BRICK ENGINEERS' DIGEST
— ARTICLES OF PERMANENT VALUE —
*Compiled and Published periodically by*
BRICK MANUFACTURERS' ASS'N of N. Y., Inc.

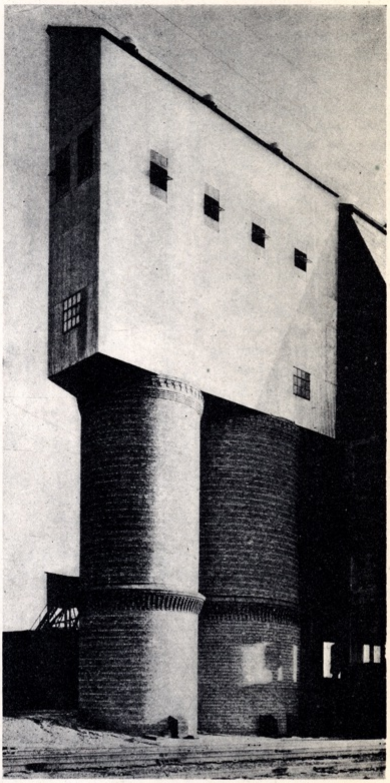
REINFORCED BRICK CONSTRUCTION
Industrial Buildings
4 Pages | Price $0.20 | No. 7

# America's First Major Structure of Reinforced Brickwork Is a Fine Job

By HUGO FILIPPI, Engineer C. B. M. A.
Chicago District

STRUCTURES for the economic storage and handling of materials play an important part in modern plant design. From the mine or field, to the finished product, the problem of storage is important, particularly for such raw materials as coal, ore, grain, sand, gravel and clay. In the silica sand industry, the storage structure is of special importance because of the high standard of purity that must be maintained after the sand has been processed for commercial use. In silica plant design use has been made of steel, wood and concrete for the storage structure but at the plant of the Wedron Silica Company, Wedron, Illinois, a new type of construction, completed in June, 1931, was used. Here the storage bins were constructed entirely of reinforced brickwork — a new development in the construction field that combines utility, beauty and lasting structural strength at minimum cost.

The ground space, fixed by economical operation and by existing plant conditions for the location of the bins, was small in area and irregular in shape. It consisted of a trapezoidal plot of ground only 12 feet wide at one end, 35 feet wide at the other end and only 50 feet in length, comprising in all an area of only 1,175 square feet. The basic problem was to provide maximum storage capacity for three grades of sand at minimum cost. This was accomplished by providing two circular bins — one 25 feet 1-inch inside diameter, divided into two compartments by a center wall, and the other bin 16 feet $2\frac{7}{16}$ inches inside diameter. Both bins are 52 feet high and provide a combined storage space for 2,100 tons of sand. A sectional elevation of the bins is shown in Figure 1. On top of the bins, and developing the full



The completed bins surmounted by a steel framed sand screening house



One of the bins under construction showing the vertical reinforcing rods

*Reprinted with permission from* BUILDING ECONOMY, *March-April 1932*

Copyright, 1935 by B. M. A. of N.Y.

area of the projected ground space, a structural steel frame sand screening house was built. In this house, which consists of two floor levels, are located the sand screens, chuting devices and other appurtenances.

Before the contract was let, plans and specifications were prepared for competitive bin designs in reinforced concrete and in reinforced brickwork. Relative economy, speed of construction and superior appearance however finally decided the owners in favor of reinforced brickwork and the contract was let on this basis. The Wedron bins were the first major structure of reinforced brick masonry built in the United States. The preparation of plans and specifications for the entire job was entrusted to the writer and following is a description of the bins as actually built.

