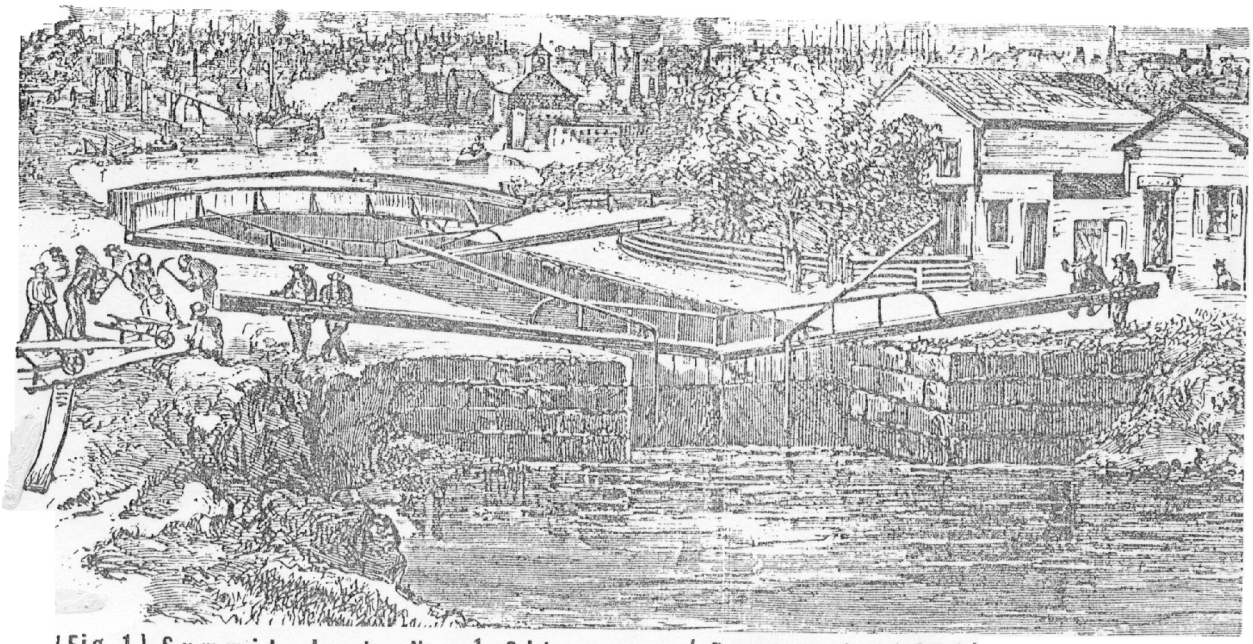
I & M Canal Locks. Lockport, Ill.: Illinois Canal Society, publication no. 4, 1981.

I. & M. CANAL LOCKS

J. M. LAMB



(Fig.1) Summit Lock No. 1 Chicago (Removed 1871)

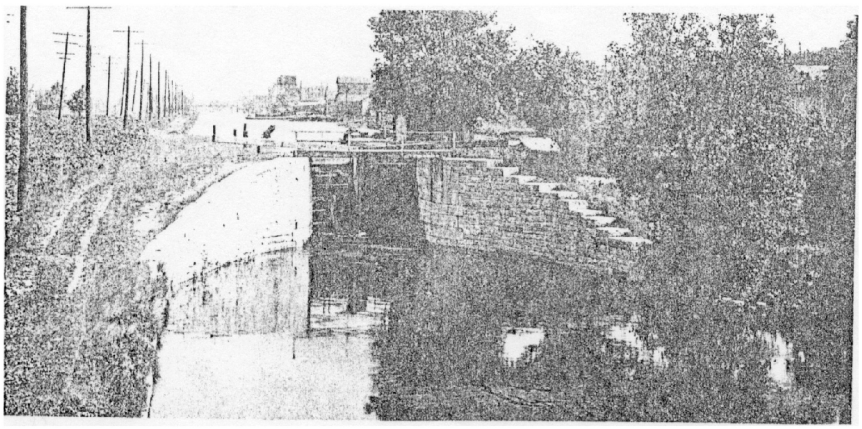


Fig. 2 Lock No.1 L copor abou 1900

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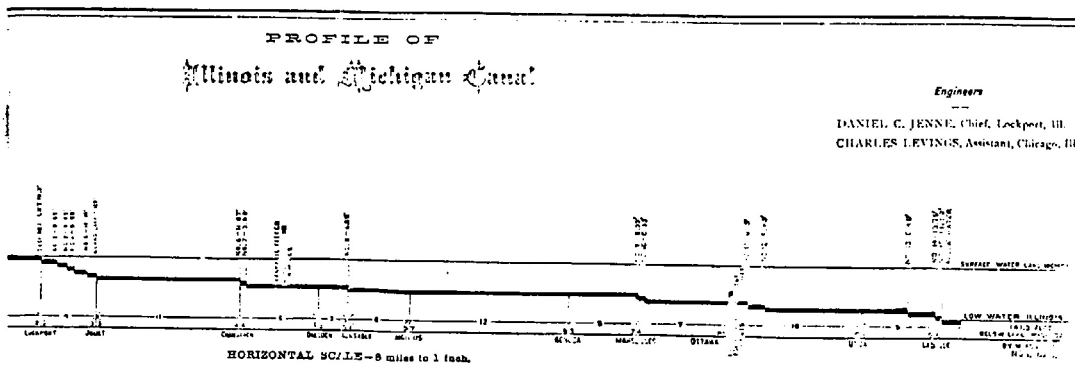
Illinois Canal Societ Pub ication Lockport, Ill 1981

LOCKS ON THE ILLINOIS AND MICHIGAN CANAL, PARTICULARLY LOCKS 1 AND 2

Although it was originally planned to have 15 lift locks on the Illinois and Michigan Canal, this had to be abandoned in 1845 when the money ran out. William Gooding, the Chief Engineer[1], as a result, had to change the plans for the summit level of the canal from Bridgeport to Lockport. The original plan had called for a "deep cut" in this area so that the Chicago River would reverse its flow away from lake Michigan and into the canal. As money for this was not available, it was decided that a lock would be built at Bridgeport, where the canal separated from the Chicago River. Another lock was built about three miles north of Lockport. These were called Summit Locks No. 1 and 2. Summit Lock No. 1, that was in Bridgeport (now Chicago), is pictured on the cover of this publication (Fig. 1). At that spot there was also a steam-driven pumping station that was used to pump water from the Chicago River into the canal. Construction was also started on a feeder canal that would supply water from the Calumet River at Blue Island. This feeder was completed in 1852. In 1871 the "deep cut" was made and Summit Locks No. 1 and 2 were removed, as was the pumping station. The Calumet Feeder was also closed. The profile of the canal (Fig. 3) was made in 1878 when there were 15 locks, as had originally been planned.

