VOL. V

### ISSUED IN APRIL 1924

No. 4

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# The Des Moines Rapids Canal

Along the Iowa shore of the Mississippi River between Keokuk and Montrose, there lies buried beneath the waters of Lake Cooper an engineering work which was, in its day, a magnificent accomplishment. In fact the Des Moines Rapids Canal was, for more than a third of a century, a waterway of considerable economic importance to the people of the entire Upper Mississippi Valley. The building of the canal by the United States government during the decade between 1867 and 1877 excited the interest and admiration of the entire nation and was the special pride of the army engineers under whose direct supervision the work of construction was performed.

Prior to the building of the canal, the Des Moines Rapids had proved a serious obstacle to the navigation of the river and imposed a heavy toll upon the commerce of the region. In low water all steam-

boats were compelled to unload their cargoes at the head or the foot of the rapids, and the river freight was then transferred to the other end of the dangerous channel on lighter-boats. This operation involved a great expenditure of time and money and caused damage to produce and merchandise from handling and exposure to the weather.

Agitation for the improvement of the channel over the rapids, whereby the river traffic might be carried on unimpeded, was instituted as early as 1830. The first official investigation of the problem was made during the year 1837 by Robert E. Lee, then a young lieutenant, who was directed by the War Department to make a detailed survey of the Des Moines Rapids of the Mississippi. According to his report the rapids consisted of a series of "chains" of hard limestone over which the shallow The water flowed smoothly but with terrific force. names of these chains, such as the "English Chain", the "Lamelus [Lemoliese] Chain", and the "Battiste [Spanish] Chain'', marked on the map accompanying Lee's report indicate that he retained the colloquial nomenclature. The river flowed between bluffs a hundred and fifty feet high, but on the Iowa side they rose beyond a narrow flood plain and sloped down to the river only at a few points. As the result of his investigation Lieutenant Lee proposed that "one of the natural channels" should be increased in width and depth so as to accommodate loaded boats at all times. He charted the channel

which he thought would "afford the easiest and safest route".

As time passed the feasibility of Lee's scheme of carving a channel in the rocky bottom of the river was debated and many serious objections were advanced, the chief of which were the extreme difficulty of its execution, the exorbitant cost, and the great danger to the vessels navigating this channel at night and in a high wind, as the boats would necessarily have to slow down and thus increase the difficulty of holding them to their true course.

Another proposal was to erect dams and lift locks. This plan, it was contended, would relieve navigation of the hazard attending the "channel improvement". The principal objection to this plan, however, was the obvious circumstance that if the dams extended entirely across the river all river craft would have to pass the locks. Large rafts and flatboats would have to be "locked through" even in high water, an inconvenience which could be obviated only by means of a chute, the navigation of which would always prove extremely hazardous. Singularly enough, while this plan was rejected at the time as being the least promising of all, it is the one which is now in operation.

While the desire of the people for the improvement of the Mississippi was repeatedly expressed in Congress, in commercial conventions, and by the press, very little was done until January 15, 1849, when Governor Ansel Briggs approved an act of the

Second General Assembly of Iowa authorizing the "Navigation and Hydraulic Company of the Mississippi Rapids" to acquire a right of way for a canal around the lower rapids of the Mississippi River. The amount of capital stock deemed adequate to complete the proposed improvement was fixed at \$500,000.

On December 1, 1849, Samuel R. Curtis, who was employed as chief engineer by this company, submitted a detailed report after making a careful survey of the project. In this report he recommended that a canal and wing-dam improvement be built along the Iowa side of the rapids, beginning at the Upper Chain and carried down the river to the "upper end of the town plot of Keokuk", thereby creating a continuous artificial channel and eliminating the necessity of using the tortuous, uncertain channel over the rapids.

It was suggested that this proposed canal would also serve as an enormous mill-race. The force of the water accumulated at the lower lock would be of equal if not greater importance than the advantages derived from the navigation of the canal for, without any apparent drain on the mighty river, sufficient power could be developed "to propel a thousand run of French burrs" and operate "all the machinery that human invention can locate within the reach of its influence." What a prophetic vision of the tremendous hydroelectric development realized on that identical site over sixty years later!

