the lock in order?"

"The pump broke, Colonel, and we couldn't get enough water into the storage tanks to operate the valves. We can open the upper gate and let you into the chamber, but that's it. You couldn't get far below the lock anyway. The river is too low."

"How long will repairs take?" Merrill asked.

"One, maybe two days," Martin replied.

Merrill grimaced, raised his hands in a gesture of despair, and told Martin: "Let's get on with it."

Martin gave the signal, the upper gate creaked and groaned as the chains tightened and rolled back into its recess. The *Geneva* followed by five boats steamed into the lock chamber, and the speeches began.

"Water, glorious water! Free as air, pure as the snowflake, refreshing as the dew dancing in the sunlight, and plentiful as the flow of Heaven." With that, Daniel Agnew finished his peroration. The applause snapped "Padre" Merrill back from his memories. He stood and walked to the bow of the *Geneva*, determined to make it short.

"Let us hope," Merrill said, "that this celebration is but the forerunner of many similar ones until our beautiful river becomes the permanent home of a steady and beneficial commerce and the ancient slur that it is dry all summer fades into oblivion." He thanked the politicians, the Ohio River Commission, and the Pittsburgh ironmasters for their support of the project, especially Harry Oliver, who had "snatched victory from the jaws of defeat." Merrill's son--it was his twelfth birthday--stepped to the flagstaff and briskly hoisted the banner to the top; and as the red, white, and blue snapped in the crisp October wind Colonel Merrill closed the ceremonies, saying: "In the name of the United States, I now declare the Davis Island Lock and Dam to be open to navigation. *Esto perpetua.*"

The recommended improvements Dr. Leland R. Johnson

The lock, however, was not opened until the following day, after William Martin made the repairs. That afternoon, the Pittsburgh *Evening Penny Press* reported with apparent glee: "An insignificant little market boat was the first of the river craft to pass through Davis Island dam. The honor intended for the Chamber of Commerce was captured by a boatload of cabbages." Perhaps the coincidence was appropriate, for major benefits of the Davis Island and Ohio River canalization project went not to elaborate passenger packets but instead to tows of bulky commodities and to the very interests that so opposed the project that they did not participate in the dedication ceremony. Opposition to locks and dams on the Ohio in 1885 was still so strong that Colonel Merrill decided not to "press the matter until the pioneer dam has fully demonstrated its usefulness."

Slackwater for the Ohio When Colonel Merrill arrived in Pittsburgh in 1870, he found a report left by William Milnor Roberts recommending "radical" improvement of the Ohio by construction of 66 locks and dams to supply six-foot slackwater from Pittsburgh to Cairo. Rivermen jeered at Roberts' plans, but Merrill continued the investigation, looking also at alternate plans.

First, there was the plan presented by Professor Benjamin S. Roberts of Yale, who had defended Clarksburg against the Jones-Imboden raid during the Civil War. Professor Roberts suggested diversion of water from Lake Erie to the Ohio through the

Mahoning and Beaver rivers, or perhaps by pumping Erie water into Lake Chautauqua and sending it down the Allegheny to increase Ohio River flow during droughts. Merrill rejected that idea when he learned the upper Ohio River was above the elevation of Lake Erie and when he calculated it would require 300 pumps at an initial cost of $625 million to move significant quantities of Erie water into Lake Chautauqua.

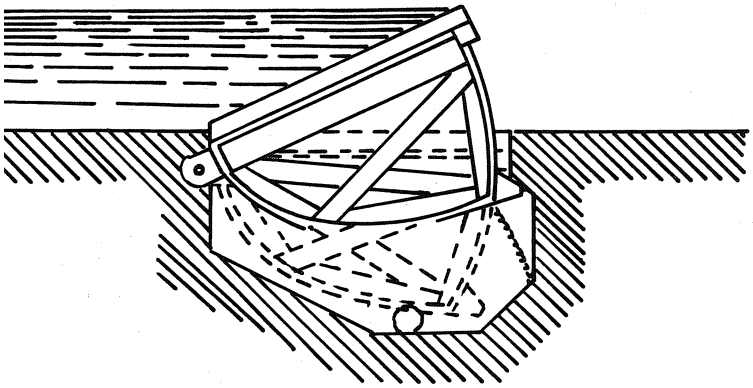
Second was Charles Ellet's reservoir scheme, which had not died with its author. William Milnor Roberts again rejected the Ellet concept in 1870 and Colonel Merrill agreed. Loss of farmlands, mines, industries, railroads, and highways in the valleys where reservoirs would be constructed was considered objectionable to begin with, and costs of relocation and land acquisition would be great, in fact prohibitive in the 1870's when Congress had difficulty funding single locks and dams. And, though reservoir releases could benefit navigation on the Ohio, the dams would block navigation on tributary streams, where traffic was still important economically in the 1870's. Engineering was also a problem. "How can one build a dam a hundred feet high," asked Merrill, "when we have difficulty building fifty-foot dams that are watertight?"

Third plan presented was that of General Herman Haupt, who obtained support in the postwar years for his idea from the Pittsburgh Chamber of Commerce. General Haupt, with his prestige increased by his service as director of Union military railroads, vigorously pressed his idea upon Colonel Merrill. He still advocated building a canal downstream alongside the river with low cross dams to divert waterflow into the canal; he added an automatic sluice patented by Alonzo Livermore that would be installed in the dams to drop at high water and allow coal tows to pass through without lockage. Merrill disapproved of the idea because of its high cost and because a canal would be damaged by floods.

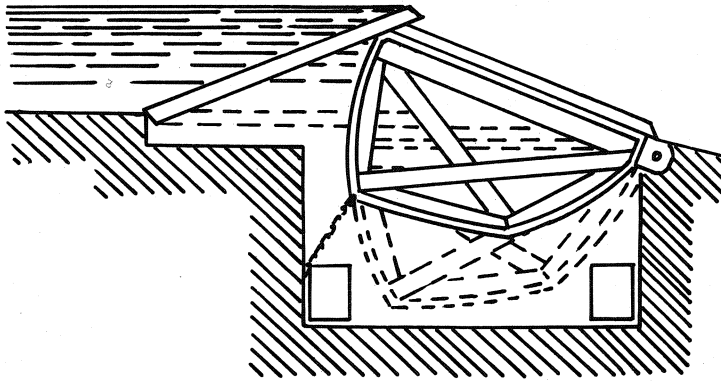
Colonel Merrill concluded that alternate plans would not serve so well as locks and dams. Slackwater navigation was an effective solution, proven on the Monongahela and many other streams, that would cause minimum flowage damages, establish riverport harbors, and, most important, cost least. Merrill recommended in 1872 that construction of a slackwater system for the Ohio River commence with the first lock and dam below Pittsburgh and proceed in general downstream order.

