Northwestern Consolidated Elevator A
West Side Milling District
119 Fifth Avenue South
Minneapolis
Hennepin County
Minnesota

HAER No. MN-16

HAER
MINN
27-MINAP,
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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Rocky Mountain Regional Office
P.O. Box 25287
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD

NORTHWESTERN CONSOLIDATED ELEVATOR A

Location:	119 Fifth Avenue South (originally 506-520 Second Street South), Minneapolis, Hennepin County, Minnesota
UTM:	15.479550.4980540
Quad:	Minneapolis South, Minnesota
Date of Construction:	1908
Present Owner:	Hayber Development Group (at time of renovation)
Present Use:	The elevator was renovated for use as office space in 1987.
Significance:	Completed in 1908, the Northwestern Consolidated Elevator A is historically significant for its intimate association with Minneapolis's "West Side Milling District," and particularly for its role in the flour-milling operations of the mills of the Northwestern Consolidated Milling Company, the third great flour-milling combine in Minneapolis. Additionally, it is significant as one of the largest--perhaps the largest--brick grain elevators ever built, and reportedly the largest in the world at the time of its construction. Brick grain elevators are the rarest of the basic elevator types (wood, steel, brick, tile, concrete). At present it is the only brick elevator in the Saint Anthony Falls Historic District, and one of only a handful in the state of Minnesota.
Historians:	Robert M. Frame III and Jeffrey A. Hess, January 1990

WEST SIDE MILLING DISTRICT

The West Side Milling District lies on the west bank of the Mississippi River, adjacent to the Falls of Saint Anthony. It is bounded by the river, Fourth Avenue South, Second Street South, and Eighth Avenue South. The Minneapolis Mill Company acquired the land in 1856 to gain riparian title to half the waterpower of the falls. The other half of the waterpower belonged to the Saint Anthony Falls Water Power Company, which owned land on the opposite shore of the river.[1]

In 1856-58, the two companies developed the waterpower by constructing a V-shaped dam across the Mississippi above the falls, creating mill ponds on the east and west sides of the river, and channeling the water into connected large power canals, thus allowing the establishment of mill sites along the canals.

The west side project of the Minneapolis Mill Company was successful, bringing in a wide variety of industries during the 1860s. By 1871, the canal powered 25 establishments, including flour mills, sawmills, woolen mills, a cotton mill, paper mill, iron works, sash mill, planing mill, and railroad machine shop.

This diversified industrial development ended in the 1870s as the flour-milling industry quickly began to dominate, thanks largely to a series of revolutionary technological changes that, by the turn of the century, had established Minneapolis as the flour-milling capitol of the world. The first change was the development of the "middlings purifier" and its associated new technique, "New Process Milling." The machine and process allowed millers to successfully grind the regionally grown and more desirable hard spring wheat. Hard spring wheat had a higher gluten content than the more commonly, and easily, ground soft winter wheat. New Process milling produced a bran-free, pure white spring-wheat flour, which quickly commanded a premium on the market. Thanks to the success of New Process milling and its product, Minneapolis millers dramatically expanded their production facilities. Between 1870 and 1880, seventeen new flour-mills were built on the West Side. When the 1874 Washburn A Mill, largest at the Falls, exploded and leveled five nearby mills in 1878, all six were rebuilt and operating within two years. Moreover, they were rebuilt with the latest technology and much greater production capacities.

By 1880, flour mills were the primary industrial structures at the Falls, along with minor auxiliary and support industries, such as foundries, machine shops, and boiler works. The other significant industrial presence was the railroad, needed for hauling ever greater quantities of incoming wheat and outgoing flour.

The second great technological development in milling came at the end of the 1870s, when the modern roller mill was introduced. The roller mill itself was not a revolutionary device; however, former Minneapolis mill engineer William Dixon Gray redesigned the roller mill placed it in a new process intended to derive the most benefit from the advantages of metal rolls over stone millstones. The resulting "all-roller, automatic, gradual-reduction" milling process was simply a modern assembly-line method of producing great quantities of spring-wheat flour with a high degree of quality control. The modern roller mill allowed the Minneapolis mills to expand their capacities even more than before. Gray's patented roller mill was first introduced in Cadwallader C.