FIGURE 3



In the construction of the locks on the Illinois and Michigan Canal there were a uniform contract and a uniform set of printed specifications based upon a ten-foot lift lock. Though basically all locks were much alike, there were variations in the design of locks. The two most interesting locks were Lock 1 (Fig. 2, on the cover) and Lock 2 in Lockport. Since these two locks were designed to fit into a system to utilize hydraulic power, and not simply for lifting and lowering boats, they will be examined in some detail.

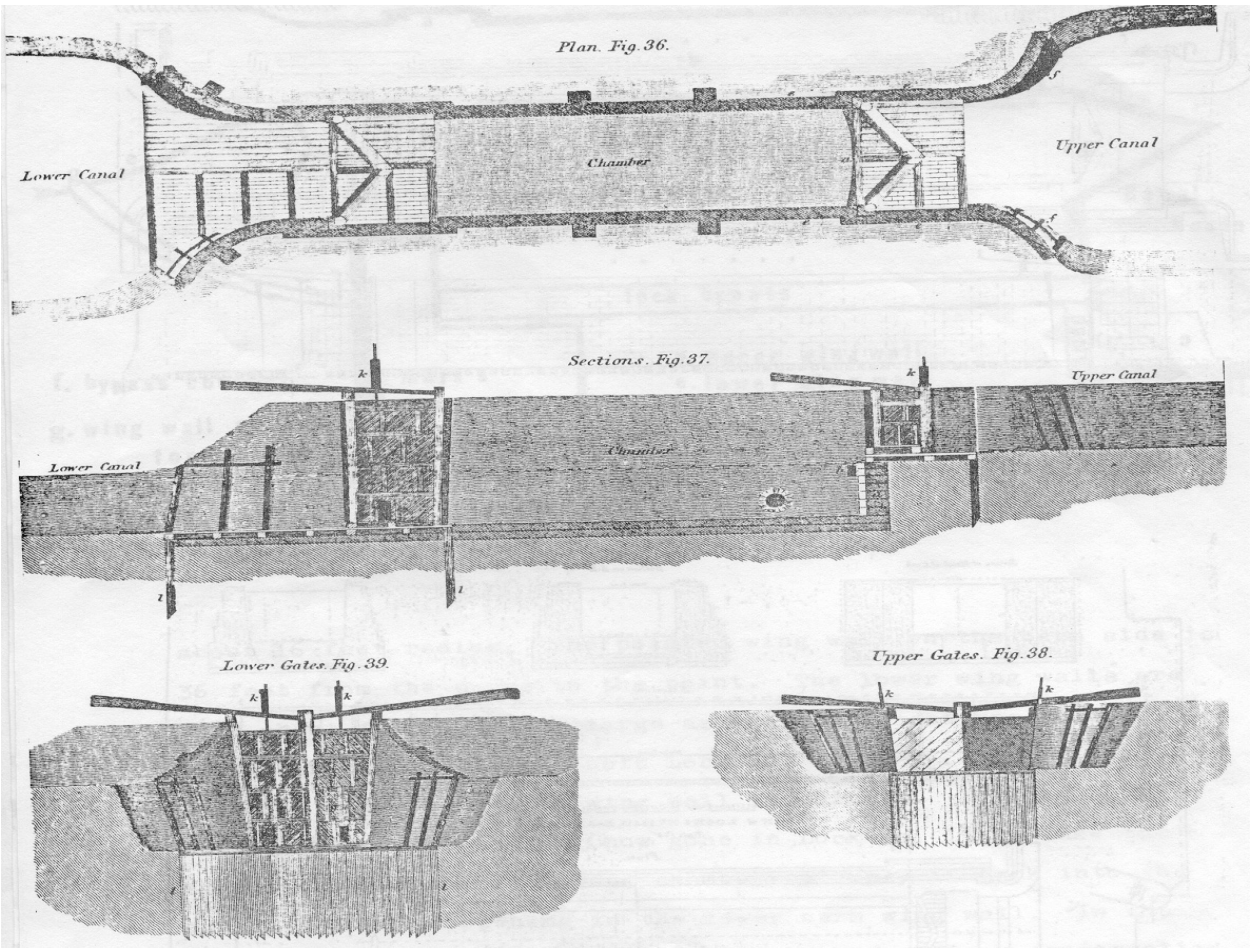
By the beginning of the 19th century the basic lock design was established in England (Fig. 4). In this lock, used in the late 18th century, there is on both sides of the upper canal ("head of the lock" in American terms) a masonry wing wall. The lock then narrows into a rectangular shape which forms the lock chamber. At the upper end of the chamber is a triangular construction called the "mitre sill." The upper lock gates, when closed, rest on this. The upper mitre sill on English locks is on top of the breast wall. The breast wall helps to strengthen the lock at that point where there is most pressure.

FIGURE 4 English Lock 18th Cent. *PLATE* I

CANALS.

LOCKS

Published as the Act directs, 1809, by Longman, Hurst, Rees, & Orme Paternoster Row: Engraved by Wilson Lowry