The slackwater plan met distinct hostility from coal shippers and towboatmen. Dams would obstruct open-channel navigation and require breaking tows for lockage; rivermen feared the system would require them to break their tows fifty or more times for lockage on the downriver trip. If Colonel Merrill were allowed to proceed, they contended, it would "utterly ruin and annihilate the entire towing system." Rivermen organized torchlight protest marches in Pittsburgh, and, despite the successful operation of locks and dams on the Monongahela, spread rumors that sewerage and garbage dropped into the river at Pittsburgh would convert "stagnant" slackwater pools into cesspools, sources of epidemic disease. With the sole exception of Captain John A. Wood, all members of the Pittsburgh Coal Exchange and the Steamboatmen's Association preferred continuance of the open-channel project and argued that locks and dams would be "unwise meddling."

Merrill found support from General James K. Moorhead, the Ohio River Commission, and iron prince Henry W. Oliver. Though accused by rivermen of seeking to dam the river to keep coal at Pittsburgh for his mills at depressed prices, "Harry" Oliver wanted slackwater because water supply for his Ohio River plant was inadequate in summer months. He worked through business and civic organizations to get the project underway. General Moorhead became chairman in 1872 of the Ohio River Commission, consisting of delegates appointed by governors of Ohio basin states, and began annual treks to Washington to urge approval for Ohio River slackwater. "Whilst millions are appropriated annually for seacost and lake harbors, piers, lighthouses, &c., we sometimes get a pitiful fifty thousand dollars for the Ohio River," General



Brunot's gate



Brunot's gate with upstream apron

Moorhead complained. "Congress has just voted four millions of dollars, very properly, for public buildings lost in the Chicago fire;" he reasoned, "why not with equal propriety vote a few million for good navigation on the Ohio and benefit ten states of the Union?"

Farmers in the 1870's were worried by high rail rates charged for grain and farm produce shipments. Colonel Merrill shared their concern and thought the issue had wide social significance. "Money expended in transportation is money wasted," he said, "inasmuch as it adds nothing to the intrinsic value of the thing transported." He thought waterways transport could reduce the price of wheat, and he argued: "Cheap bread is a guarantee against such starving mobs as began the French Revolution, and in these days when the poor are said to be growing poorer, it is a matter that deserves most serious attention. A nation can well afford to expend large sums in assisting the masses to earn their daily bread without excessive labor."

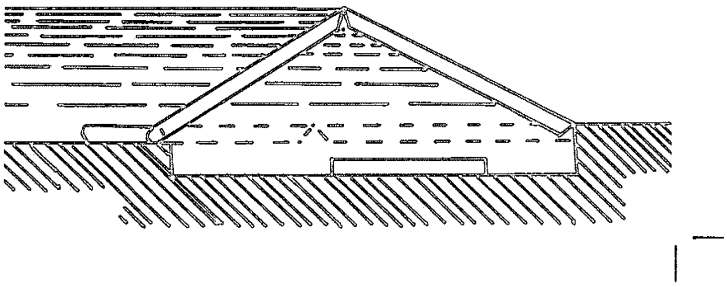
Merrill testified before the Senate Committee on Transportation Routes to the Seaboard, the "Windom Committee," formed to develop plans for reducing transportation costs for grain and other commodities, and presented the case for slackwater on the Ohio effectively. In 1874 the Windom Committee recommended construction of a six-foot slackwater project from Pittsburgh to Cairo, along with study of canal routes from the Ohio basin to the seacoast, as a means of reducing the price of bread.

Planning Davis Island Dam To placate hostile rivermen, Colonel Merrill turned to the idea of movable dams that would be raised to hold water during droughts and be lowered at high water to pass coal fleets without lockage. He sent his deputy, Lieutenant Frederick A. Mahan, to Europe for on-site studies, while he personally translated literature about British, French, Russian, and German waterways engineering, eventually publishing his translation in paperback as *The Improvement of Non-Tidal Rivers. Memoirs of S. Janicki, L. Jacquet, A. Pasqueau.* He also began experiments and model studies of movable dams and chutes proposed by Americans.

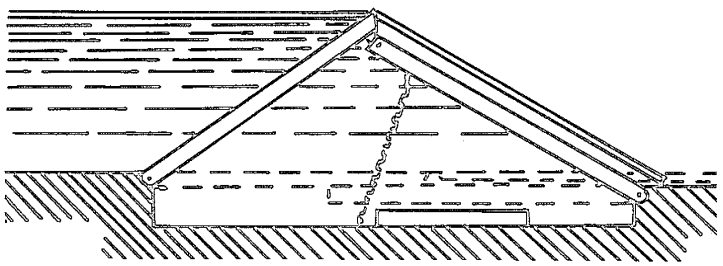
River captain John A. Wood submitted plans for gates raised or lowered with a chain and axle system located in a masonry foundation beneath the gates. S. M. Petitdidier, assistant engineer on the Monongahela, sent plans for wooden gates moved up and down by counterweights in masonry piers. Philip J. Schopp, superintendent of the Louisville and Portland Canal, suggested triangular caissons operated by hydraulic pressure. Model studies showed those plans unsuitable because of their complexity, friction, or operational power requirements, but Merrill became interested in plans submitted by John DuBois and Felix R. Brunot.

John DuBois, a rugged lumberjack who made millions driving logs down the Susquehanna and Allegheny rivers and their tributaries, had patented a beartrap gate in 1862 for use as a splash dam to flush logs and rafts downstream. Invented by Josiah White on the Lehigh River in 1818, the beartrap gate, so named because it somewhat resembled the deadfalls used by pioneers to trap wild animals, consisted of two wooden platforms or leaves hinged between piers in an opening or chute in a dam. The two leaves could be raised to an upright inverted "V" position forming a dam by allowing water from the upper pool to flow through culverts into the space beneath the leaves. Closing the culverts stopped flow under the leaves and allowed them to collapse against their foundation. Colonel Merrill inspected the modified beartraps John DuBois had in operation on Sandy Lick Creek near Dubois, Pennsylvania, and on the West Branch of the Susquehanna. He thought the Dubois beartrap had potential, but noted the wooden leaves had a tendency to warp on rising.