Washburn's Experimental C Mill in 1879. So rapidly did the automatic, all-roller technology spread through the industry, that the nearby Standard Mill (see HAER No. MN-14), completed in late 1879, was the last mill built at the Falls that did not incorporate the change.

By the end of the 1880s, the technological situation in the flour-milling industry in Minneapolis had solidified. All the important mills had been built, all the major changes in equipment and processes had been incorporated in them, and the supporting infrastructure of power and transportation was largely in place. Major changes from this point onward involved business and economics, ownership and administration, more than technology.

THE NORTHWESTERN CONSOLIDATED MILLING COMPANY

The most significant development after the 1880s was a trend toward consolidation in ownership. In 1882, two firms controlled approximately 51 percent of daily production capacity of Minneapolis mills, while the remaining production was divided more or less evenly among 16 different firms. By 1890, four large corporations controlled 87 percent of the city's milling capacity; and by the early 1900s, three corporations managed 97 percent of the total flour production.[2]

One of the major consolidations came in 1891, when John Martin, a Minneapolis lumberman turned miller, led a successful effort to combine several mills and elevators into a single corporation, the Northwestern Consolidated Milling Company (NCMC). When formed, the new combination included the following mills: Galaxy, Columbia, Crown Roller (see HAER No. MN-12), Zenith, Northwestern and Petit. It had a combined capacity surpassing that of the Washburn-Crosby firm and almost equalled that of the Pillsbury-Washburn. Its brand was "Ceresota." NCMC eventually operated nine flour mills and several elevators in Minneapolis.[3]

Undercapitalized and with a divided and impractical management arrangement, plus having paid too much for its properties in 1891, NCMC was forced to reorganize in 1895. By 1898, the new system, in which the property was leased to an operating company, appeared to have solved some of the problems. The solution, however, came at the expense of dividends to the stockholders, who were left understandably dissatisfied. In 1898-99, an attempt was made to bring together virtually all spring-wheat mills in a huge new monopoly combination, the United States Flour Milling Company, which grew out of the Hecker-Jones-Jewell Company of New York City. In the end, about the only property that the new trust actually bought was the NCMC. Soon in financial trouble because it sold less than half its projected securities, the U.S. Flour Milling Company was forced into receivership in 1900 and reorganized as the Standard Milling Company. The Minneapolis mill holdings were combined under the Northwestern Consolidated as a subsidiary to the Standard. At last the NCMC was in a financially and managerially stable situation.

As the industry consolidated, the new owners continued to increase the output of their mills by adding and updating equipment. As the interior space of existing mills was used for more milling equipment, auxiliary functions were moved outside to other structure. For example, in 1908 NCMC erected a brick boilerhouse addition to the 1879 Crown Roller Mill to house the mill's auxiliary steam-turbine power plant and coal bunkers.[4] Another exterior addition of significance was the construction of a grain elevator to supply the firm's hungry mills with adequate supplies of raw materials. The NCMC expansion and projected elevator had a triple implication, reported the Minneapolis Journal in February 1908: "It marks the continued expansion of the milling industry, will increase the fireproof grain storage capacity of the city, which is already the largest in the world, and it will add an item of importance to the permits for the building season of 1908."[5]

GRAIN-ELEVATOR DESIGN AND CONSTRUCTION[6]

Elevator Type

The Northwestern Consolidated Elevator A is a "receiving elevator," meaning that it is designed to receive and hold grain for a nearby processing plant, in this case the firm's flour mills. In general, it is similar to a terminal elevator, an elevator functional type designed to receive, store, and ship grain out for additional transportation. The storage area, or bin section, of the receiving elevator may be almost identical to that of the terminal elevator. Since the receiving elevator is intended to take in large quantities but ship out only as much as the mills would need, it has extensive rail unloading facilities but only minimal--if any--rail out-loading facilities. In the case of Elevator A, the shipping function was limited to the overhead conveyors to the Standard and Crown mills.[7]