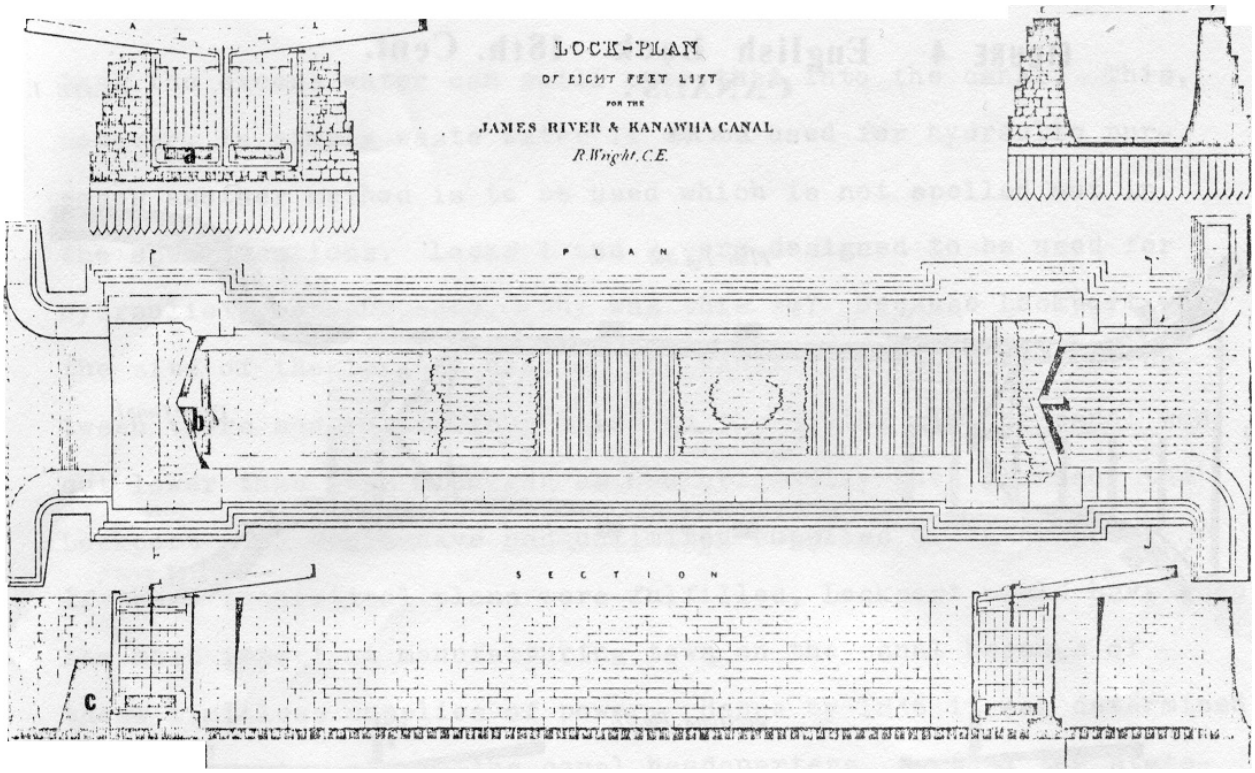


In American locks the upper mitre sill is usually below and behind the breast wall, so the wall can help to reduce pressure at the bottom of the lock gates. The mitre sill on both the upper part of the lock and the lower is positioned so that the lock gates when closed will rest against it and help the gates resist the water pressure. As can be seen from Figs. 5 and 6, the upper gates in American canals were the same height as the lower gates. While in the English canal, because the upper gates rest on the breast wall, it is about half the height of the lower gate.

The chamber is that part of the lock between the upper and lower mitre sill. Here the boat was raised or lowered by opening the valve (or, sluice valve) at the bottom of the lock gate to let water in or out. The lock gates were made of wood with heavy timbers, and were opened or closed by means of a balance beam that extended from the top of the lock gate beyond the lock wall. The entire mechanism was hand operated.

A typical American lock design is that of R. Wright for a lock of eight-foot lift on the James River and Kanawha Canal[2] (Fig. 5).

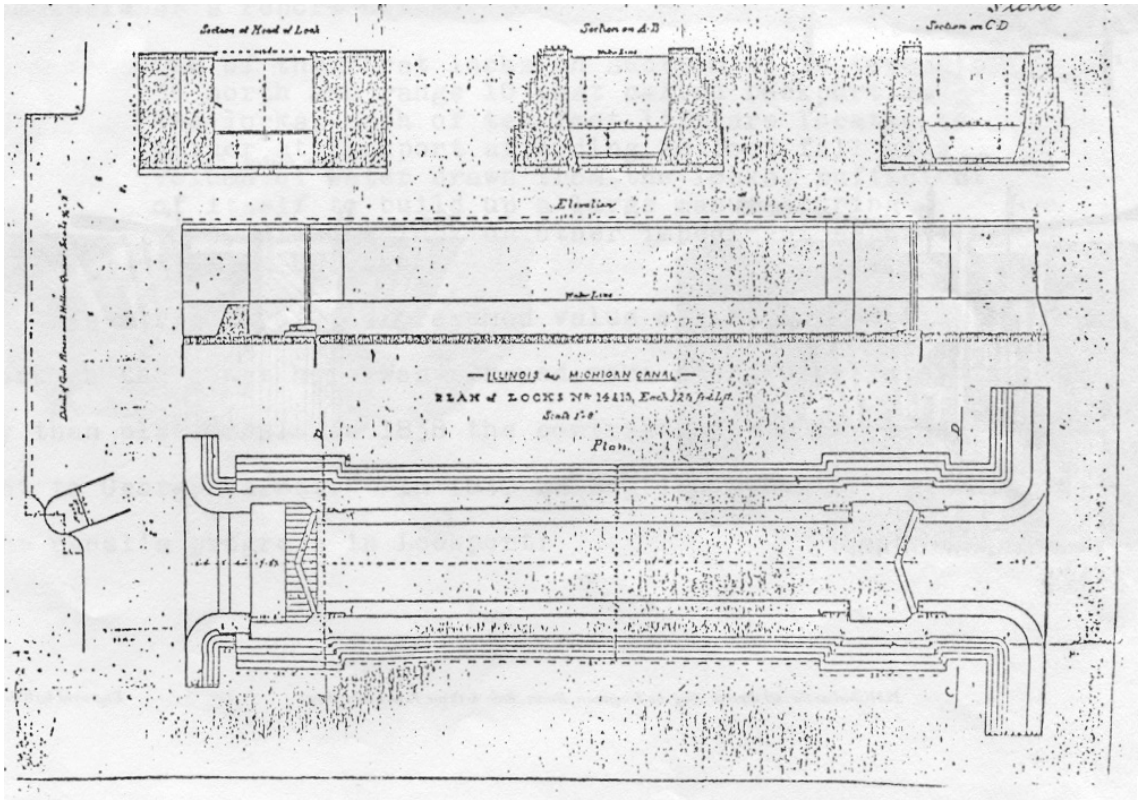
FIGURE 5



a. sluice gate b. upper mitre sill c. breast wall

As can be seen from this, locks had wood flooring and a foundation built on wooden piles. The head of the lock was the thickest as that was where the maximum water pressure was. The walls of the lock were strengthened by increasing their thickness to the foundation. For example, the specifications for a ten-foot lift lock on the Illinois and Michigan Canal required an 18-foot height for the lock walls, and at their foundation they were to be 11 feet 6 inches thick.[3] An examination of Lock No. 1 in 1977 has borne out that it was that wide at the bottom.[4]