Merrill also became interested in the hollow metal caissons invented in 1867 by Felix R. Brunot, for whose father the first island in the Ohio below Pittsburgh was named. Brunot had assisted Milnor Roberts in planning the Monongahela slackwater project and had become president of the Allegheny



Bear trap with DuBois' apron



DuBois modification

Valley Railroad and director of the Monongahela Navigation Company. The mainspring of Pittsburgh humanitarian organizations for years, Brunot had chartered steamers in 1862 to deliver surgeons and medical supplies to the Shiloh battlefield, where he was captured along with the field hospital and sent to the same Confederate prison that held "Padre" Merrill. The Brunot caissons were to be installed atop masonry foundations and be raised or lowered by admitting or expelling water into and from the caissons.

"Old Slackwater" Moorhead had long wanted a chute closed by movable gates in Dam 1 on the Monongahela to pass coal fleets and relieve congestion at the locks. Since Merrill wished a full scale test of movable dam devices before building them on the Ohio, General Moorhead suggested the test be made at Dam 1 with the company and the government splitting costs. The Chief of Engineers rejected the idea because funds appropriated for the Ohio could not be spent on the Monongahela, and General Moorhead proceeded on his own, cutting a chute for a 120-foot wide and 9-foot high DuBois beartrap in Dam 1 and contracting with John Dubois for installation of the wooden leaves. DuBois completed the gates in 1884, but they warped, one end rising five feet in advance of the other, and DuBois was never able to make them work properly. Not a single boat ever passed through the chute and in 1886 the company sealed the gap in Dam 1 and ended the experiment.

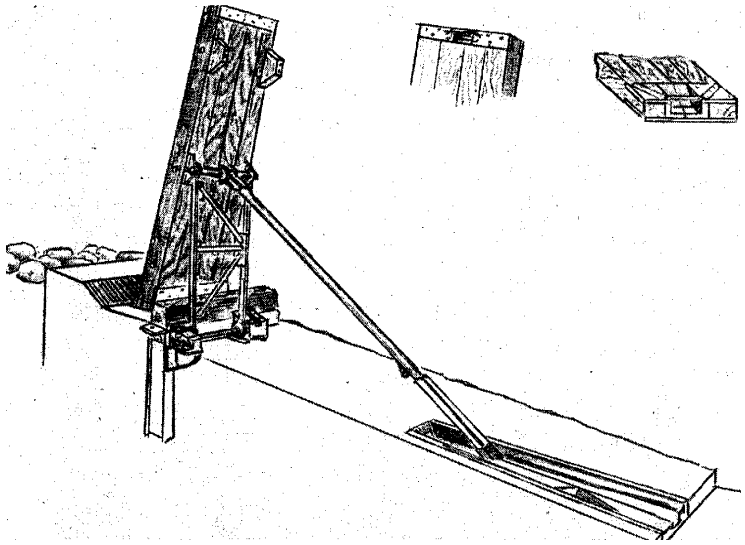
During his study of international engineering, Merrill learned that French engineers saw beartraps in operation on the Lehigh River in 1818, built similar structures on French rivers, developed more sophisticated movable dams, and had 124 movable dams operating in 1874 on the Seine, Marne, Meuse, and Yonne rivers. He, Colonel William P. Craighill, and their assistants went to Europe for onsite inspection and decided the movable wicket dams invented in 1852 by Chief Jacques Chanoine of the French Corps of Engineers could be modified to serve the needs of Ohio and Kanawha river navigation, because such dams were already serving coal tow traffic on the Seine River near Paris.

Chanoine wickets, timbers bolted together that somewhat resembled huge wooden ironing boards, laid flat against masonry foundations at high water and left an open channel for navigation; they could be raised on end at low water to form a dam. When rivers fell, French engineers raised a metal service bridge on the foundation upstream of the wooden wickets, ran a hand winch out on the service bridge, and with cable and grapple from the winch caught handles on the wickets and raised them out of the water, allowing an iron prop on the backside of each wicket to catch in a groove in the foundation to hold the wickets upright. They raised and set each wicket into place until the entire river was dammed and a slackwater pool formed. They lowered the wickets when a rise came by moving long iron tripping bars back and forth on the foundation to dislodge the props and allow the wickets to fall.

Colonels Merrill and Craighill in 1874 recommended construction of chanoine wicket dams on the Ohio and Kanawha rivers to assist steamboat and coal tow traffic. Merrill specifically asked Congress to provide for six-foot slackwater from Pittsburgh to Wheeling through construction of thirteen chanoine wicket dams, each with a lock 630 feet long and 78 feet wide. German engineers had built swinging mitering lock gates to close locks as wide as 76 feet; Merrill thought he could design mitering gates for chambers 78 feet wide, which would permit lockage of barges three abreast, or a total of 9 barges and towboat without breaking tow. But coalmen still denounced the project as a "damnable move," because even the widest mitering lockgates in the world would not permit lockage of the normal Ohio River coal tow, usually four barges abreast (100 feet wide) without breaking tow.

Merrill went back to the drafting board to design lockgates capable of closing 110-foot wide lock chambers, capable of passing four barges abreast with a few feet to spare. He found no way to design swinging mitering lock gates of wood and iron for a

Detail of wicket



Chanoine dam under construction

110-foot wide chamber that would not sag in the middle or break loose from their anchorages on the lockwalls. As substitute, he designed 117-feet long rolling lockgates, simply a wooden Howe truss laid on its side and mounted on iron wheels and axles. Housed in a recess in the riverbank when the lock was open, the Merrill rolling gates ran out on tracks like a railroad car across the chamber to a niche in the lock riverwall to close the lock. He also reduced lock chamber length to 600 feet, which with a 110-foot width could handle ten barges and a towboat without double lockage.

Because opposition from coalmen did not abate, because wicket dams had never been built in a river the size of the Ohio, and because 110-foot wide locks and rolling lockgates were engineering firsts, Colonel Merrill recommended the Ohio River canalization project begin with construction of a single lock and dam at Horsetail Ripple next to Davis Island about five miles below Pittsburgh. It would form a deepwater harbor for Pittsburgh where coaltows could be made up for their down-river trip. If the experiment were not a success, if rivermen were not pleased with the structure, he could blast it out of the river and restore the channel to its natural condition.