Structural Materials

Of all the structural materials used in grain elevator construction, brick has turned out to have been the least used. At the turn of the century, when all of the fireproof materials were receiving their first experimental uses, followed quickly by early full-scale structural employment, brick was given largely equal status with the other materials in the industry literature discussions. Nevertheless, There is no evidence that many brick elevators actually were built.[8]

The first brick elevator reportedly was built at Buffalo, N.Y., in 1869 by George H. Johnson, who four years earlier had designed and erected the first two iron elevators and whose son would co-author the important series of tile-elevator construction patents. Johnson's 1869 Plympton Elevator was patented and employed a double wall of bricks specially designed to interlock vertically using projecting knobs or dowels on the bottom that fit into recesses in the top of the brick below, or that is what published drawings illustrate. A description of the actual construction states that only standard common bricks were used. As with all brick and tile elevators, iron or steel was needed to enhance the low tensile strength of the material. In the 1869 example, it is reported that: "At intervals of eighteen courses they are reinforced with cast-iron bond plates which are bolted together horizontally. Each course of bond plates is bolted to the next course of plates both above and below with vertical iron rods in the air spaces around each circle distant from each other about twenty inches." The Plympton might be considered to have been ahead of its time, since it employed cylindrical brick bins and allowed them to stand unenclosed, a feature that, as Reyner Banham has observed about the first iron elevators, did not reemerge until the end of the century. Although this elevator was said to have been successful, and stood for 32 years, there is no indication that it inspired other builders.[9]

For reasons that are not readily apparent, brick seems to have been used more extensively in other countries than in the United States. In his 1903 survey of fireproof elevator construction for the Northwestern Miller, E.P. Overmire stated that "brick grain elevators have been built successfully in Europe for many years, on both the bin and warehouse systems . . . Several large elevators with brick bins have been built at Odessa and Novorosissk, on the Black Sea in Russia." He also described a recent 1,500,000-bushel square-bin brick elevator erected in Liverpool, England.[10] Of the handful of brick examples in the 1913 edition of Plans of Grain Elevators, published by Grain Dealers Journal, the most impressive is the huge 4,500,500-bushel round-bin brick elevator built in 1904 in Buenos Aires, Argentina.[11] None of the technical literature suggests that there was any transfer of information on brick construction between foreign and American builders.

As far as brick construction in the United States was concerned, Overmire actually had little specific to report. In fact he did not list a single American example and only discussed rather general notions about brick design and construction. Compared to tile, he observed, brick was more adaptable, allowing for both rectangular and round bins, and especially noteworthy, "Where varying sizes of bins are required, brick seems to be especially well suited, provided stability can be assured." Without naming any system or elevator example, Overmire noted that "in the brick bins, besides the adhesion between the brick courses, there is a dowel feature, which adds considerably to the tensile strength, although this system depends frankly upon iron tie rods for its main source of strength when the bins are full." It would appear that he had knowledge of the Johnson patent, since that is the only doweled-brick example that appears in any literature. Overmire also included a brick-elevator plan showing rows of rectangular bins, reinforced with tie rods, but gave no description, name, or source for the plan. In the end, his view of the brick matter amounted to a vague gesture toward the future:

> This system [brick elevator construction in general] is adapted to both square and circular bins of varying capacities and promises well as far as the preservation of contents goes. It is too early at present to say that it will prove a complete success structurally, as only a small amount of work has been done and that of a comparatively small nature. If the claims of its advocates prove well founded, it should become an important factor in the elevator problem, particularly where small or various-sized bins are required in the same structure.[12]

Writing a few years later, engineer Milo Ketchum took the opposite approach and briefly described two brick construction techniques, one circular and one rectangular, without making much of a statement concerning their general application. He described a circular brick bin, which he attributed to the Cleveland Elevator Building Company of Minneapolis. The system is similar, as he noted, to tile systems, having a double wall, with the inner wall reinforced with steel placed in a channel. The Cleveland firm built an experimental circular steel-reinforced brick tank in Minneapolis about 1902-03 for the Huhn Elevator Company. The rectangular system described by Ketchum used brick pilasters on the two outer corners and columns in the two inner corners, with steel bars passing through the pilasters and columns, in the planes of the walls, making a box in plan. The brick walls would be arched, with the concave side to the exterior. His narrative neatly describes the drawing reproduced with Overmire's article.[13]