FIGURE 6

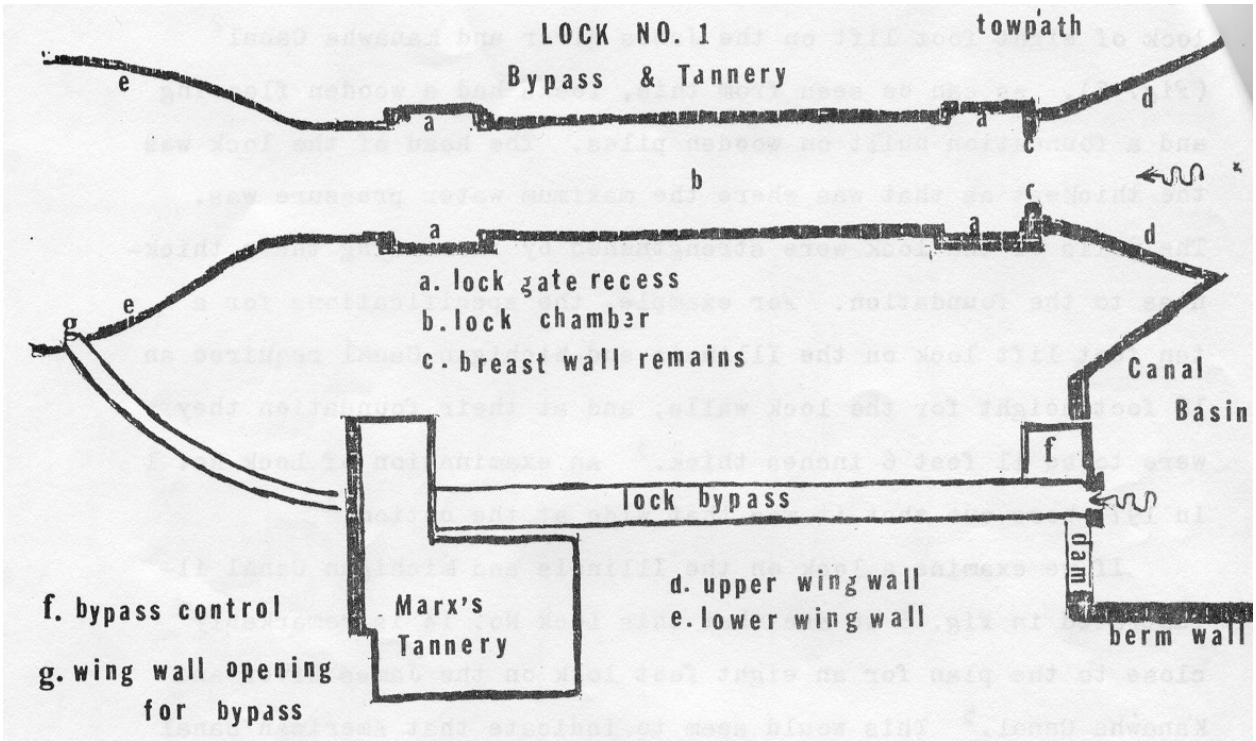


If we examine a lock on the Illinois and Michigan Canal (Fig. 6) we see that this lock, No. 14, is remarkably close to the plan for an eight-foot lock on the James River and Kanawha Canal.[5] This would seem to indicate that American canal locks in the era of the 1840s were very similar.

However, Lock No. 1 and its sister lock, No. 2 (known as Jack's Lock), as can be seen from the sketch in Fig. 7, were different from either Lock 14 or the lock in the James River and Kanawha Canal. The noticeable difference is the upper and lower wing walls of Lock 1 (Lock 2 was built on the same lines as Lock 1) are much longer and differently shaped than wing walls traditionally were. The wing wall was intended to narrow the canal width as the waterway entered the lock chamber. According to the I. And M. Canal specifications for locks, the wing walls at the head or the upper end of the lock were to be 7.5 feet long and attached to the lock wall by a curve of 6-foot radius.[6] Though Lock 1 is of ten-foot lift, as were the locks on the specifications, it has an upper wing wall of 53 feet in length, attached to the wall by a curve of about a 16-foot radius. The pointed wing walls are also about four times as large as the specifications call for.7

One other peculiarity of both Lock No.1 and Lock No. 2 is that the upper berm side wing wall is pointed. The dam next to this wall has an opening (now gone in Lock No. 1) to take excess water around the lock chamber to empty it back into the canal through an opening in the lower berm wing wall. In the aforementioned lock specifications, a method of lock construction for handling excess water not required in lockage is spelled out. It required a wall set at right angles with the lower wing so that the excess water could spill over that into the canal. This, however, is simply waste water; if it is used for hydraulic purposes,

FIGURE 7 LOCKPORT, LOCK No. 1



another method is to be used, which is not spelled out in specifications. Locks 1 and 2 were designed to be used for hydraulic power purposes. Why was this so? Because Lockport was the site of the largest drop in the canal line about 40 feet between there and Joliet, four miles to the south.

If the canal had been cut lower than Lake Michigan as had originally been planned, the Lockport site would have had unlimited supplies of waterpower.

If these theoretical plans had been fulfilled, Lockport would have been the most important town on the canal because of these limitless supplies of power. Hence, by 1836 it was determined that Lockport would be the canal headquarters, so that the state-owned canal would be the chief beneficiary of the location. The state would be rewarded and the canal helped by its income from the sale of land and waterpower leases. Thus, the 1836 Canal Commissioners' report notes:

> One of the first locks on Section 23 in township 36 north and range 10 east called Lockport. . . . Two locks, each of ten foot lift, are located together at Lockport affording 20 foot fall of a volume of water drawn from the locks, sufficient of itself to build up a large manufacturing town, without lock or other impediment separating it from Chicago.[8]

As a result of the presumed value of the Lockport site, work on the canal here was pursued more energetically and rapidly than elsewhere. In 1838 the contracts for Locks 1 and 2 were let to George Barnet.[9] In 1840 an English traveler comments on the canal's progress in Lockport:

> The works for the canal here were prosecuted with more vigor than elsewhere, and the whole place has a very thriving aspect. A basin and locks were there constructed which gave the name to the town.[10]

By 1843 the hopes for a large supply of waterpower at Lockport were dashed. The state did not have the funds to build the canal on the "deep cut" plan between Bridgeport and Lockport. Thus, Lockport would not have a direct access to the waters of Lake Michigan. The main concern now was sufficient water for navigation on this, the summit level. It was decided that main reliance would be on a steam-driven pump at Bridgeport that would pump water out of the Chicago River into the canal. In addition, a feeder would be built (finished in 1852) to carry water from the Calumet River at Blue Island some 17 miles to the canal at the Sag, four miles north of Lemont. This feeder was 40 feet wide and 4 feet deep, as were all the feeders. The main canal was 60 feet wide and 6 feet deep.