Congress funded Merrill's experiment at Davis Island in March 1875, but the "Padre" met another obstacle in the Pennsylvania legislature, which had to cede jurisdiction over project lands and the right of eminent domain before construction could start. General James Moorhead arranged submission of the necessary legislation to the Pennsylvania General Assembly, and the bill passed both houses but was vetoed by Governor J. F. Hartranft because he questioned the legality of certain provisions. A new version of the bill passed the House in the spring of 1875, but was mysteriously mislaid in the Senate. Coal shippers of Pittsburgh used their influence in the legislature to defeat the bill on its third trial in late 1875.

"The course of the coal-dealers of Pittsburgh is unjustifiable and contrary to public policy," Colonel Merrill angrily declared. "They condemn the whole project in advance," he complained, "and refuse to consent to the construction of even one dam, notwithstanding the fact that, in case of failure, the dam could be removed without either injury or delay to navigation." Ironmaster Harry Oliver and the Pittsburgh Chamber of Commerce came to the rescue of the bill at its fourth appearance in the legislature; it passed and Governor Hartranft signed it on March 17, 1877.

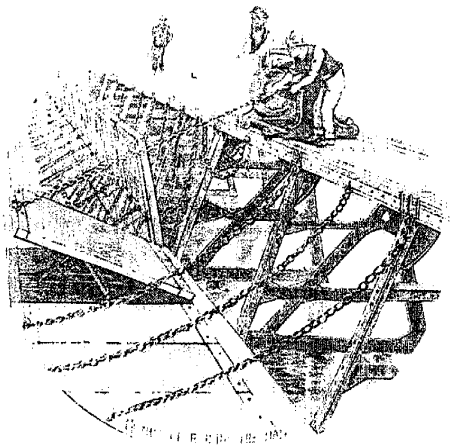
During the wait for approval from Pennsylvania, Merrill refined and improved the Davis Island design, notably by substituting hurters for tripping bars. Iron tripping bars, used by the French to dislodge wicket props and drop the wickets out of the way of boat traffic, were frequently clogged by drift and debris. French engineer Alfred Pasqueau in 1877 designed a cast iron double-step hurter for La Mulatière dam on Saône River near Lyons that eliminated need for tripping bars and service bridges. Laid in the masonry foundation behind and below the wickets, Pasqueau hurters had two grooves to carry wicket props. When men in a maneuverboat pulled a wicket up, the trailing prop followed to a notch against which it rested to support

the wicket. Maneuverboat crews dropped wickets by pulling them upstream until the prop reached the end of the groove, where it shunted sideways into a second unobstructed groove and slid down it as the wicket fell. Pasqueau sued the government for compensation for use of his invention, and in 1900, after twenty years of litigation, received a small sum, which doubtless had been consumed by attorney fees. The Corps of Engineers switched to an improved hurter, designed about 1890 by Addison Scott on the Kanawha River, for the Ohio River dams.

Construction at Davis Island Colonel Merrill sent Lieutenant Frederick A. Mahan to open a suboffice at Bellevue near the site of Davis Island Lock and Dam, and Mahan hired laborers and began clearing brush from the riverbank on August 19, 1878. The dredges *Ohio* and *Oswego* excavated the lockpit, sandstone for the lock masonry was brought in by river from Stoop's Ferry and by rail from Baden, and Louisville natural cement was imported for the masonry because the cost of Portland cement was thought prohibitive.

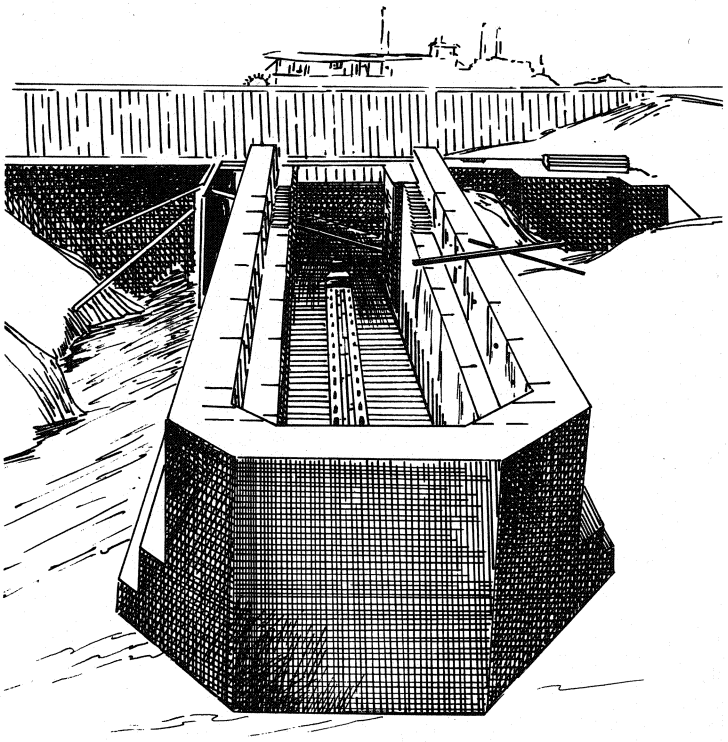
James H. Harlow and William Martin served as resident engineers at Davis Island; project or office engineers were Merrill's deputies: Lieutenants Frederick Mahan, William M. Black, Lansing H. Beach, and George W. Goethals. Harlow, a founder of the Engineers' Society of Western Pennsylvania, left the Corps in 1881 to become chief engineer on the Monongahela. Martin directed the Davis Island project and construction of Merrill Dam (No. 6) until 1905. Lieutenant Mahan became an international expert on waterways engineering and in 1911 a principal consulting engineer for the National Waterways Commission; Lieutenants Black and Beach became Chief of Engineers for the Corps; and Lieutenant Goethals built the Panama Canal.

Davis Island Lock and Dam was George W. Goethals' first civil works assignment. Goethals, a stickler for military protocol, just after his graduation from West Point was presented to the disheveled William Tecumseh Sherman, commander of the Army, who was cordial until Goethals told



Method of raising the dam (The service bridge was later wrecked by drift and runaway barges)
Pittsburgh History and Landmarks Foundation

William Martin



Sketch of recess for rolling lock gate

him he was joining the Engineers. "Oh, hell!" barked Sherman with apparent disgust. "However, in spite of that," Sherman remarked, "I hope you may do some good for your country some day." When Goethals marched in full uniform complete with epaulets into Colonel Merrill's office in 1884, Merrill told him to get the uniform off if he wanted to learn river engineering; otherwise, he could stay in the office and do paperwork. Goethals donned overalls, went to work as a survey rodman, and graduated to masonry foreman and project engineer before leaving Merrill's tutelage to continue his civil works career, capped by his work at Panama.