There are very few reported examples of brick elevators being constructed in Minnesota, and all of these have rectangular bins. By far the most significant is the Northwestern Consolidated Elevator A. The Gould Elevator at 3110 California Street N.E. in Minneapolis is an extant example of a brick working house, built in 1907-08 by S.H. Tromanhauser for the Gould Elevator Company.[14] Another Minnesota example described in the industry literature is the 45,000-bushel rectangular-bin elevator erected in 1916 by an unknown builder for the Farmers' Elevator Company in Lamberton and noted in the Grain Dealers Journal. The construction system is not detailed in the article, but from an accompanying photograph it appears that the bins are flat and not concave. A 20,000-bushel brick elevator of about the same size, built in 1903 by S.H. Tromanhauser for the Farmers' Elevator Company in Rushford, did have concave bins, which were not sheathed on the exterior and therefore were quite obvious.[15] A 50,000-bushel, architecturally distinctive brick elevator built in 1902 at Watertown, South Dakota, appears to have bins employing the same concave wall and rod-reinforced design. The builder also was S.H. Tromanhauser.[16]

Why were not more elevators built in brick? Brick construction seemed to have a future when all of the new fireproof materials--steel, brick, tile, and reinforced-concrete--were lined up equally at the starting gate about 1901. It soon was totally eclipsed by concrete for terminal elevators, as were the others, and never could compete economically with wood for country elevators. Even in 1901-02, as much as Overmire was mildly optimistic, James Macdonald was doubtful: "The great weight and volume of bin walls constructed of brick will always be a powerful argument against its adoption where either concrete, tile or steel is available."[17] And as the 1916 description of the Lamberton elevator noted: "Altho [sic] one of the oldest materials of construction brick has not come into general use for grain elevator buildings, the cost being so much more than that of the usual wooden house."[18]

NORTHWESTERN CONSOLIDATED ELEVATOR A

In April 1908, NCMC received bids and began excavation for the foundation for Elevator A, which was planned to have a million-bushel capacity. The builder was G.T. Honstain of Minneapolis. Construction began on April 15, 1908, and work on both the boiler house and the elevator continued through the summer and fall and by October the bin section was largely complete, with only the working house remaining to be finished. At the end of 1908 the work was done and a photograph of the new structure was published in the first 1909 issue of the Northwestern Miller, and the elevator was reportedly used for the first time in January 1909. The firm's articles of incorporation were suitably amended so "that it might have full scope in operating its new million bushel elevator," and shortly it was "made regular" so it could function as a public warehouse (elevator) in addition to being a captive receiving elevator.[19]

As built, the elevator was constructed on a concrete foundation laid on solid rock 26 feet below grade. The elevator's outside dimensions were 79 feet, 10 inches, in width, and 195 feet, 4 inches, in length. The car shed was 85 by 83 feet. The working house, above the bins, was 40 by 80 feet. The total above-grade height of the elevator at its highest point was 165 feet; the total height of the structure including the basement level was 180 feet.[20]

The structure included 57 grain bins. Of the 57 bins, 32 were 19 feet square and 93 feet high, with a capacity of 26,000 bushels each; 20 bins were 9 feet square and 93 feet high, with a capacity of 6,000 bushels each; the remaining 5 bins were 7 by 19 feet and 84 feet high, with a capacity of 10,000 bushels each. The total capacity of the "million bushel" elevator was 1,002,000 bushels.[21]

The grain bins employed a design patented by Fred W. Cooley of Minneapolis and assigned in part to the builder, George T. Honstain.[22] The bin construction was described in a contemporary trade article as follows:

> The walls are 8 inches in thickness and are reinforced with band-iron linked at the corners with crucible steel links. They are further reinforced with corner rods running through V-shaped piers of reinforced concrete. The bands are placed at every 9 inches for the first 30 feet; and are placed 9 and 12 inch intervals alternative for the second 30 feet, while for the third 30 feet they are 12 inches apart. The rods are placed 4 feet apart, the size of the rods being 1-1/2 inches, 1-3/8 inches and 1-1/4 inches. The bands are 4 inches wide and made of No. 9 and 10 steel.
>
> The wall is further protected by a 4-inch air space and an outside 4-inch wall of brick as a veneer. This air space, which is a special feature of this type of construction, entirely eliminates all possibility of moisture reaching the grain, and a test at the Minneapolis Brewery, in bins there with air spaces, the interspace showed but 3 per cent of moisture. The air spaces are also a protection against fire originating in other and adjacent buildings, because the inner wall of the bins and the reinforcing material cannot be reached by heat from the outside.[23]

The use of the reinforcing "ribbons" and the steel corner rods created "a continuous chain of reinforcement."[24]

The grain arrived at the elevator by rail and was unloaded in the car shed, where four tracks were laid over two receiving pits. Each receiving pit held 2,500 bushels and each had its belt conveyor to the two receiving legs of the elevator. The conveyors each had a capacity of 10,000 bushels per hour. Each receiving leg, which also had a 10,000-bushel-per-hour capacity, had a pan, boot, and pit built after another Cooley-Honstain patent of 1906. Some of the steel hoppers in the elevator were fabricated by the William Bros Boiler & Manufacturing Company. The legs raised the grain to the top of the elevator working house where it was delivered into two garners, each with 2,000-bushel capacity, and then was weighed on one of two Fairbanks scales, also of 2,000-bushel capacity each. From the scales the grain was fed to the cleaning system, consisting of two Prinz & Rau Grain Cleaners, with a cleaning capacity of 7,000 bushels-per-hour each. Following the cleaning, the grain was fed to two 10,000-bushel-capacity conveyors, from which it was directed to selected bins via the tripper on each conveyor.[25]

The grain was held in the bins until needed in the mills. At that time, it was withdrawn from the bins via gravity, deposited onto one of two main conveyors in the basement, and discharged into boot of the "mill" leg or "out" leg. The out leg carried the grain to the top of the working house and deposited it into a 2,000-bushel garner and, from there, into the 1,000-bushel Fairbanks Hopper out-scale. The out scale deposited the grain onto two mill conveyors, either a 115-foot conveyor to the Crown Roller Mill (see HAER No. MN-12) or a 30-foot conveyor to the Standard Mill (see HAER No. MN-14).[26]

The elevator's combination of individual electric motors and a main rope drive brought together the most modern power generation and transmission systems of the day for grain elevators. The electric motors were manufactured by General Electric, with horsepower ranging from 5-1/2 to 50-1/2. The electricity was generated in the nearby power plant, which was built at virtually the same time as the elevator. A state-of-the-art continuous ("American system") rope-drive system transmitted power from electric motors to the elevator legs, which were equipped with the Evans Back Stop to prevent the leg from backing up and choking. A Day Company (Minneapolis) Dust Collecting System was installed.[27]

The subsequent structural history of the elevator is virtually undocumented, since the only city building permit clearly designated for this structure is the one issued for the original construction. On the other hand, the evidence presented by the structure and its equipment suggests that alterations were minimal. At one point, a fourth elevator leg was added. Termed the "short leg" and located just west of leg 1, the short leg extended from the top of the working house only down to the bin deck floor. Its purpose was to transfer material within the working house itself without the necessity of running the full height of the elevator and interrupting the use of the major receiving and shipping legs. The short leg allowed a relatively direct transfer from the grain cleaner to scale 3, the shipping scale, and thus also could be used for out loading. The original grain cleaners had been replaced by a Superior Grain Separator Model CG16A (Superior Separator Company, Hopkins, Minnesota; a Eureka Cleaner No. 1212 (S. Howes Company, Inc., Silver Creek, New York; and two Ideal Grain Cleaners, Model 14 W.G.[28]

