ALKER
RIES
COMPANY
PITTSBURGH PENNSYLVANIA
1909

CATALOGUE

Containing useful information in connection with the use of

SILICA, MAGNESIA CHROME AND FIRE CLAY BRICK and various REFRACTORIES

as furnished by the

HARBISON-WALKER REFRACTORIES CO

Pittsburgh — Pa.

EAST CHICAGO WORKS

WE have recently erected at East Chicago, Ind., a modern plant equipped for making the highest grade silica brick. For shapes made, see page 9.

TOTAL DAILY CAPACITY OF ALL WORKS

1,100,000 BRICK

FIRE BRICK DEPARTMENT

GOOD material is the factor of supreme importance in all manufacturing business. During the growth and expansion of the fire brick business from small beginnings to the present output—corresponding to the growth and demands of the iron and steel industries—it has been the aim of this Company to maintain the lead in supplying all demands for high grade fire brick and refractory material. To this end, all clay deposits, seemingly worthy of investigation, have been core drilled, the best experts employed and record maps placed on file, enabling the Company to open mines in the irregular formations of fire clay with exact knowledge of what will be opened. This work has been going on systematically for over thirty years. The results, with the association of a few of the most experienced and successful brick manufacturers, enable us to offer the following unrivaled list of well known brands of fire brick. Some of the brands are specially fitted for special work, as the "BENEZET" for blast furnace linings. Some are similar in character to others, but owing to location of works one brand may obtain a more favorable freight rate in a given case. Correspondence or an interview will determine, according to circumstances, which is the most suitable brand to use. With a wide range of records on hand, the broadest experience in

the business, and the good will of over seven thousand patrons to maintain, it is reasonable for customers to assume that they will get reliable advice and careful attention to orders, however large or small.

The brands included carry the world's record for output of metal per furnace lining, blast furnace stove brick that neither disintegrate nor become vitrified with the severe changes of temperature and blast that occur in furnace stoves incident to conditions connected therewith; the best of brick for cupolas, rotary cement kilns, lime kilns, open hearth steel furnaces, copper smelting, boiler settings, continuous glass furnaces and general purposes where high temperatures are in use.

The brick intended for different parts of a blast furnace lining are branded "HEARTH & BOSH," "INWALL" and "TOP" to prevent the mason from making mistakes. The records held by these brands are the result of careful observation over a long period and selection from the best clays. Our Ganister rock used in making Silica brick is selected from decidedly the finest deposits of this rock to be found anywhere. Our silica brands hold the best continuous records in open hearth steel, copper and continuous glass furnaces; also in longitudinal, by-product and bee hive coke ovens.

STANDARD SHAPES—FIRE CLAY

Shapes	Page	Brands
9" Straight	26	Benezet
	26	Hearth & Bosh Benezet
	26	Inwall Benezet
	26	Top Benezet
	26	Woodland
	26	Hearth & Bosh Woodland
	26	Inwall Woodland
	26	Top Woodland
	26	H.-W. Special
	26	Tyrone
	26	C.-Tyrone
	26	Quartzite
	26	Widemire
No. 1 Key	29	Benezet
	29	Hearth & Bosh Benezet
	29	Inwall Benezet
	29	Top Benezet
	29	Woodland
	29	Hearth & Bosh Woodland
	29	Inwall Woodland
	29	Top Woodland
	29	H.-W. Special
	29	Tyrone
	29	C.-Tyrone
	29	Quartzite
No. 2 Key	29	Benezet
	29	Hearth & Bosh Benezet
	29	Top Benezet
	29	Woodland
	29	Hearth & Bosh Woodland
	29	Top Woodland
	29	H.-W. Special
	29	Tyrone
	29	C.-Tyrone
	29	Quartzite
No. 3 Key	29	Benezet
	29	Woodland
	29	C.-Tyrone
	29	Quartzite
No. 4 Key	29	Woodland
	29	Quartzite
No. 1 Arch	26	Benezet
	26	Hearth & Bosh Benezet
No. 1 Arch	26	Top Benezet
	26	Woodland
	26	Hearth & Bosh Woodland
	26	Top Woodland
	26	H.-W. Special
	26	Tyrone
	26	Quartzite
No. 2 Arch	27	Benezet
	27	Hearth & Bosh Benezet
	27	Top Benezet
	27	Woodland
	27	Hearth & Bosh Woodland
	27	Top Woodland
	27	H.-W. Special
	27	Tyrone
	27	Quartzite
No. 1 Split	27	Benezet
	27	Woodland
	27	H.-W. Special
	27	Tyrone
	27	Quartzite
No 2 Split	27	Benezet
	27	Woodland
	27	Quartzite
No. 1 Wedge	28	Benezet
	28	Woodland
	28	Tyrone
	28	H.-W. Special
	28	Quartzite
No. 2 Wedge	28	Benezet
	28	Woodland
	28	H.-W. Special
	28	Tyrone
	28	Quartzite
No. 3 Wedge	28	Benezet
	28	Woodland
	28	Quartzite
No. 1 Jamb	29	Benezet
	29	Woodland
No. 1 Circle	31	Benezet
	31	Woodland