Because the Davis Island project was experimental, Merrill maintained complete records in minute detail and devoted personal attention to all construction features. In 1882, for example, while designing the chain and power system for rolling the heavy lockgates back and forth across the lock chamber, he wrote to Commodore George Dewey of the Navy:

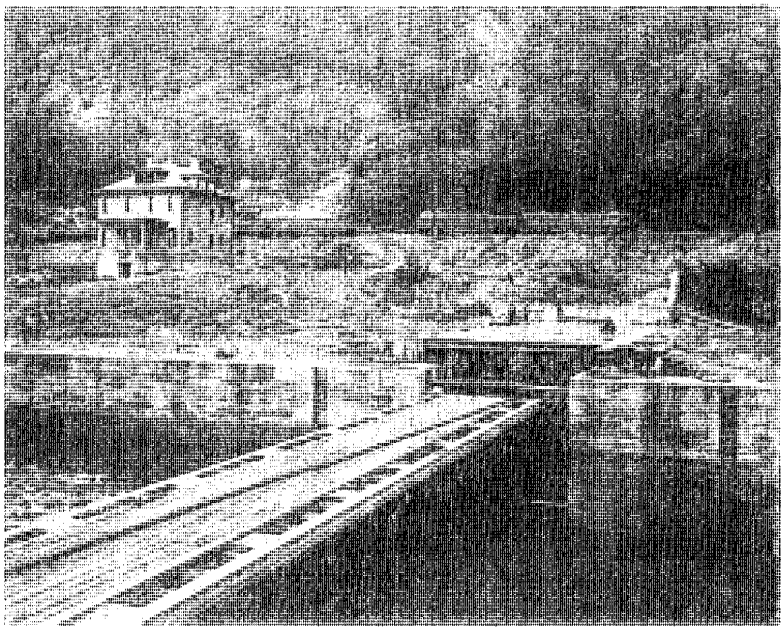
> *My dear Dewey:*
>
> *Please answer the following naval conundrum.*
>
> *How many turns ought a ⅝" chain to take around an 18" cast-iron drum so that it won't slip when pulling a weight of 2 tons?*
>
> *I want to use such a chain and drum at the Davis Island dam & want to know how many extra turns I must provide for. I suppose that your experience in weighing anchor will enable you to answer at once, but out here we don't use anchors.*

Merrill and his aids commonly experimented with new construction procedures to reduce costs and expedite progress: "value engineering" at its finest. Cutstone masonry at first was lifted from scows and railcars into place in the lockwalls by men cranking drums to operate cables on stiffleg derricks. In 1881, Lieutenant Mahan attached steam engines to the drums and lifted 150 six-ton stones in ten hours, speeding work because men could lift only 60 stones in ten hours. That method also achieved a reduction in force.

The timber pile and wooden framework cofferdams around the work sites were first filled with loam dug by men with shovels on Davis Island, moved in wheelbarrows and scows to the coffers, and again shoveled into the coffers. Workmen were paid only 12½¢ per hour, but filling the coffers by hand was costly. Mahan and Martin installed a pump and 900 feet of pipeline from Davis Island to the cofferdams, had horses pulling plows and scrapers drag island soil into a vat agitated by streams of water, and pumped liquid mud puddling from the vat into the cofferdams. Delivered in that fashion at a rate of 25 cubic yards an hour and at a cost of $1.05 per cubic yard, the mud penetrated into every crack in the cofferdams and hardened as it dried.

Excavation of the foundation within the cofferdams was also performed by hand at first, with shovels, wheelbarrows, and stiffleg derricks. The engineers accelerated work and reduced costs in 1882 by installing a "running dump," which was an endless rail track round which cars constantly moved and were filled with spoil and emptied in turn.

Construction of Lock and Dam No. 1 at Davis Island was completed at a cost of $940,832.31 on October 7, 1885, after seven years and nineteen days of work. Locks and dams built later on the Ohio were often completed in three years, but funding for No. 1 was irregular, floods severely damaged construction equipment in 1883 and 1884, and Colonel Merrill worked deliberately because the project was an experiment upon which the future of the Ohio River canalization project depended.



Typical rolling lock gate - Ohio River

The people aboard the *Geneva* and the other steamboats who dedicated Davis Island Lock and Dam on October 7, 1885, saw a 1,223-foot dam, not including a timbercrib structure built to close a channel behind Davis Island, composed of a 559-foot long navigable pass, through which boats passed at high water, and three weir sections used to regulate pool levels, and three masonry piers separating the four dam sections. They saw a total of 305 chanoine wickets with water spraying through between them that somewhat resembled a picket fence across the channel. Because the dam foundation was underwater, the most impressive structure was the massive masonry lock. Its 600-foot long and 110-foot wide chamber was the largest in the world, and wider even than the locks built in 1914 at the Panama Canal. Construction had been successful, but operations would determine whether it would be the first, or the last, lock and dam on the Ohio.

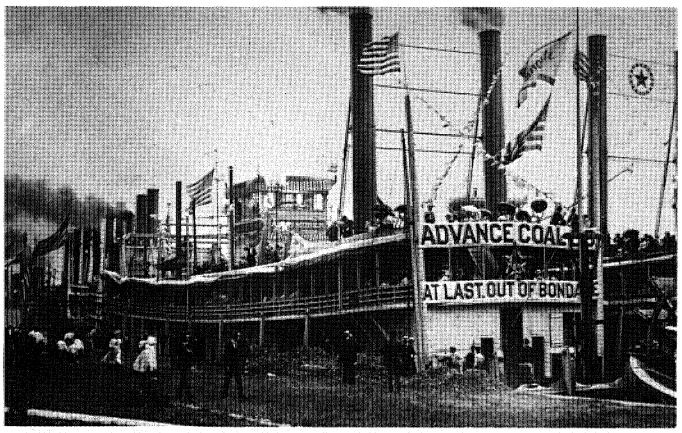
Freeing the Monongahela It was 1897. Rivermen thronged around the office of William Speakman, superintendent of Lock 1 on the Monongahela, waiting impatiently for word to arrive. They had begun their vigil on July 2 and had littered the lock grounds with cigar butts, tobacco splatters, and accumulated scraps during their five day wait. Sixteen million bushels of coal up the Monongahela was loaded and ready. Lockmasters Charles Wood at No. 2, George Connell at No. 3, Abram McGowan at No. 4, Abraham Milliken at No. 5, Thomas Speakman at No. 6, and George Lutes at No. 7 were standing by their phones and waiting, too, for almost no boats were moving.