In the late 1940s and early 1950s, the two mills supplied by the elevator closed. Standard Milling operated the Standard Mill until 1948, when it sold the building. The mill then was used primarily as a warehouse.[29] The Crown Mill was kept operating until June 30, 1953, when milling ceased and the building began life as a warehouse and light industrial facility.[30]

Notes

1. Unless otherwise noted, this history of the West Side Milling District and other portions of this report were drawn from a study prepared by MacDonald and Mack Partnership, and others, for the Minneapolis Riverfront Development Coordination Board, subsequently published as Saint Anthony Falls Rediscovered (Minneapolis: Minneapolis Riverfront Development Coordination Board, 1980). Jeffrey A. Hess, a joint author of this report, was responsible for the historical sections of original study. For additional information, see Robert M. Frame III, Millers to the World: Minnesota's Nineteenth Century Water Power Flour Mills (St. Paul: Minnesota Historical Society, 1977); Frame, "The Progressive Millers: A Cultural and Intellectual Portrait of the Flour Milling Industry, 1870-1920, Focusing on Minneapolis, Minnesota" (Ph.D. Dissertation, University of Minnesota, 1980); and Lucile M. Kane, The Falls of St. Anthony, 2nd ed. (St. Paul: Minnesota Historical Society, 1987).

2. The figure for 1882 is based on "The Mills of Minneapolis," Northwestern Miller 14 (October 15, 1882): 7. The statistics for 1890 and 1900 are from Saint Anthony Falls Rediscovered, p. 37.

3. For information on the Northwestern Consolidated Milling Company and John Martin, see the following sources: Charles A. Kuhlmann, The Development of the Flour-Milling Industry in the United States (Boston: Houghton Mifflin Co., 1929), pp. 136-38, 167-71; "A Mammoth Flour Making Establishment," Northwestern Miller 32 (November 27, 1891): 753; Saint Anthony Falls Rediscovered, p. 46; Pen and Sunlight Sketches of Minneapolis (Minneapolis: Phoenix Publishing Company), pp. 104-05; and Shutter, History of Minneapolis, p. 368.

4. See Minneapolis building permits in the Minneapolis Inspections Department: A-10212 (July 23, 1908), A-10272 (September 18, 1908); and A-10295 (October 7, 1908).

5. "New 1,000,000 Bu. Elevator Next," Minneapolis Journal, February 27, 1908, p. 1.

6. This discussion of grain-elevator design and construction is drawn from "Grain Elevators in Minnesota," National Register of Historic Places, Mul-

tiple Property Documentation Form, prepared by Robert M. Frame III, September 30, 1989. A copy is on file in the Minnesota State Historic Preservation Office.

7. For a discussion of grain-elevator functional types, see G. Boumans, Grain Handling and Storage, Developments in Agricultural Engineering 4 (Amsterdam: Elsevier, 1985), 5.

8. A search through the four available editions of Plans of Grain Elevators yields very few examples of built or planned brick elevators, despite the general advocacy of its use as a structural material.

9. "Fire-proof Grain Storage Buildings," The Brickbuilder 11 (November 1902): 232-36; Reyner Banham, A Concrete Atlantis: U.S. Industrial Building and European Modern Architecture (Cambridge, Mass.: The MIT Press, 1986), 117.

10. E.P. Overmire, "Modern Fireproof Grain Elevators (part 2)," Northwestern Miller 56 (November 25, 1903): 1155.

11. Charles Schmucker Clark, ed., Plans of Grain Elevators, 3rd ed. (Chicago: Grain Dealers Journal, 1913): 43.

12. E.P. Overmire, "Modern Fireproof Grain Elevators (part 2)," 1155-56.

13. Milo S. Ketchum, The Design of Walls, Bins and Grain Elevators, 3rd ed., rev. and enlarged (New York: McGraw-Hill Book Company), 304-05. See also advertisement for the W.S. Cleveland Elevator Building Company, Minneapolis, which states: "Our specialty is brick storage tanks under the Cleveland and Stahr patents," Minneapolis Chamber of Commerce, The Minneapolis Chamber of Commerce 1881-1903 (Minneapolis: Chamber of Commerce, 1903), 50; a photograph of a Cleveland company circular brick tank under construction is on page 39 (see note confirming Cleveland's role on page 43).