STANDARD SHAPES—FIRE CLAY

CONTINUED

Shapes	Page	Brands
No. 2 Circle	31	Benezet
	31	Woodland
No. 3 Circle	31	Woodland
No. 5 Circle	31	Woodland
Soap	26	Benezet
	26	Woodland
	26	Tyrone
	26	Quartzite
Checker	26	Woodland
No. 3 Neck	30	Woodland
No. 2 Side Skew	30	Benezet
	30	Woodland
Large 9"	26	Benezet
	26	Woodland
Small 9"	26	Benezet
	26	Woodland
No. 1 Cupola	31	Woodland
No. 2 Cupola	31	Woodland
No. 3 Cupola	32	Woodland
No. 4 Cupola	32	Woodland
13½" Straight	38	Hearth & Bosh Benezet
	38	Inwall Benezet
	38	Top Benezet
	38	Hearth & Bosh Woodland
	38	Inwall Woodland
	38	Top Woodland
13½" No. 2 Key	38	Hearth & Bosh Benezet
	38	Inwall Benezet
	38	Top Benezet
	38	Hearth & Bosh Woodland
	38	Inwall Woodland
	38	Top Woodland
Siemens Steel Furnace Blocks	100	Woodland
Our Plan Siemens Blocks	102	Woodland
Featheredge	27	Woodland
13½" No. 4 Key	38	Hearth & Bosh Benezet
	38	Top Benezet
	38	Hearth & Bosh Woodland
	38	Top Woodland

Shapes	Page	Brands
9 x 6" Straight	39	Hearth & Bosh Benezet
	39	Inwall Benezet
	39	Top Benezet
	39	Hearth & Bosh Woodland
	39	Inwall Woodland
	39	Top Woodland
9 x 6" Key	39	Hearth & Bosh Benezet
	39	Inwall Benezet
	39	Top Benezet
	39	Hearth & Bosh Woodland
	39	Inwall Woodland
	39	Top Woodland
Liner Brick	40	Coke—H.-W. Co. Clay
Bottom Tile	40	
Trunnel	40	H.-W. Co. Clay
Bridge Block	32	Woodland
Stock Hole	32	Woodland
Regenerator Tile	44	Inwall Benezet
	44	Tyrone
101A Special Cover	33	Woodland
102A Special Cover	33	Woodland
103A Special Cover	33	Woodland
104A Special Cover	33	Woodland
Bevel Cover	43	Woodland
Square Cover	43	Woodland
Arch Cover	43	Woodland
Hearth Block	61	Hearth & Bosh Benezet
	61	Hearth & Bosh Woodland
Bung Arch	27	Woodland
No. 66	45	H.-W. Special
No. 72	45	H.-W. Special
No. 78	45	H.-W. Special
No. 84	45	H.-W. Special
No. 90	45	H.-W. Special
No. 12	46	H.-W. Special
No. 13	46	H.-W. Special