By the time this decision was made it appears that both locks were already built. In 1844 Governor John Davis of Massachusetts, sent to inspect the canal for the foreign and Eastern bankers, reports in his journal:

> I took a walk upon and down the canal and found it, as I judge, walled up from the bottom nine feet at least and over 100 feet wide affording a very spacious and convenient basin well adopted to business. At the lower end of the basin is a very beautiful lock of ten foot lift (Lock No. 1).
>
> In the original plan it was intended to create here a large water power. But as the lake feeder is abandoned the success of this scheme must depend upon the supply of water derived from other sources.[11]

In 1847, a full year before the completion of the canal, a reporter from the East wrote this about the locks and the canal in Lockport.

> The canal so far as this place is nearly level, and is for a greater part of the way nearly finished. It is faced on the inside with a yellowish stone, which is found at different points, and which appears to be a combination of lime and sandstone; it is easy to work and lies in quarries in layers of unequal thickness, but none of it more than a foot or a foot and a half thick. At Lockport the canal must be about 200 or 250 feet in width at the bottom, and the locks and abutments are laid in smooth handsome masonry, that would do no discredit to any part of our country.[12]

In the construction of Locks 1 and 2 their foundations were solid bedrock, so no piles or other foundation work was necessary. A three-inch planking was laid on as the first flooring, and a two-inch white oak planking for the second flooring. The walls were built up from this foundation. The depth of Lock No. 1 from the coping stones on top of the walls to the bottom was 16 feet.[13] The breast wall is five feet six inches from the bottom. Since the lock's lift was ten feet, six inches this would require gates of 16 feet height.

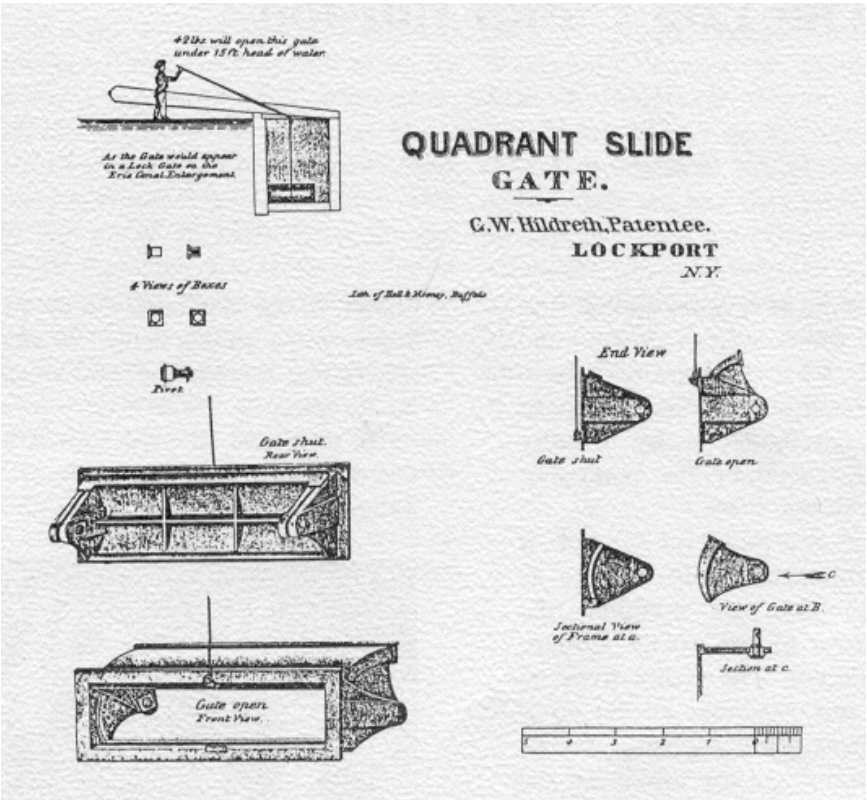
The northeast, or berm, upper wing wall is pointed at about a 60-degree angle which was designed to divert water around the lock chamber. Where this wing wall terminated there was a dam about 50 feet in length. About four feet from the wing wall termination the dam opened into a waterway, lined with stone, (Fig. 15) that allowed a determined quantity of water to flow around the lock chamber and into the lower northeast wing wall (Fig. 7). When the hydraulic power, thus created, was actually used after 1871, a control house was erected at this point on the dam. Above the dam and lock was a basin 120 feet wide and stretching a mile and a quarter north to Fourth Street.

Although it was originally intended to build Locks 1 and 2 together as indicated in the original plats of the town in 1836 and 1837– as well as by the quotation already given from the 1836 Canal Commissioners' Report– when constructed, they were about a mile apart. The reason for this was to better exploit the hydraulic power usage at Lock No. 1 and Lock No. 2. The canal south of Lock No.1 narrowed to about 100 feet, forming another basin that would continue to Lock No. 2. Lock No. 2 was designed the same as Lock No. 1, except that its dam was smaller and the bypass was never modified to make it usable for waterpower. (Figs. 13, 14 and 15).

The most important part of the lock's operation was the timber and hardware that made it possible to operate the canal lock gates. It was this manually operated mechanism that lifted and lowered the boats. The lock gate was made of timber. (Fig. 8 is a blueprint for an I. and M. Canal lock gate from the Society's files).