This conception, however, proved to be altogether too big an undertaking for the times, and the Navigation and Hydraulic Company of the Mississippi Rapids, failing to secure sufficient support, was compelled to abandon its plans without attempting any construction work. Talk of the canal, however, tended to crystallize public opinion on the question of improving river navigation so that the influence of the discussion was felt in the halls of Congress.

In 1852, an appropriation was secured from the national government and John G. Floyd was placed in charge of "blowing out the channel" after the fashion recommended by Lieutenant Lee. The army engineers at that time did not favor a canal. This work, however, proved disheartening, and the appropriation woefully inadequate. It was estimated that at the rate of progress made during the first two years fully two centuries would have been required to complete the project.

Up to the time of the Civil War, though repeated efforts had been made, very little had actually been accomplished toward any permanent improvement of the navigability of the Des Moines Rapids. During the summer of 1866 Major General J. H. Wilson resurveyed the rapids and proposed that a lock canal seven and six-tenths miles in length be built along the Iowa shore. The construction of this canal under the supervision of the Department of War was authorized by Congress in March, 1867. and the work began the following October.

Plans of the improvement called for the construction of a canal along the river from Nashville (now Galland) to Keokuk by building a guard bank three or four hundred feet from the shore and excavating the channel thus formed to a depth sufficient to provide five feet of water at the extreme low stage of the river. Where points of land jutted into the stream the canal was to cut across instead of following the sinuosities of the shore line. The rock and earth removed from these cuts and from the bottom of the canal were to be used in the construction of the guard bank or outer wall. Locks were located at the upper and lower ends of the canal and a third lock with a lift of eight feet was situated at the mouth of Price's Creek about two miles above Keokuk. Above Nashville to the head of the rapids a channel was to be excavated along the Iowa shore in the open river. This stretch was known as the "improved river".

One of the most difficult tasks in the construction of the canal was the excavation of the rocky channel inside the guard bank. Electrically discharged dynamite for blasting beneath the surface of the water had not yet been introduced, so that common black powder had to be used. In the absence of compressed-air drills, holes for the powder charges were made with hand or churn drills within the coffer dams, while two boats equipped with steam drills were used where drilling beneath the surface of the water was required. The charges of powder were

lowered into the blast holes by means of long tin tubes with a fuse for detonating extending up through the tubes to the surface of the water. The force of the powder explosion was mostly upward, resulting in a "big noise and considerable muss" but relatively little damage to the rocky ledges below. All summer long while the work was in progress the blasting on the canal could be heard for a distance of twenty-five or thirty miles and sounded like cannonading in a distant battle.

Three chisel-boats were also used in cutting away the rock beneath the surface of the water. Thev were employed to good advantage where the ledges of limestone were thin and interbedded with shale or marl. These boats were of very shallow draught and equipped with a pile-driver device on the bow, operated by steam power. Attached to the lower end of a mauling head which weighed about a ton and a half was a chisel-like bit, from which the boats derived their name. These boats were held in place by a hawser attached to the stern and fastened some distance upstream. Another rope, extending from the shore at right angles across the bow of the vessel, was wrapped around a capstan so that the boat could be swung slowly back and forth on the arc of a circle as the ledges were broken or chipped away by means of the heavy chisel.

At first the chisel bits were permanently attached to the heavy maul head and the entire contrivance had to be shipped to Pittsburgh every time the chisel

needed sharpening. This caused so much delay and expense that a means was devised of attaching removable bits to the heavy maul head by shrinking an iron hoop around the bit and head like a tire on a wheel. A large supply of these detachable bits was obtained so that sharp ones could be substituted in a few hours.

The river embankment which formed the outer wall of the canal was constructed by first piling up a riprap "toe" of broken rock taken mainly from the bottom of the canal, though some stone was brought in from a quarry up Price's Creek in the vicinity of the "Old State Fair Grounds" and some from the Gladstone quarries up the river in Illinois. Upon this foundation a track was laid and earth hauled in from the cuts. When completed the bank was ten feet wide on top and about twenty feet high. At various places temporary cross banks were built from the canal wall to the shore line and excavation was completed before the water was let in. These units of construction were called pits and fifty or sixty workmen constituted the gang for each pit.