STANDARD SHAPES—SILICA

Shapes	Page	Brands
9" Straight	26	Star
	26	XX Sand
	26	XX Silica
Large 9"	26	Star
	26	XX Sand
	26	XX Silica
Small 9"	26	Star
	26	XX Sand
	26	XX Silica
Soap	26	Star
	26	XX Sand
	26	XX Silica
No. 1 Arch	26	Star
	26	XX Sand
	26	XX Silica
No. 2 Arch	27	Star
	27	XX Sand
	27	XX Silica
No. 3 Arch	27	Star
No. 1 Split	27	Star
	27	XX Sand
	27	XX Silica
No. 2 Split	27	Star
	27	XX Sand
	27	XX Silica
No. 1 Wedge	28	Star
	28	XX Sand
	28	XX Silica
No. 2 Wedge	28	Star
	28	XX Sand
	28	XX Silica
No. 3 Wedge	28	Star
	28	XX Sand
	28	XX Silica
Large 9" No. 1 Wedge	28	Star
Large 9" No. 2 Wedge	28	Star
No. 1 Key	29	Star
	29	XX Sand
	29	XX Silica
No. 2 Key	29	Star
	29	XX Sand
	29	XX Silica
No. 3 Key	29	Star
	29	XX Sand
	29	XX Silica
No. 4 Key	29	XX Sand
	29	XX Silica
Key Wedge	28	Star
No. 1 Jamb	29	Star
No. 2 Skew	30	Star
No. 3 Neck	30	Star
Featheredge	27	Star
12 x 6 x 2½" Straight	35	Star
12 x 9 x 2½" Straight Soap	36	Star
12 x 2½" No. 1 Wedge	35	Star
12 x 2½" No. 1 Wedge Soap	36	Star
12 x 2½" No. 2 Wedge	36	Star
12 x 2½" No. 2 Wedge Soap	36	Star
12 x 6 x 3" Straight	35	Star
12 x 3 x 3" Straight Soap	34	Star
12 x 9 x 3" Straight Soap	35	Star
12 x 3" No. 1 Wedge	34	Star
12 x 3" No. 1 Wedge Soap	34	Star
12 x 3" No. 2 Wedge	34	Star
12 x 3" No. 2 Wedge Soap	34	Star
12" No. 1 Arch	36	Star
12" No. 2 Arch	36	Star
12" No. 1 Key	34	Star
12" No. 2 Key	34	Star
13½" Straight	35	Star
13½" Binder	35	Star
Siemens Steel Furnace Blocks	100	Star
Coke Oven Crown	40	XX Silica

Other shapes made to order

EAST CHICAGO WORKS

WE have erected at East Chicago a modern plant for the manufacture of first quality silica brick.

The location was selected especially with regard to the trade in Indiana, Illinois, Michigan, Wisconsin, Missouri, Colorado and other western points.

New features have been successfully introduced in the works, placing this plant decidedly in advance of any silica brick works heretofore erected.

The Ganister rock used in "W. STAR," the East Chicago brand, comes from the well-known Wisconsin deposits. The quarries were selected after careful prospecting of the entire territory and numerous tests of brick made from rock of various localities.

"W. STAR" in every way is a high grade silica brick for open hearth furnaces, glass furnaces or for any purpose where the best silica brick are required.

For standard shapes, see the following page.