FIGURE 8

The most important part of the gate was the valve at the bottom, which was opened by the lock operator to let water in or out in order to raise or lower the boat in the lock chamber. The valves used on the Illinois and Michigan Canal were designed by a New Yorker named Hildreth. Canal Society member Mary



Yeater-Rathbun uncovered the fact, in an excellent monograph on locks written for the Illinois Department of Conservation, that Hildreth had actually violated a patent held by George Heath, also a New Yorker.[14]

In any case, the canal and particularly Canal Engineer William Gooding were involved in the litigation over the conflicting patent claims. Hildreth seems to have been acquainted with Gooding. Although the canal had to eventually pay some royalties to Heath, the illustration of the operation and construction of these valve gates is Hildreth's circular, reproduced from the Yeater-Rathbun work (Fig. 9).[15] The valve was operated by a long lever that can be seen on the Chicago lock pictured on the cover. In the late 19th century this locking valve mechanism was changed to a simple mechanism operated by a short lever situated on top of the lock gate. The lock operator had to get on top of the lock gate in order to operate it.

FIGURE 9

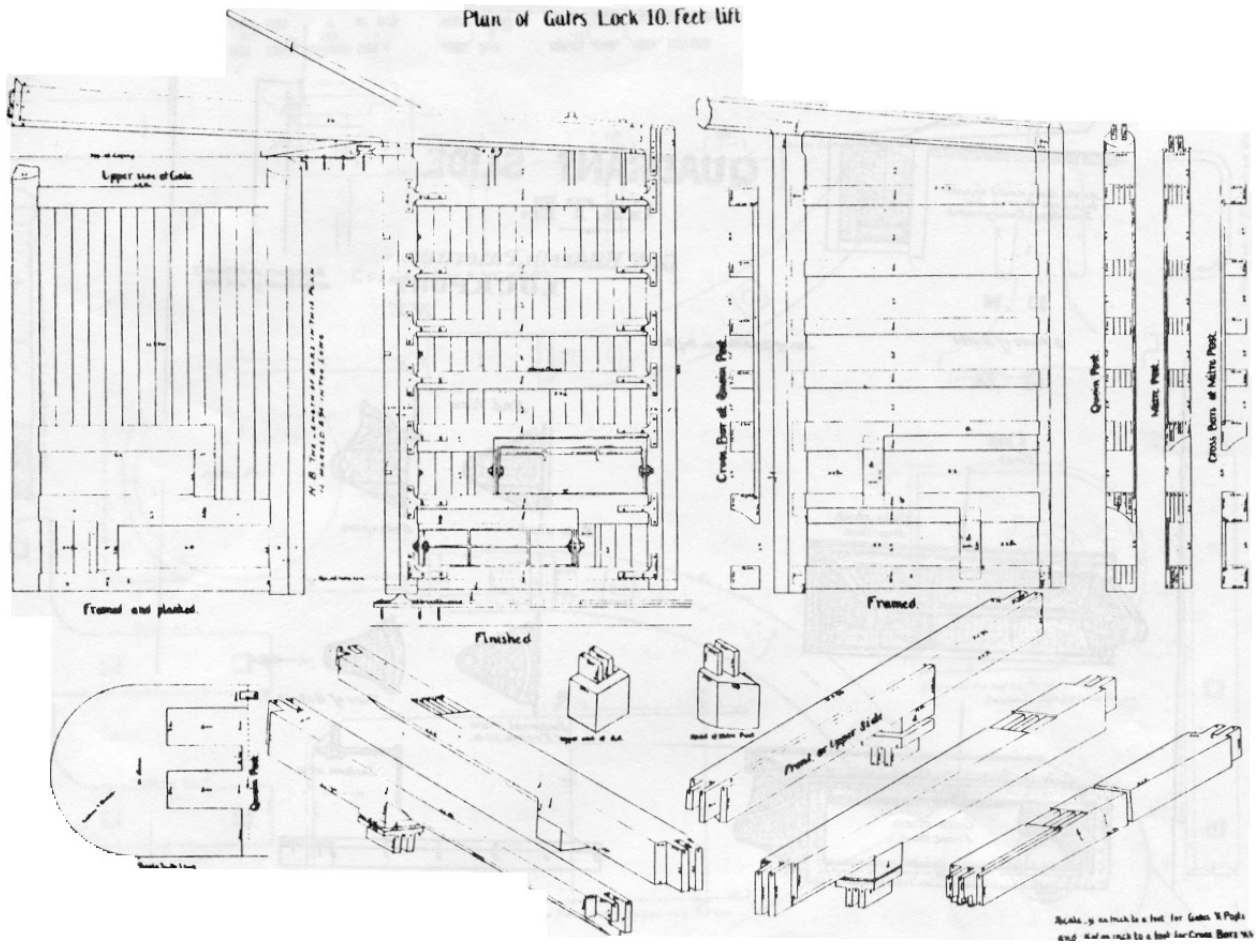
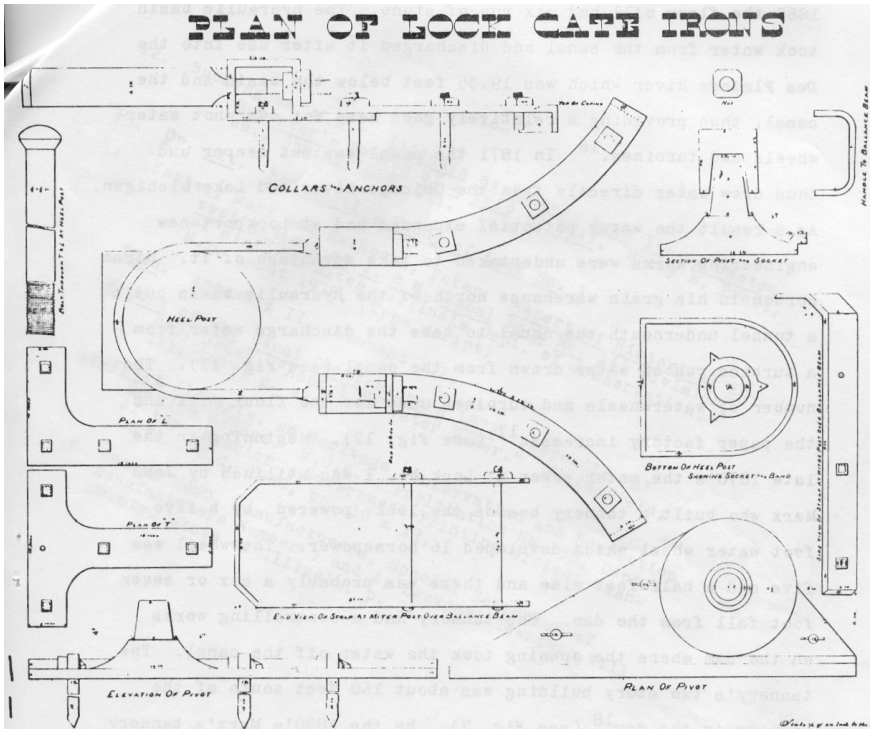


Figure 10 is also from blueprints in the Society's files for a ten-foot lift lock. It indicates some of the hardware needed to attach the gate to the lock wall, and to make it pivot and attach it to the lock foundation. The two plans are for all the lock gates on the canal; neither lock 1 nor 2 needed special lock gate equipment.