14. See City of Minneapolis Building Permit No. B-69334, 1906. A block of circular reinforced-concrete bins with hexagonal caps was added in 1913 by the tile-system designers, Witherspoon-Englar, Minneapolis; see Permit No. B-102405, 1913; see also Sanborn, Minneapolis, 1912, vol. 7, p. 849. In 1989, the facility was owned by the firm of Demeter Argo.

15. For the Lamberton elevator, see "Country elevator of Brick," Grain Dealers Journal 37 (September 10, 1916): 415. For the Rushford elevator, see the inventory form in National Register Multiple Resources Nomination Form for Fillmore County, Minnesota, copy in Minnesota State Historic Preservation Office. Unfortunately, the Rushford elevator has been razed.

16. Only a photo of the Watertown elevator, with no description, appears in Plans, 1913 ed., 309. See also the advertisement for S.H. Tromanhauser of Minneapolis, stating: "Not the biggest elevator in the world, but the best grain elevators of fireproof brick construction in any design"; the advertisement is accompanied by a photograph of an elevator similar to the

Rushford and Watertown elevators, in American Elevator and Grain Trade 27 (October 15, 1908): 237.

17. James MacDonald, "Fireproof Grain Elevator Construction," 45.

18. "Country elevator of Brick," Grain Dealers Journal 37 (September 10, 1916): 415.

19. The original building permit no. A10161 was granted May 27, 1908 by the City of Minneapolis to the Northwestern Consolidated Milling Company. The "brick and steel" grain elevator was to be built by G.T. Honstain for an estimated $165,000, on lots 2,3, and 4, Block 16. The length was to be 198 feet, the width 89 feet, and the height to be 92 feet (165 including the "cupola"). The estimated completion date was December 15, 1908. "Building in the Congested Milling District," Minneapolis Journal, April 8, 1908, p. 17; "Minneapolis & the Northwest" [column of local news notes], in Northwestern Miller April 8, 1908; October 14, 1908; December 30, 1908; January 6, 1909; January 27, 1909; February 10, 1909; "New elevator for the Northwestern Consolidated Milling Company," American elevator & Grain Trade 27 (April 15, 1909): 530. Little is known of elevator builder George T. Honstain. He advertised as a "contractor and builder of grain elevators," was located at this time at 29th Street and Grain Avenue in Minneapolis, had reportedly completed large elevators (design unknown) in Minneapolis, Chicago, St. Louis, and Great Falls, Montana, along with some 400 country elevators. Honstain was assigned two-thirds of grain elevator improvements patented by Fred W. Cooley (see note below). In 1914 an improved distributing spout for elevators was designed by Honstain and announced in the trade press (see "An Improved Distributing Spout and Dial," Grain Dealers Journal 33 (December 10, 1914): 841.

20. Construction details from "New Elevator for the Northwestern Consolidated Milling Company," American Elevator & Grain Trade 27 (April 15, 1909): 530; supplemented by data presented in "Machinery Layout" drawings by Ellerbe Company, April 14, 1986.

21. Bin details from "New Elevator for the Northwestern Consolidated Milling Company," American Elevator & Grain Trade 27 (April 15, 1909): 530; supplemented by data presented in "Machinery Layout" drawings by Ellerbe Company, April 14, 1986. A 1920 reference credited the elevator with a capacity of 1,250,000 bushels, but provided no justification for the difference from earlier references; see "The Grain Handling Facilities of Minneapolis," Supplement to Grain Dealers Journal, September 25, 1920.

22. Fred W. Cooley is unknown outside of his grain elevator patent records and related announcements in grain elevator trade literature. All of Cooley's recorded patents between 1899 and 1909 were assigned two-thirds to Honstain. In addition to the patents discussed below, this included patents no. 683,441; 683,442; 683,443; 707,086; 707,910; and 839,813.