STANDARD SHAPES—W. SILICA

EAST CHICAGO WORKS

Shapes	Page	Brands
9" Straight	26	W. Star
Large 9"	26	W. Star
Small 9"	26	W. Star
Soap	26	W. Star
No. 1 Arch	26	W. Star
No. 2 Arch	27	W. Star
No. 3 Arch	27	W. Star
No. 1 Split	27	W. Star
No. 2 Split	27	W. Star
No. 1 Wedge	28	W. Star
No. 2 Wedge	28	W. Star
No. 3 Wedge	28	W. Star
No. 1 Key	29	W. Star
No. 2 Key	29	W. Star
No. 3 Key	29	W. Star
No. 2 Skew	30	W. Star
No. 3 Neck	30	W. Star
Featheredge	27	W. Star
No. 1 Jamb	29	W. Star
12 x 6 x 2½" Straight	35	W. Star
12 x 9 x 2½" Straight Soap	36	W. Star
12 x 2½" No. 1 Wedge	35	W. Star
12 x 2½" No. 1 Wedge Soap	36	W. Star
12 x 2½" No. 2 Wedge	36	W. Star
12 x 2½" No. 2 Wedge Soap	36	W. Star
12 x 6 x 3" Straight	35	W. Star
12 x 3 x 3" Straight Soap	34	W. Star
12 x 9 x 3" Straight Soap	35	W. Star
12 x 3" No. 1 Wedge	34	W. Star
12 x 3" No. 1 Wedge Soap	34	W. Star
12 x 3" No. 2 Wedge	34	W. Star
12 x 3" No. 2 Wedge Soap	34	W. Star
12" No. 1 Arch	36	W. Star
12" No. 2 Arch	36	W. Star
12" No. 1 Key	34	W. Star
12" No. 2 Key	34	W. Star
13½" Straight	35	W. Star
13½" Binder	35	W. Star

Other shapes made to order

MAGNESIA AND CHROME DEPARTMENT

IN this department we manufacture two brands of "MAGNESIA" brick for use in basic open hearth steel furnaces or other places where basic material is required, and one brand of "CHROME" brick specially adapted for use in basic open hearth steel furnaces or other places where basic material is required.

All our "MAGNESIA" and "CHROME" brick are branded "H.-W. R. Co."

DEAD-BURNED OR GRAIN MAGNESITE

THE first magnesite brought to the United States was a shipment of 800 tons, bought in Europe in 1885. The first basic steel made in the United States was manufactured in 1886. The use of magnesite has increased progressively with the increased production of basic steel.

Our magnesite is the standard quality and is prepared in the most careful manner, material shipped being carefully manufactured and selected. Owing to the severe rejections in the quarry and the shrinkage in weight in calcining, it is necessary to quarry five tons of rock for every ton of magnesite shipped. That which is accepted is hand-picked, absolutely dead-burned, and contains the correct proportion of fluxing constituents to make it frit or set at the proper temperature in the bottoms of BASIC OPEN HEARTH STEEL FURNACES. Its low silica and lime contents, careful selection, thorough burning and careful hand-picking make it the most uniform, satisfactory and economical, and in every way the best magnesite on the market.

The principal use of magnesite is for forming bottoms in BASIC OPEN HEARTH STEEL FURNACES. A more limited use of magnesite is to make bottoms in MECHANICAL PUDDLING FURNACES, HEATING FURNACES, and tamped in the side walls of COPPER REVERBERATORIES to take the splash of the metal.

CHROME ORE

SESQUIOXIDE of Chromium, known commercially as Chrome Ore, is exceedingly refractory, dense and neutral; it is neither acid, basic, reducing nor oxidizing.

It is used principally in BASIC OPEN HEARTH FURNACES, in such places as along the back walls of STATIONARY and TILTING FURNACES; on the floors of the ports, and as a protection to the silica brick in the ports and furnace blocks. Chrome Ore is generally useful where chemical action and high temperature combined are to be resisted.

We can furnish a Chrome Ore running especially low in silica and containing from 38 to 42 per cent. of chromium sesquioxide, and a Chrome Ore running 50 per cent. chromium sesquioxide or over, shipping either in lump form or finely ground, as ordered.

MAGNESIA BRICK

WE use the highest quality selected magnesite in making Magnesia Brick. The utmost attention, care and experience are given to all the processes of manufacture and burning, and our Magnesia Brick are the standard of quality.