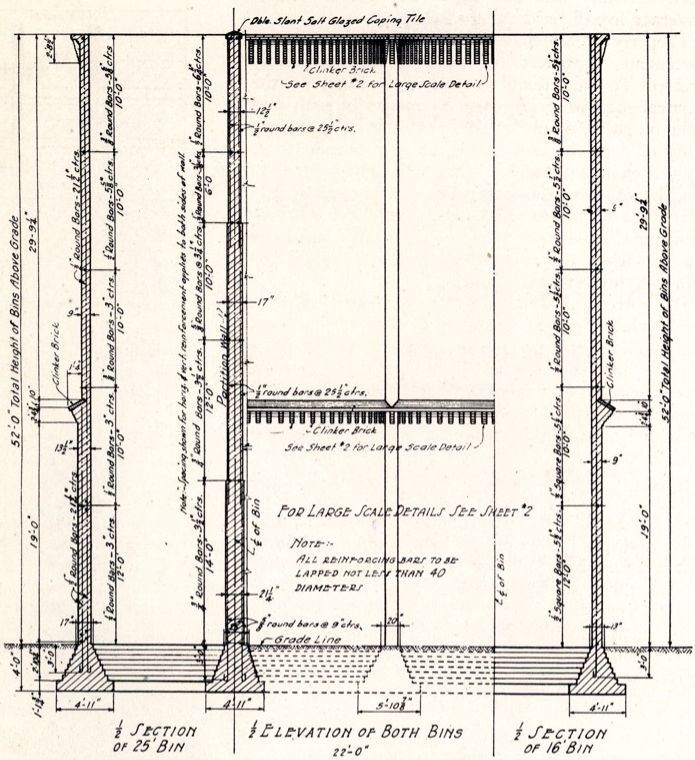



**Figure 1-A — By which is shown the size and position of all reinforcing steel**

The new sand bins are built entirely of Chicago common brick. All walls rest on stepped brick footings which in turn rest on a bed of mixed sand and gravel about 5½ feet below grade. The circular wall of the 25-foot bin is 13½ inches for a height of 22 feet above the top of the foundation and the balance of the wall, 30 feet, is 9¼ inches thick. The center dividing wall in the 25-foot bin is 21 inches thick for the first 14 feet above top of foundation; 17 inches thick for the next 22 feet, and 13 inches thick for the upper 16 feet. As shown in Figures 1 and 2, the ends of this center wall were splayed or flared. The circular walls of the 16-foot bin are 9¼ inches thick from bottom to top.

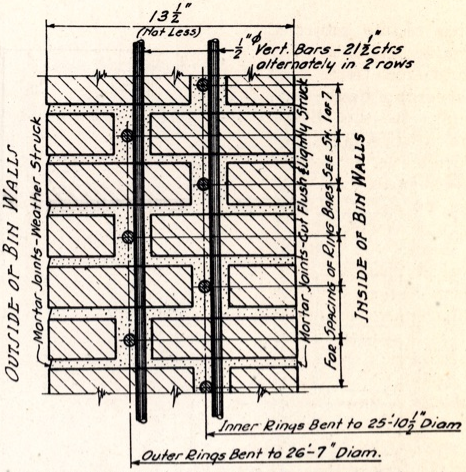
The principal reinforcement consists of bent horizontal rings in the circular walls and of straight and bent horizontal bars in the center wall. In addition, however, the lower 14 feet of the center wall was reinforced vertically. The size and spacing of all reinforcing steel is shown in Figure 1, and its position in the circular walls is shown in Figures 3 and 4. From these it may be seen, that reinforcing bars in reinforced brickwork can be spaced easily and accurately, but what is more important, the intended size and location of each bar may be checked visually in the field *as the work progresses when and as each bar is being placed.* Since the disposition of reinforcement in reinforced brickwork design is a function of the thickness, width or length of a brick, it follows that danger of bar displacement is, in general, totally absent. If reasonable care is taken in laying out the bonding of the brick courses, cutting, clipping or splitting of bricks can easily be eliminated, thereby effecting decided economy in cost of construction. It may be observed, by studying Figures 3 and 4, that no cutting of bricks is required and that the mortar joints have

been carefully laid out so as to provide proper coverage for all reinforcing steel.