The locks, each three hundred and fifty feet long and eighty feet wide, were constructed of the "best magnesian limestone" laid in "hydraulic cement". The dimension stone was quarried from the bluffs skirting the rapids, much of the finest coming from the famous Sonora quarries along the Illinois shore. This stone was usually quarried in rough blocks and loaded on barges which were pushed across the river

by the light-draught tow-steamer Cricket to the stone vards at Nashville and Price's Creek, where the blocks were dressed and numbered. Two steam derricks, one on each side of the lock, were used in laying the walls.

The locks were filled through culverts leading to each gate recess, passing in the rear of the main walls, and discharging through openings in the chamber walls. From five to ten minutes were required for the process, depending upon the stage of the river. The mechanism for opening and closing the gates and wickets was controlled by hydraulic pressure furnished by pumping engines of special design, built in the Buckeye Foundry at Keokuk. For many years Thomas Hartley was in charge of the lower lock, Jack Russe, the middle lock, and Thomas Harrington, the upper lock.

The canal was built by contract, principally by the firm composed of James J. Dull of Pittsburgh and George Williams of Keokuk. Dull and Williams began operations with a substandard-gauge locomotive and a few dump cars and gradually expanded the equipment until they had four locomotives, about five hundred cars, and some twenty miles of track. The main track ran along the guard bank from which spurs extended into the excavation pits and guarries. The construction road connected with the Chicago, Burlington, and Quincy at Keokuk, but owing to the difference of gauge all of the coal, lumber, stone, and other supplies had to be trans-

ferred to construction cars before they could be moved over the works or unloaded at Sandusky where the company maintained large warehouses and machine shops.

The four locomotives were said to have been "little beauties". They had two pairs of three-foot drive wheels and were built like switch engines without a pony truck in front. They were powerful and in skillful hands were most versatile in their accomplishments. At noon their deep melodious whistle called the men from labor to refreshments, while they were continually busy, with their chug, chug, chug all day long, hauling cars from place to place, plowing the ground, driving piling, pulling stumps, dragging logs, towing lighter-barges up over the rapids after the tow-path for the horses had been cut off by the canal construction, transporting visitors over the works, and even hauling their unfortunate companions out of the river when they occasionally took an unanticipated plunge.

The track of the construction railroad was seldom in good order, owing to the fact that it frequently had to be shifted laterally over the bed of the canal or raised vertically in building the outer wall. The track was raised by shimming up the ties with large blocks of stone, sometimes as much as two or three feet. Stone and earth were then hauled in over this raised track and dumped between the ties, thus building up the wall to the level of the track, whereupon the operation was repeated.

The unstable condition of the track when so elevated was the cause of frequent accidents, sometimes of a serious nature even involving loss of life. One day opposite Rickey's point the outside rail settled under the "George Williams" and the engine rolled over into the river. Engineer Ed Johnson and fireman F. A. Whitney, who were in charge at the time, narrowly escaped with their lives. As fireman Whitney crawled out of the river as "wet as a drowned rat" an Irish workman remarked, "Shure, a man that is born to be hung, will niver be drowned." Great difficulty was experienced in salvaging this engine because she came to rest with her wheels up. On another occasion the "James D. Dull" jumped the track below the mouth of Price's Creek and backed into the river before she could be stopped. A track was built down the embankment. however, and she was pulled out practically unharmed by two of her sister engines.

On March 2, 1870, a workman by the name of Daniel Pletcher was decapitated by a dump car, and on March 16, 1871, William Dugan was crushed to death beneath an overturned car. Another man's arm was broken and several others were severely injured by the same accident. Michael Cahill, a foreman, lost a leg when a string of empty dump cars ran down grade and struck a car he was pushing. Hardly a month passed in which some workman was not hurt.

There was plenty of excitement along the canal.

Drinking was rampant, though most of the men are said to have been rather more given to sobriety than the average of the times. There were nearly as many saloons in the towns as all other places of business combined. Among the itinerant workmen, who were mostly single fellows seeking temporary employment, fights, brawls, and assaults were so common as to excite little comment. Occasionally a quarrel between cliques or gangs resulted in a battle royal. On January 23, 1870, for example, more than forty men engaged in a general fight at Ballinger's Switch. Several were painfully wounded by flying bottles, chairs, and other weapons. About two months later, the workmen went on a strike and Sheriff John A. Bishop with a posse of fifty deputies was summoned from Keokuk to quell a threatened riot.