In BASIC OPEN HEARTH STEEL FURNACES a number of courses of magnesia brick are used in making the foundation for the bottom; the bottom being made of dead-burned magnesite. Sidewalks are built of magnesia brick to a height of about 15 inches above the bottom of the charging doors. They are used around the door jambs and tapping holes, and to face the furnace blocks as a protection to the silica brick. They are also being used to advantage in the bulkheads of the ports. Several companies report excellent results by putting in six or eight courses of magnesia brick as the top courses in the gas checkers.

In the construction of SOAKING PITS magnesia brick have replaced fire brick in the six or eight bottom courses, where they last a long time.

Magnesia brick are used along the slag line of METAL MIXERS instead of fire-clay brick.

In BILLET and BAR HEATING FURNACES running on producer or natural gas, magnesia brick are found to be an economy when used in the bottom and on the bridge wall. Sometimes bottoms are made of magnesite mixed with roll scale in the proportion of one ton of dead-burned magnesite to 600 or 800 pounds of roll scale.

Magnesia brick are being widely adopted by COPPER REVERBERATORIES; they are being used in the bottom, which is built as an inverted arch, and in the side walls and on the bridge wall to take the splash of the metal.

Many COPPER CONVERTERS are, next to the shell, lined with one course of magnesia brick laid in magnesite cement.

Special types of furnaces, such as SILVER SLIMES; DROSS and BULLION FURNACES; ELECTRICAL SMELTING, HEATING, WELDING and MELTING FURNACES; CALCIUM CARBIDE KILNS, etc., find the use of magnesia brick a solution of the problem of refractory linings.

Some manufacturers of Portland cement have found magnesia brick to last very well in the burning zone of ROTARY KILNS.

Magnesia brick should be laid in magnesite cement. They are very good conductors of heat, and where this heat conductivity would injure the plate work they should be backed up with some other of our high-grade material. They expand slightly at high temperatures. They are better conductors of electricity than porcelain at 2,000 degrees Fahrenheit or over; at low temperature their electrical conductivity is less than porcelain.

The best results are obtained from magnesia brick in furnaces where continuous heats are used. Great variation of temperature, exposure while hot to currents of cold air or to contact while hot with water or oil, will cause them to shatter and spawl.

Magnesia brick should not be subjected to excessive weight when hot.

CHROME BRICK

CHROME brick are very refractory, dense in structure, and neutral. They are practically infusible.

In BASIC OPEN HEARTH STEEL FURNACE construction they are used as a neutral course between the fire clay brick on the bottom plates and the magnesia brick forming the foundation for the hearth or furnace bottom. The floors of ports and the facing of port walls and backwalls of uptakes are built of chrome brick in many furnaces. Chrome brick are useful in making quick repairs in furnace at working heat, as they are not affected by sudden changes of temperature.

In bottoms of SOAKING PITS six or eight courses of chrome brick replace fire clay brick with advantage.

Chrome brick are being used with good results along the slag line of COAL-FIRED HEATING FURNACES having cinder bottoms.

In COPPER SMELTING and REFINING PLANTS chrome brick are used in the bottom courses and around the tap holes of BLAST FURNACES; in lining SETTLERS, especially on the slag matte line and around the tap holes, and in lining CONVERTERS next to the shell. When chrome brick are put next to the shell they should be laid in magnesite cement instead of chrome ore, the former sticking well to iron work.

LEAD SOFTENING and REFINING FURNACES and many types of SPECIAL FURNACES used in melting and smelting alloys, have adopted chrome brick in places where fire clay or other refractory brick are rapidly destroyed.

They have been used with success in several ROTARY CEMENT KILNS making Portland cement.

Chrome brick should be laid in finely ground chrome ore with the exception noted above. They expand slightly at high temperatures. They should not be subjected to excessive weight when hot. Chrome brick are practically unaffected by changes in temperature; at furnace heat they can come in contact with water without breaking or spawling.