Properly to support the first run of vertical reinforcement templates of wood were temporarily erected. To these templates, shown in Figure 5, the vertical rods were attached by means of nails and held in position until well bricked in. Subsequent runs of vertical bars were, at the proper time, spliced to bars already in place and lightly wired to lengths of bent reinforcing bar rings temporarily placed at a convenient height above the working platform. Thus the correct diametral dimensions for the newly placed vertical steel was maintained and swaying was prevented.

All horizontal steel was placed directly on or in freshly laid beds or channels of mortar. To keep the bars at the proper distance from the brick surface and thereby secure the needed complete envelope of mortar around the bars for bond, a new and novel "kink" was developed on this job. It consisted of laying an ordinary wire nail, at proper intervals, under the bar. Thus, to get a minimum coverage of ¼-inch, a 20 penny nail was used; to obtain a $\frac{3}{16}$-inch coverage, a 10 penny nail was used and to obtain a ⅛-inch coverage, a 6 penny nail was employed. Obviously, where a rod was laid in a mortar channel, this practice was not observed.

The construction scaffold used was extremely simple. Instead of the customary braced tower, a loose plank platform, cut to fit the inner diameter of the bins, was employed. This planking was supported by a suitable number of 4 x 6-inch timbers




A large scale detail of the 13½-inch wall construction in the larger bin

(commonly called "put-logs"), let into the brickwork. This platform arrangement is very economical and convenient and follows the practice commonly used in constructing brick chimneys. Figure 2 clearly shows the working platforms of the 25-foot bin. It should be observed that these platforms carried the full load of workmen, material stock and the tripod arrangement used for hoisting.

The reinforced brickwork was built up from these

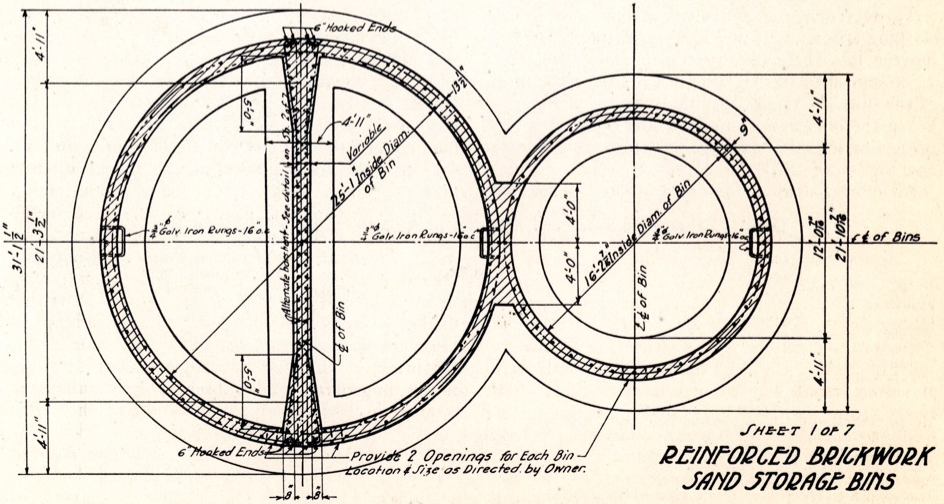
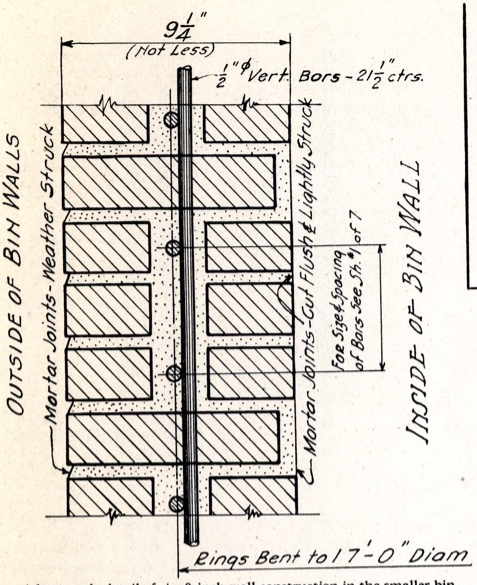



Figure 1 — A sectional plan showing the relative position and size of the bins




A large scale detail of the 9-inch wall construction in the smaller bin

platforms to a height of about 5½ feet. When this limit of working height was reached, a second set of "put-logs" was placed on the fresh brickwork, the loose planking was transferred to the new working level, and bricklaying was resumed at once.