23. "New Elevator for the Northwestern Consolidated Milling Company," American

Elevator & Grain Trade 27 (April 15, 1909): 530, 531. See U.S. Patent No. 795,344, "Fireproof Structure," filed December 13, 1904, patented July 25, 1905, by Fred W. Cooley and two-thirds assigned to George T. Honstain.

24. "Million Bushel Elevator," Northwestern Miller 76 (December 30, 1908): 790.

25. Transport, scale, and cleaning information from "New Elevator for the Northwestern Consolidated Milling Company," American Elevator & Grain Trade 27 (April 15, 1909): 530, 531.; William Bros Boiler & Mfg. Co. noted in "Supreme Court Decision," Northwestern Miller 83 (September 14, 1910): 666; combination boot and boot tank illustrated in Plans of Grain Elevators, 3rd ed., Charles Schmucker Clark, ed. (Chicago: Grain Dealers Journal, 1913), 52-53 (reprinted with no change in 4th ed., 1918, same page numbers); see also U.S. Patent No. 825,191, "Grain-elevator," filed March 27, 1906, patented July 3, 1906, by Fred W. Cooley, Minneapolis, two-thirds assigned to builder George T. Honstain.

    Each tripper remaining in the elevator had the manufacturer indicated on the frame: "Weller Mfg. Co., Chicago"; the north tripper also had "1037" in the top of the frame casting.

    At the time the elevator ceased operating, legs 1 and 2 used 10-inch-wide buckets. The "out" and "short" legs used 9-inch-wide buckets.

26. Transport and scale information from "New Elevator for the Northwestern Consolidated Milling Company," American Elevator & Grain Trade 27 (April 15, 1909): 530, 531.

27. Specific power and transmission information from: "New Elevator for the Northwestern Consolidated Milling Company," American Elevator & Grain Trade 27 (April 15, 1909): 530, 531; "Million Bushel Elevator," Northwestern Miller, December 30, 1908, p. 790; news note, Northwestern Miller, September 30, 1908. At this time, rope drives competed with geared drives, belt drives, and individual electric motors. The Northwestern Consolidated A combined the two most advanced systems, electric motors and rope drive. The continuous ("American") system employs a single rope that may wind through the driving and driven sheaves several times and uses a traveling tension carriage to maintain a uniform tension throughout the rope. The multiple ("English") system uses a series of independent ropes running side by side. The first main rope drive ever installed was used in a Belfast, Ireland, mill in 1856, and was a multiple system. By 1911-12 when the American Manufacturing Company published the 6th edition of its Blue Book of Rope Transmission (New York: American Manufacturing Company, 1912), it could report that rope drives, supplanting geared and belted drive systems, were "especially noticeable along the Great Lakes, where numerous grain elevators are now found in which belting has entirely disappeared and the shafting throughout is turned by ropes" (p. 8). See also The Columbian Book of Rope Transmission (Auburn, N.Y.: Columbian Rope Company, 1911): 7-13.

H.L. Day organized the Day Company in Minneapolis in 1881, shortly after the 1878 mill explosion, to engineer and install dust control systems to help prevent explosions and fires in mills and elevators. The firm later expanded to include the manufacture of steel flour bins, pneumatic conveying systems, bag cleaning units, flour mill air conditioning systems, and the Dual-Clone centrifugal dust collector. Day died in 1927 at the age of 72. See "Death of H.L. Day," Northwestern Miller 152 (December 14, 1927): 1028, and "The Day Company Expands," Grain Dealers Journal 94 (June 13, 1945): 438. Original drawings of dust collecting systems installed by the Day Company, not including any Northwestern Consolidated Milling Company elevators or other properties, are preserved in the Minnesota Historical Society collections.

28. See drawings of "machinery layout," April 14, 1986, Ellerbe; additional information and interpretation from field notes by Jeffrey A. Hess and Robert M. Frame III, 1985.

29. Rock Island Holding Company, Warranty Deed to Sol Leader and others, February 6, 1948, in "Abstract of Title to Lot 13 in Block 16, Minneapolis."

30. Information on building use from the 1950s to the 1970s derived from Minneapolis city directories.