STANDARD SHAPES—MAGNESIA

Shapes	Page of Illustrat'n	Brand
Straight, Standard Size	52	H.-W. R. Co.
No. 1 Arch, Standard Size	52	H.-W. R. Co.
No. 2 Arch, Standard Size	52	H.-W. R. Co.
No. 3 Arch, Standard Size	52	H.-W. R. Co.
No. 1 Wedge, Standard Size	52	H.-W. R. Co.
No. 2 Wedge, Standard Size	53	H.-W. R. Co.
Soap, Standard Size	53	H.-W. R. Co.
No. 1 Split, Standard Size	53	H.-W. R. Co.
No. 2 Split, Standard Size	53	H.-W. R. Co.
No. 1 Key, Standard Size	53	H.-W. R. Co.
No. 2 Key, Standard Size	53	H.-W. R. Co.
No. 3 Key, Standard Size	53	H.-W. R. Co.
No. 4 Key, Standard Size	53	H.-W. R. Co.

STANDARD SHAPES—CHROME

Shapes	Page of Illustrat'n	Brand
Straight	51	H.-W. R. Co.
No. 1 Wedge	51	H.-W. R. Co.
No. 2 Wedge	51	H.-W. R. Co.
No. 1 Key	51	H.-W. R. Co.
No. 2 Key	51	H.-W. R. Co.

Other shapes made to order.

All "CHROME" and "MAGNESIA" brick are branded "H.-W. R. Co."

THE PORTSMOUTH HARBISON-WALKER COMPANY

THE Portsmouth Harbison-Walker Company has large tracts of fine quality flint clay in southern Ohio and northern Kentucky. The plants of this company are favorably located for supplying the iron, steel and other industries in the territory lying west and south of Pittsburgh.

The following brands manufactured have been long recognized as standards in this district:

H. & W. Co. Hearth and Bosh H. & W. Co. Inwall H. & W. Co. Top Kentucky Steel Anglo-Saxon R-Jenkins	First quality clay brick for blast furnaces, or where brick are required to withstand friction as well as high temperature.
H. & W. Co. High Grade Franklin Crown Malleable Royal Star	First quality brick for high grade mill work, malleable iron works, steel works, hot blast stoves, boiler settings, engine tile, cupolas, glass works, and for all other purposes where brick are required to withstand high temperature.
H. & W. Co. No. 1 Sligo Scioto Star Webster	Second quality brick for hot blast stoves, steel works, boiler settings, cupolas, side walls of malleable furnaces, and other purposes where good second quality fire brick are required.
C-Franklin Crown C-Sligo	C-Franklin Crown and C-Sligo are made especially for cupolas, cement and lime kilns.
H. & W. Co. Crown H. & W. Co. Liner	Special brands for bee hive coke ovens.

For standard shapes, see pages 16 and 17

THE PORTSMOUTH HARBISON-WALKER CO.

STANDARD SHAPES—FIRE CLAY

Shapes	Page	Brands
		H. & W. Co. Hearth & Bosh
		H. & W. Co. Inwall
		H. & W. Co. Top
		H.& W.Co. High Grade
		H.& W. Co. No. 1
		Kentucky Steel
9" Straight	26	Anglo-Saxon
		R. Jenkins
		Franklin Crown
		Royal Star
		Malleable
		Scioto Star
		Sligo
		Webster
		Special Silica
		H. & W. Co. Hearth & Bosh
		H. & W. Co. Inwall
		H. & W. Co. Top
		H.& W.Co. High Grade
		H.& W. Co. No. 1
9" No. 1 Keys	29	Kentucky Steel
13½" Straights	38	Anglo-Saxon
		R. Jenkins
		Franklin Crown
		Royal Star
		Malleable
		Scioto Star
		Sligo