FIGURE 10



As already mentioned Locks 1 and 2 formed an important element in the planned use of canal waterpower in Lockport. After the construction of the two locks, a hydraulic basin was built at about 12th Street. This was begun in 1848 and was finished in 1852 when the Calumet Feeder began to supply enough water to provide a surplus on the summit level. A flour mill was built on the basin by Hiram Norton in 1853 that used three run of stone. By 1860 the flour mill had six run of stone. The hydraulic basin took water from the canal and discharged it after use into the Des Plaines River, which 19.35 feet below the basin and the canal, thus providing a relatively good head fro overshot water wheels and turbines.[16]

In 1871 the canal was cut deeper and thus drew water directly from the Chicago River and Lake Michigan. As a result the water potential expanded, and at Lockport new engineering works were undertaken to take advantage of it. Hiram Norton in his grain warehouse north of the hydraulic basin built a tunnel underneath the canal to take the discharge water from a turbine run on water drawn from the canal (Fig. 11). The number of water wheels and turbines used for the flour mill and the paper factory increased[17] (Fig. 12).

Beginning in the late 1870s the water power at Lock No. 1 was utilized by John Marx, who built a tannery beside the lock, powered by a five-foot water wheel which developed 16 horsepower. The wheel was five and a half feet wide and there was probably a six or seven-foot fall from the dam. The tannery had a controlling works on the dam where the opening took the water off the canal. The tannery's two story building was about 160 feet south of the opening in the dam[18] (Fig. 7). By the 1890s Marx's tannery ran only intermittently and used the canal waters fro tanning purposes but not for power. The foundations are all that remain of this operation.