Word of the end to the fifteen-year legal tangle had arrived at Pittsburgh on July 2, and newspapers had reported the Monongahela would be freed on July 3. The comptroller of the Treasury, however, wanted careful review of the papers before issuing warrant No. 38 for $3,601,615.46 to the Monongahela Navigation Company. At noon on July 7, 1897, the Monongahela was still not free, and rivermen were disgusted.

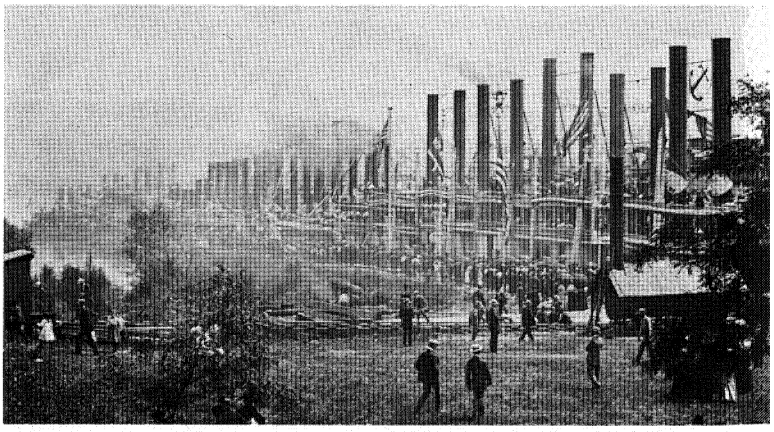
From the beginning in 1841, rivermen had resented payment of tolls to the Monongahela Navigation Company, and about 1883 Captain John F. Dravo of the Pittsburgh Coal Exchange had launched a public and political campaign to secure federal purchase and operation of the slackwater project. He received encouragement from members of Congress, especially Representatives Thomas Bayne and John Dalzell and the influential Senator Matthew Quay, who in 1886 arranged appointment of an engineer board of investigation. Members of that board were taken aback when the Monongahela Navigation Company told them it would not sell the project and wished to be left "in undisturbed enjoyment" of its property.

Colonel Merrill asked the company in 1888 if it would sell Lock and Dam 7, next below the locks Merrill was building on the upper river, but the company would not even negotiate and Merrill,. through the Justice Department, initiated a condemnation suit against the company to secure Lock 7 for public use. In November 1890, the Circuit Court awarded the company $209,000 for No. 7, but the company appealed to the Supreme Court, which decided in 1892 that the company had a right to compensation for loss of its franchise to collect tolls in addition to the tangible value of its property and remanded the case for a new trial.

John Dravo and his colleagues continued their agitation for government purchase and freeing of the Monongahela, arguing that company tolls hampered development of West Virginia coalfields and undermined the value of government Locks 8 and 9. They also thought it unfair that they should pay tolls while the government was building locks



"Emancipation Day"



Captain Fred Way

and dams on the Kanawha River to furnish regular and free navigation for Kanawha coal shippers. Merrill, William P. Craighill, and Addison Scott had begun canalization of the Kanawha in 1875, and, with the full support of Kanawha coal shippers, had built the project in short order, completing all ten locks and dams by 1899. Free from the burden of tolls and located nearer downriver markets, Kanawha coal undersold Monongahela coal. Rivermen and coal shippers of Pittsburgh began to regret their opposition to slackwater on the Ohio and to increase their clamor for a free Monongahela.

The Pittsburgh Coal Exchange entertained the House Committee on Rivers and Harbors aboard the steamer *C. W. Batchelor* on November 9, 1893. Accompanied by John W. Arras and William Martin of the Pittsburgh District and Maxwell Moorhead and Thomas P. Roberts of the Monongahela Navigation Company, the House committee inspected Lock 1 on the Monongahela and Davis Island Dam. During the trip, John Dravo and the Coal Exchange won a commitment from the committee for federal acquisition of the Monongahela slackwater.

The House committee directed the Engineers to report the value of the navigation company property and franchise. After Pittsburgh District Engineer Richard Hoxie estimated the value of the company works and rights at just over $3.6 million, Congress directed that condemnation of the Monongahela Navigation Company proceed. In 1897, the Circuit Court awarded the company $3,761,615.46 for its property, the largest condemnation award made to that date.

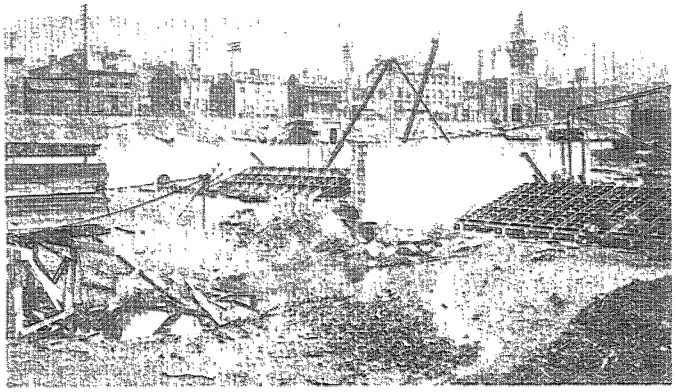
The Corps of Engineers finished its share of the paperwork for the transfer by the end of June 1897 and tried to arrange for freeing the river by the Fourth of July. On July 3, District Engineer Charles F. Powell informed the Monongahela lockmasters the United States would soon take possession and sent Chief Clerk Gulentz to each lock to explain government records keeping and navigation regulations.

After rivermen protested the transfer delay, Congressman John Dalzell went to the comptroller's office in Washington to expedite the business and walked with the papers to see them handed to the Secretary of War, who put his assistant G. D. Meiklejohn with the papers on the first train to Pittsburgh. Meiklejohn met Monongahela company president J. J. Donnell at the Duquesne Club for breakfast on July 7, then joined Major Powell at the District office, and the three walked to the Bank of Pittsburgh to complete the transfer.

At 3:13 p.m., Superintendent William Speakman at Lock 1 answered his phone. Every ear in the lock office strained to hear. "Yes, this is Speakman," he said. A moment's pause. "Very well, Major, goodbye," he said, and put the receiver back on the wall. Without a word to the men in the office, he strode to the window, and he shouted: "Hoist the flag!"

Lockman C. W. Keibler ran up the banner and at that signal pandemonium broke loose. Boats that had been waiting with full steam raced for Lock 1 for the first free lockage and the *Courier* won. First free coal tow was pushed through Lock 1 by the *Charles Jutte*, and it was followed by some 16 million bushels of coal that had been sold at reduced prices contingent upon freeing of the river. "It was a long battle, but we have victory at last," commented Captain John Dravo. "She's free," said another grizzled riverman, with tears on his face. "Thank God, I lived to see it."