To overcome the difficulties imposed by limited working space, and other local conditions surrounding the job, three construction openings were provided and all materials were hoisted from the inside of the bins. A typical opening is shown in Figure 6. When the bins were completed, the reinforcing steel projecting into the openings was spliced out and the openings were neatly bricked up.

All mortar used in this job consisted of one part of Portland Cement and three parts of screened Torpedo sand, to which was added 18 per cent of Wisconsin high magnesium ground lime putty. This mortar mixture, obtained by successive experiments, provided suitable plasticity. Laboratory tests showed it had all desired physical properties.

As field experience with the construction of reinforced brickwork in this country is still limited, an analysis of cost, based on labor hour units, should be especially interesting and helpful. A very careful classified daily check was kept on all labor employed, the amount of work performed, and on materials used. The figures given below are taken from and based on actual job records. This information is original and never before published. It can be applied to similar work in any part of the country, providing of course that the job conditions are the same or reasonably so.

The experience resulting from the construction of the Wedron bins and from several other jobs of reinforced brickwork more recently completed, justifies the definite statement that reinforced brickwork offers no practical difficulties to the experienced mason contractor or bricklayer, nor does it cost more than competitive construction. In fact, alternate bids on several recent jobs show an appreciable saving over reinforced concrete for comparable designs.

***Editor's Note:***

**Reinforced Brick Masonry cannot be mentioned without bringing to mind the name HUGO FILIPPI, for some years engineer of the Chicago office of the Brick Manufacturers Association and at present general manager of the Illinois Brick Co. He shares with Judson Vodges the distinction of having put this type of construction on a practical basis, having himself designed and directed the construction of dozens of structures. His book entitled "Brick Engineering, Volume III" published by the Brick Manufacturers Association of America ($2.50) describes in detail a series of tests made by the Hunt Laboratories, and many of his own. When the construction industry finds in R. B. M. a valuable tool this man will be due our thanks.**

**Data on Labor Performance and Materials Required to Build Sand Storage Bins**

| Part of Structure | Total Number of Bricks Laid | Bricklayer Hours per Thousand | Common Labor Hours per Thousand | Number of Bricks Laid per 8-Hour Day Per Man |
|---|---|---|---|---|
| Foundation | 32,100 | 3.67 | 4.24 | 2,175 |
| 13½-inch Wall — 25-foot Bin | 33,200 | 6.40 | 5.35 | 1,225 |
| 9¼-inch Wall — 25-foot Bin | 29,700 | 7.12 | 7.84 | 1,110 |
| 9¼-inch Wall — 16-foot Bin | 35,800 | 8.12 | 8.82 | 985 |
| 21-inch Center Wall — 25-foot Bin | 9,700 | 8.71 | 6.28 | 920 |
| 17-inch Wall — 25-foot Bin | 11,700 | 6.72 | 7.90 | 1,190 |
| 13-inch Wall — 25-foot Bin | 6,700 | 7.03 | 8.45 | 1,135 |

Moving Scaffold — 1.26 hours common labor per M Bricks laid.
Bending and carrying steel — 2.71 hours common labor per M Bricks laid.
Cement required per M bricks laid — 8.48 sacks.
Lime required per M bricks laid — 1.52 sacks.
Sand required per M bricks laid — 1.62 tons.
Reinforcing Steel required per M bricks laid — 25.9 pounds.*

**For walls above grade only.*