Between one and two thousand men were employed in building the canal. The pay roll for November, 1875, amounted to \$67,700 and showed an average of sixteen hundred and fifty men employed that month. About half of the workmen were Swedes, "fresh from the old country". Most of the rest were Irish. Between Keokuk and Montrose the river bank was dotted with shanties built by the contractors and rented for a nominal sum. There the workmen lived with their families or bunked together in bachelor quarters.

The construction of the Des Moines Rapids canal was, for the day in which it was executed, an engi-

neering feat comparable to the building of the Panama Canal. The undertaking attracted nation-wide interest. Magazines and newspapers in all sections of the country carried comments upon the progress of the work and the economic benefit to be derived. People came from far and near, especially engineers, to witness the operations. Indeed, the visitors were so numerous that a flat car was converted into an observation car by placing boards across for seats and a railing around for safety. When "influential strangers" or government officials arrived in Keokuk a boy was sent up to Sandusky on horseback, with instructions for an engine to bring the sightseers car down to the lower lock for a tour of inspection. This job was a diversion much coveted by the engine crews. On February 24, 1868, Horace Greeley, who lectured that evening in Keokuk, spent the day inspecting the canal.

On the whole the construction of the canal was a slow and laborious business. Modern machinery was almost unknown. As many as fifty men were required to do the work of a single steam shovel. All of the earth was moved by hand shovels and wheelbarrows, after having been loosened by enormous horse-drawn plows. High water often interfered with the work. In April, 1870, construction had to be suspended on account of the flood and considerable damage was done.

Sometimes money ran out and then all work ceased until Congress made a new appropriation.

When the canal was nearly complete Dull and Williams were underbid by a rival firm and lost the contract. Thereupon they promptly pulled up all their tracks, loaded the engines, rails, and equipment, and moved to Florence, Alabama, where they had secured a contract to recondition the old canal around the Muscle Shoals of the Tennessee River. Kittle and Middleton, the new contractors, being unable to purchase any of the old machinery or tools from Dull and Williams, were compelled to go into the open market and secure new equipment of their own. They reconstructed a narrow-gauge railroad, and purchased two locomotives and a number of cars to carry on their operations.

Just a little less than ten years after the first spadeful of earth was turned at Nashville on October 8, 1867, the canal was opened for traffic. The locks were completed long before the rest of the canal was finished but at last, on August 22, 1877, the steamboat *Montana* passed through the canal from Fort Madison and that evening, thronged with public officials, newspaper representatives, and prominent personages, she led the *Northwestern*, the *Golden Eagle*, and the *Cricket* from Keokuk to the head of the canal and back. On shore a Burlington excursion train accompanied the flotilla. The band played, speeches were made, canal officials were fêted, and general enthusiasm prevailed.

In the open season the canal fairly teemed with packets, rafts, and excursion steamers. But river

transportation had reached its peak before the canal was begun and by the time it was completed steamboating on the Mississippi was rapidly de-The railroads were already sapping the clining. life of the river traffic so that the canal proved to be a disappointment commercially. For thirty-five years it remained in operation. Now and then the timber lock gates were renewed and the sediment washed into the canal by the creeks was dredged out, but few other repairs were ever needed. As time passed the great steamers and rafts gradually disappeared from the river and only government dredges, an occasional excursion boat, and a few stoical packets passed through the canal around the hazardous rapids of an earlier epoch.

During the second week of June, 1913, the flood gates of the Keokuk Dam were closed and gradually the still waters of Lake Cooper flowed over the old canal. To-day no vestige remains visible except a few feet of the inner abutment of the lower lock. There it stands, an excellent sample of old masonry, perfectly preserved and containing in the center of the point a well which now shelters the automatic apparatus for recording the stage of the river.

It is a singular circumstance that this well was the only part of the old canal which was never used during the operation of the canal and is at present the only part of the old canal that is not under water, and is now functioning in the way it was originally intended. While the canal was in use

there was no particular need of watching the stage of the river but now the regulation of the flood gates in the great dam requires that heed be taken of the rise and fall of the water. And so this old abutment remains a fitting monument to a splendid piece of engineering, to an improvement which served its purpose and passed out of existence in the wake of eternal progress.

BEN HUR WILSON