On July 16, the official "Emancipation Day," a hundred thousand people watched 32 packets and towboats under command of "admiral" John Dravo steam from Monongahela Lock 1 to Davis Island Lock, where the crowd was treated to orations to the effect that Western Pennsylvania might have lost the fight against the whiskey tax in 1794, but had won its fight against river tolls in 1897. The real jubilee occurred, however, on Sunday, July 11, when the Monongahela locks first opened to Sunday traffic.



Bear traps at Herr's Island lock and dam

The navigation company had held Sunday traffic to a minimum, locking only regular packets and, during river rises, coal tows. Sunday excursions had been thereby limited to the Allegheny and Ohio, but on July 11 excursion boats packed with people celebrating the free Monongahela demanded lockage and the District Engineer had no authority to refuse them. The celebration was rather overenthusiastic, even riotous, and during the week following the Chief of Engineers was bombarded by protests. One read, for example: "We felt that the Sunday steamboat excursion, one of the most demoralizing and prolific sources of crime in our midst, would be cut off. Our hearts are saddened, our hopes blighted, hearing that this floodgate of crime and degradation should be thrown open wider than before."

District Engineer Powell received a telegram from the Chief of Engineers directing that the Monongahela locks remain open to all traffic on Sundays, but deploring the desecrations of the Sabbath that occurred on July 11 and ordering that they be stopped. Major Powell issued an order to the Monongahela lockmasters: "Referring to Sunday excursions, you will give me information of any disorder, indecent exposure of person, selling of liquor, or similar conduct on such excursion boats when at the locks." There was no further trouble from the excursion boats, at least not in sight of the locks.

Just after freeing of the river in July, the Hudson Brothers moved their *Florence Belle* and *Nellie Hudson No. 3* from the Allegheny to the Pittsburgh to Morgantown run in competition with the packets *Adam Jacobs* and *James G. Blaine* operated by the Pittsburgh, Brownsville and Geneva Packet Company; by the end of 1897, nine passenger packets were plying the river of falling banks. Only about a million bushels of coal annually had come down the Monongahela from above Dam 5 prior to 1897; freeing the river stimulated the upstream coal industry and shipments assumed major proportions.

Locks 1 to 4 were each passing about 40,000 craft in 20,000 lockages annually by 1901, and Thomas P.

John W. Arras Dr. Leland R. Johnson

Roberts, retained by the Pittsburgh District as principal engineer for the Monongahela, complained the lockmen had to perform heavy labor in 12-hour shifts, nights and days and Sundays, and were subjected to much abuse from rivermen angered by delays at the locks. Boat captains often told lockmen what should be their destination and sometimes assaulted them. Roberts requested a change to 8-hour shifts at Locks 1 to 4 and requested protection for the lockmen. The District Engineer concurred with the two recommendations and also began planning new and larger locks and raising of dams to increase channel depth to at least eight feet. Improving the Monongahela slackwater was undertaken as the 20th century began.

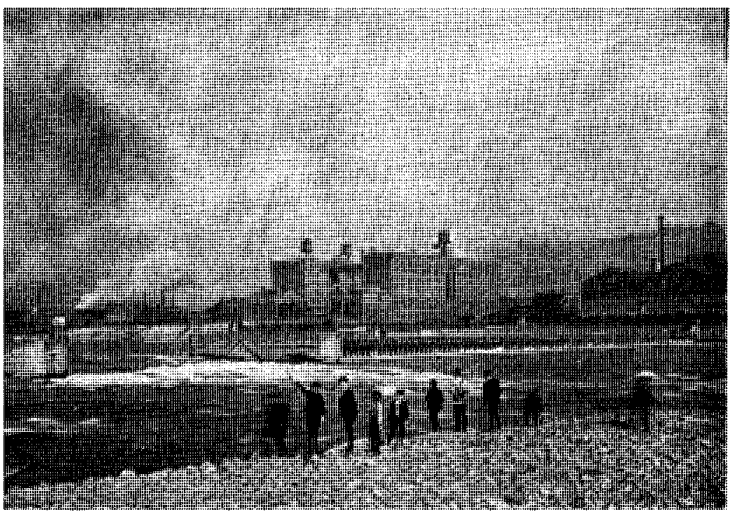
Herrs Island Lock and Dam "Such a work, in connection with the Davis Island Dam, would complete the harbor of Pittsburgh," said Colonel Merrill, "and would receive throughout its limits the cheap transfer of coal, coke, ore, petroleum, limestone, pit and manufactured iron, and other bulky articles to the great advantage of the manufacturer, and, ultimately, of the consumer." Thomas Roberts had placed a temporary sandbag wing dam at Garrison Ripple in 1878 to permit boat access to Allegheny Arsenal at low water. Colonel Merrill in 1880 indorsed construction of a lock and dam at Herrs Island to submerge Garrison Ripple, a wide shoal where the Allegheny fell two feet in a quarter mile. Congress approved the plan in 1885.

Construction at Herrs Island was delayed because Pennsylvania did not cede jurisdiction over the site

until 1887 and because riparian owners and the City of Pittsburgh opposed the project. Owners of land adjacent to the locksite opposed because the lock would block their access to river transportation, and Pittsburgh opposed because it feared a fixed dam might increase flood crest heights and cause ice gorges. To allay those fears, Colonel Merrill and project engineer John W. Arras substituted a movable dam for a fixed dam and located the lock fifty-five feet away from the river bank to allow continued access to river terminals. Those changes satisfied adversaries, and on July 12, 1893, Arras began building workshops on Twenty-Second Street in Pittsburgh and the cofferdam for the lock.

Arras planned a concrete instead of a cutstone masonry lock because he had observed deterioration of the sandstone used at the Monongahela locks; he also proposed use of beartraps instead of chanoine wickets because those at Davis Island Dam were constantly fouled by drift. Division Engineer Orlando M. Poe disapproved the Arras plans, saying Arras should stick with cutstone masonry and wickets. The Corps had built only one other concrete lock at that time, a tiny lock on the Rough River in Kentucky, and had experienced operational problems with the beartrap sluices built at Davis Island Dam and on the Kentucky River in 1888. A review board approved the Arras plan for a concrete lock, but directed that the dam be chanoine wickets throughout.