FIGURE 11

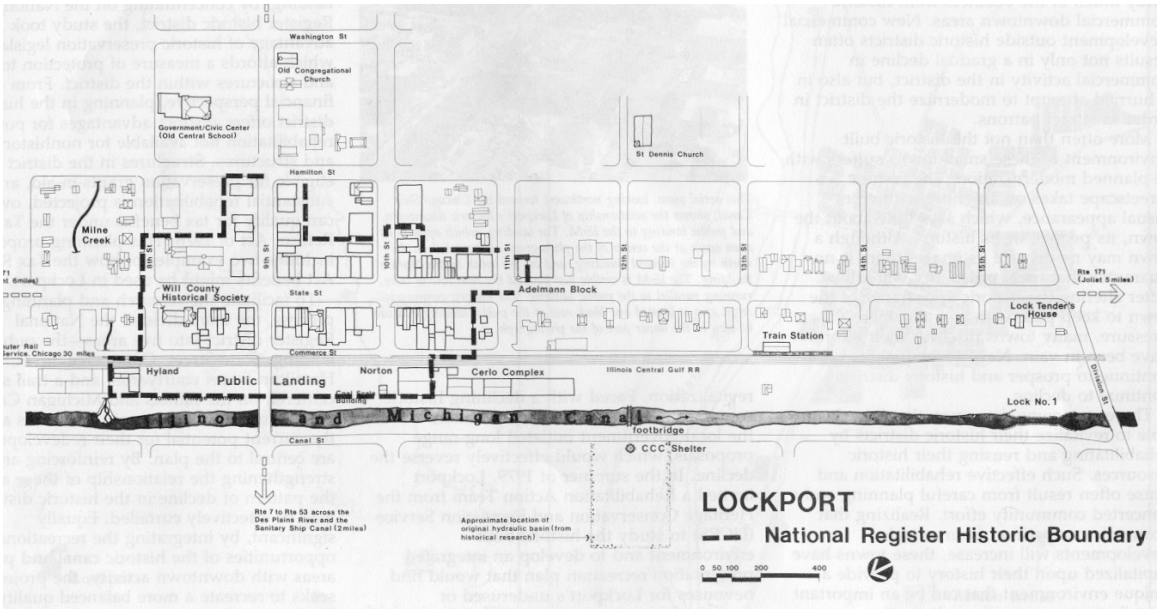


FIGURE 12

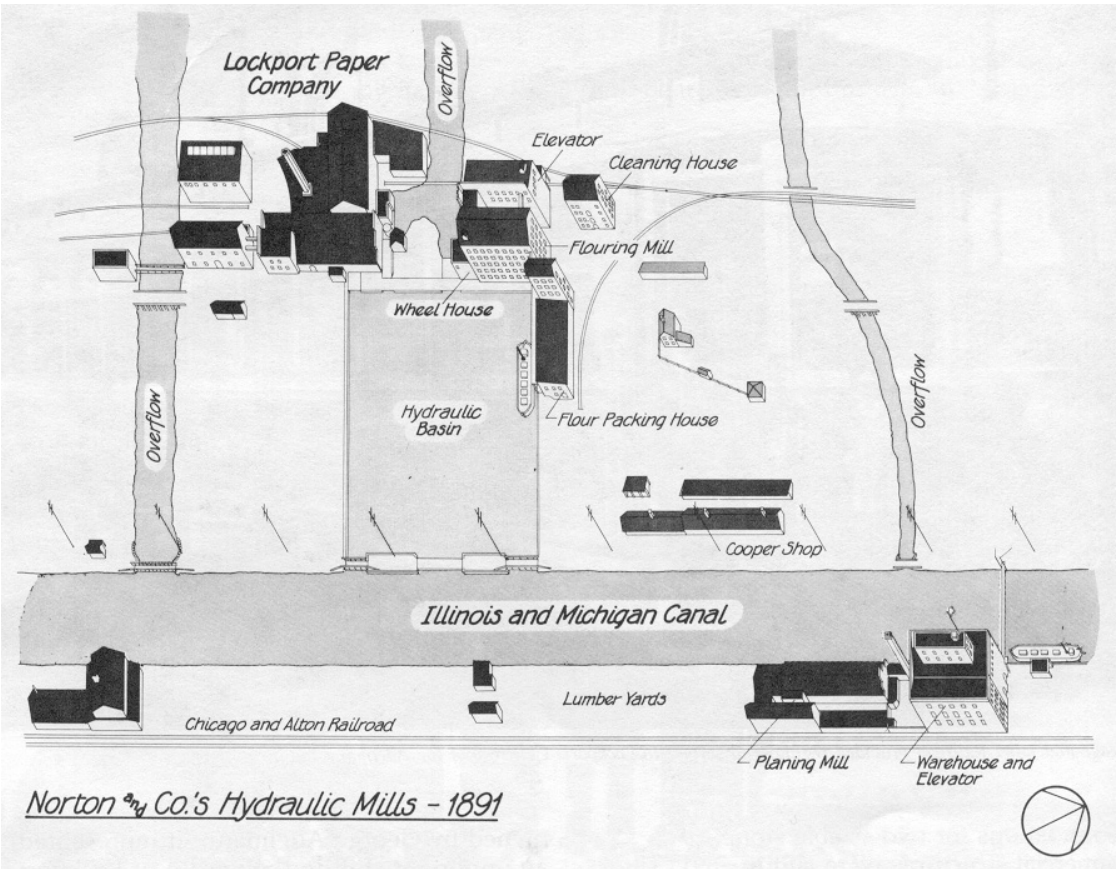


FIGURE 13
Lock No. 2 (known as Jack's Lock)
Shows dam and opening for lock bypass

FIGURE 14
Lock No. 2 Inside lock bypass:
Shows tumble and stone opening facing north.

FIGURE 15
Lock No. 2
South or lower end of lock: Shows opening in berm wing wall for lock bypass.

Another aspect of lock activities was the lockkeeper. This person was responsible for locking boats through, checking cargo manifests to see if tolls were paid, and recording the water level daily over the upper and lower mitre sill.

The lockkeeper's house at Lock No. 1 still remains, built in 1848. It is now located at 1513 S. State. It is one of only three lockkeeper's houses left on the canal. The lockkeeper's salary was $300 per year in 1848 when the canal opened. They were relatively busy locking boats through. For example, at Lock No. 2 in 1863, the keeper, James Sloan, locked an average of 30 boats a day. On some days there were as few as 20 and on some days as many as 45. It took about 15 minutes for a boat to clear the lock. The 1860s, however, was the busiest decade in the canal's history.

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Today, both Locks No. 1 and 2 are in sad shape. The State of Illinois has done little or nothing to preserve them or to help the visitor understand their operation. Since 1906, when the summit level of the canal was closed because it was cut by the Calumet-Sag Canal of the Metropolitan Sanitary District of Chicago, neither lock has been repaired. It is a pity that the State of Illinois Dept. of Conservation has not seen fit to maintain them and explain their significance to today's visitor. The canal has always belonged to the State of Illinois and it is now owned by the Illinois Department of Conservation.

The Department of Conservation has plans to reconstruct Lock 14 in La Salle at the termination of the canal. It is hoped that in a year or so it will be possible for the visitor to learn how 19th century canal locks operated. An examination also of Locks 1 and 2 on the Illinois and Michigan Canal show how complex locks were, and how diverse their usage.

FOOTNOTES

1. William Gooding was born in 1803 in Bristol, New York. He studied engineering on his own. He worked on the Welland Canal in Canada from 1826-1829. He also worked on the Ohio Canal in Socitio until 1832. He also surveyed the Erie and Wabash Canal in Indiana from 1833 to 1835. In 1836 he was appointed Chief Engineer for the Illinois and Michigan Canal and held that post until 1848 when the canal was completed. His removal in that year created something of a scandal in the State. In 1848 he became Secretary to the Canal Trustees. He also served as U.S. Civil Engineer, and Special Commissioner of the Board of Public Works of the City of Chicago. He died in March 1878 and is buried in Lockport.

2. Strickland, William, ed. *Public Works of the United States of America*, published by Edward Gill and Henry Campbell, London 1841.

3. *Specifications of the Manner of Building Locks for the Illinois and Michigan Canal of 10 Feet Lift*. Oct. 15, 1847.

4. *Restoration Study Lock Number 1, I. and M. Canal State Park, Lockport, Illinois*. Prepared by Hanson Engineers, Inc. Springfield, Ill., 1978. (Typescript)

5. *The Annual Report of the State Engineer and Surveyor for the Fiscal Year Ending Sept. 30, 1891*. Albany, N.Y., 1892, p. 476.

6. Op. cit. *Specifications of the Manner of Building Locks*.

7. Op. cit. *Restoration Study Lock Number 1 ...*

8. Reprint of 1836 report to the Governor by Chief Engineer Gooding in the *Report of the Canal Commissioners of the Illinois and Michigan Canal*. Springfield, Ill. 1901, pp. 116-117.

9. *Message of the Governor Transmitting the Report of the Canal Commissioners of the Illinois and Michigan Canal*. Dec. 31, 1836, Vandalia, Ill. 1839, p. 64.

10. Buckingham, Joe. H.: *The Eastern and Western States, Vol. III*. London. 1842, pp. 249-250.

11. Lee, Gary A., ed.: "A Diary of the Illinois and Michigan Canal Investigation 1843-1844, Governor John Davis." *Papers in Illinois History and Transactions for the Year 1941*. Illinois State Historical Society, Springfield, Ill. 1938.

12. Buckingham, J.H.: *Illinois as Lincoln Knew It: A Boston Reporter's Record of a Trip in 1847*. Harry E. Pratt, ed., Springfield, Ill. 1938.

13. Op. cit. *Restoration Study Lock Number 1 ...*

14. Yeater, Mary and Peter Rathbun: *Report of Historical Investigations at I. & M. Canal Lock No. 14.* Division of Historic Sites, Illinois Dept. of Conservation. n.d. about 1978. (Typescript)

15. Ibid. Appendix II, Document E.E.

16. *Report of the Canal Commissioners 1872*. Appendix "A." D.C. Jenne, "Report on Water Power." Springfield, Ill. 1873, p. 42.

17. Lockport, Illinois. A Heritage Conservation and Recreation Service Report. H.C.R.S. Publication No. 35, Dept. of the Interior. Government Printing Office, Washington, D.C. 1980, pp. 10 and 17.

18. U.S. Census 1880, Manufacturers, Special Schedules of manufacturers Number 3 and 4, Lockport Township, Will County, State of Illinois, p. 21.