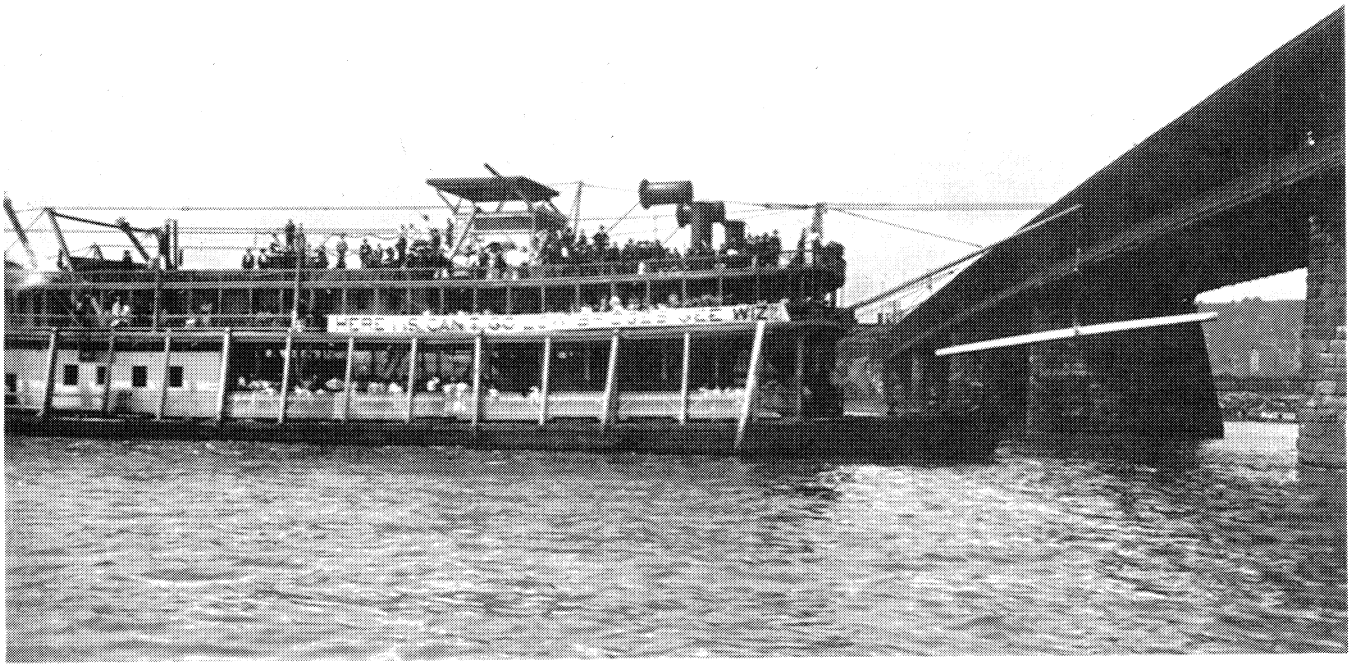
Allegheny River Lock No. 1 (Herr's Island)



When Arras completed the cofferdam around the Herrs Island locksite in 1893, he found it impossible to pump dry. Years of private dredging at the site had removed sand and small stones, leaving boulders with spaces between and a permeable bottom. Arras decided to place the foundation underwater without a dry cofferdam. He dredged the lockpit and drove in the piles to hold the concrete forms. High water stopped work in late 1894, filled the excavation with new material, and winter ice destroyed the piles. He began anew in 1895, redredging the site and driving new piles. In July, he sent divers down to attach hemlock lumber stringers and plank forms to the piles; workmen above the water lowered each stringer and plank to the divers who spiked them securely to the piles.

Floods and other troubles constantly interrupted the work at Herrs Island: six times in 1896; five times by floods and once by a tornado that destroyed the steam powerplant. The delays so angered rivermen that they accused District Engineer Richard Hoxie of neglect of duty and threatened charges against him. Divers finally had the forms spiked in place on August 28, 1896, and concrete placement began from 1.5 cubic yard mixers mounted on piles under which scows were loaded to carry concrete to the forms.

Concrete was placed underwater with six iron tubs handled by derricks and placed in the lockwalls by shoveling directly from scows to the forms. Poured dry as brown sugar and rammed in six-inch layers by men pounding with cast iron tools, the concrete was placed with little time for curing, allowing completion of the lockwalls in 63 working days. Concrete quality and placement were primitive at the second concrete river lock built in the United States, but proved satisfactory: closing and pumping Herrs Island Lock for repairs was not necessary until 1930.



Though an engineer review board had disapproved use of beartrap sluices at Herrs Island Dam in 1894, Arras and John McCulloch had continued studies of improved beartrap designs. Engineers had used wood, because of its buoyant qualities, in beartrap leaves since 1818; Arras and McCulloch designed the first steel beartrap leaves and devised a system of introducing compressed air into the lower leaf for added buoyancy. They won approval from the Chief of Engineers in 1898 for installation of steel beartraps at Herrs Island.

First test of the steel beartraps came in the spring of 1903. Arras opened Herrs Island Lock on December 2, 1902, and when the Allegheny subsided in April 1903 began raising the dam to hold a seven-foot pool for navigation. The chanoine wickets of the 500-foot navigable pass came up without trouble, but the beartrap leaves would not budge an inch. Three days he tried; three agonizing days he failed. It seemed he might become the laughing stock of Pittsburgh and of his profession. He lowered the wickets, cleaned the culverts to the beartraps, installed new air valves and a propeller pump to force water under the leaves. Nothing happened. April passed. May. No results. As a last resort, he fastened boards beneath the upper leaves to reduce leakage between the leaves. On June 2, they popped up under water head with a sound perhaps equalled in volume by the sigh of relief from John Arras.

Crowded steamboats gathered at Herrs Island Lock on July 28, 1903, to celebrate completion of Allegheny Lock and Dam 1 and hear a dedicatory speech by John L. Vance, first president of the Ohio Valley Improvement Association (OVIA). Larger packets, however, could not get to the lock because of the Union Bridge, and rivermen improved the occasion by publicizing the need for raising low bridges over the Allegheny. "Here I is; can't go. Low bridge. Gee whiz!" read a sign carried on the steamer *Mayflower*. Though Arras and the Pittsburgh District had Locks and Dams 2 and 3 underway by 1903, rivermen, led by Captain William B. Rodgers, complained slackwater on the Allegheny would have little value until obstructive bridges were raised or removed. They launched a political and legal battle that disrupted progress on the canalization of the Allegheny for a quarter century.