Shapes	Page	Brands
		H. & W. Co. Hearth & Bosh
		H. & W. Co. Top
		H.& W. Co. High Grade
		H. & W.Co. No. 1
9" No. 2 Keys	29	Kentucky Steel
9" No. 1 Arch	26	R. Jenkins
9" No. 2 Arch	27	Franklin Crown
		Royal Star
		Malleable
		Scioto Star
		Sligo
Large 9"	26	
Soaps	26	
No. 1 Splits	27	
No. 2 Splits	27	H. & W.Co. High Grade
No. 1 Wedge	28	H. & W.Co. No. 1
No. 2 Wedge	28	Franklin Crown
No. 3 Key	29	Malleable
No. 1 Jamb	29	Royal Star
Feather Edge	27	Scioto Star
No. 2 Side Skew	30	Sligo
No. 3 Neck	30	
No. 1 Circle	31	
No. 2 Circle	31	
Small 9"	26	

Other shapes made to order

THE PORTSMOUTH HARBISON-WALKER CO.

STANDARD SHAPES—FIRE CLAY—CONTINUED

Shapes	Page	Brands
No. 3 Wedge	28	H.&W. Co. High Grade
No. 4 Key	29	
No. 1 Skew	30	H.&W. Co. No. 1
No. 2 Neck	30	
		Franklin Crown
		Malleable
No. 3 Circle	31	Royal Star
		Scioto Star
		Sligo
		H. & W. Co. Hearth & Bosh
		H. & W. Co. Inwall
13½" No. 2 Keys	38	H. & W. Co. Top
		Kentucky Steel
		Anglo Saxon
		R. Jenkins
		H. & W. Co. Hearth & Bosh
13½" No. 4 Keys	38	H. &W. Co. Top
		Kentucky Steel
		R. Jenkins
101 Special	33	H.&W. Co. High Grade
102 Cover	33	

Shapes	Page	Brands
No. 1 Cupola	31	C.-Franklin Crown
No. 2 Cupola	31	
No. 3 Cupola	32	C.-Sligo
No. 4 Cupola	32	
Hearth Blocks		
18 x 9 x 4½"	61	H. & W. Co. Hearth & Bosh
Coke Oven Brick — Liner	40	H.-W. Co. Liner
Coke Oven Brick — Crown	40	H.-W. Co. Crown
Coke Oven Brick — Door Block 5 x 4 x 4"	41	H.-W. Co.
Coke Oven Brick — Trunnel	..	H.-W. Co.
Coke Oven Brick — 12 x 12 x 3"	40	H.-W. Co.
Coke Oven Brick — 12 x 12 x 4"	40	H.-W. Co.
Coke Oven Brick — 2' 8" Fronts	..	H.-W. Co.
Boiler Tile — 12 x 12 x 2"	..	H.-W. Co.
Boiler Tile — 15 x 12 x 2"	..	H.-W. Co.
Boiler Tile — 18 x 12 x 2"	..	H.-W. Co.

Other shapes made to order

CLEARFIELD FIRE BRICK WORKS

THE trade of the Clearfield Fire Brick Company extends over a wide territory and the brands of brick made are favorably known for steel purposes, malleable iron works, blast furnaces, puddling furnaces, lime kilns, general mill purposes and other places where brick made from high grade clay are required. The clays used are all selected flint clays.

On the following page is a list of brands and standard shapes, giving page of illustration.

CLEARFIELD FIRE BRICK WORKS

STANDARD SHAPES—FIRE CLAY

Shapes	Page	Brands
9" Straight	26	Clearfield S
	26	Hearth & Bosh Clearfield
	26	Inwall Clearfield
	26	Top Clearfield
Large 9"	26	Clearfield S
Small 9"	26	Clearfield S
Soap	26	Clearfield S
Checker	26	Clearfield S
No. 1 Arch	26	Clearfield S
	26	Hearth & Bosh Clearfield
	26	Top Clearfield
No. 2 Arch	27	Clearfield S
	27	Hearth & Bosh Clearfield
	27	Top Clearfield
No. 1 Split	27	Clearfield S
No. 2 Split	27	Clearfield S
No. 1 Wedge	28	Clearfield S
No. 2 Wedge	28	Clearfield S
No. 3 Wedge	28	Clearfield S
No. 1 Key	29	Clearfield S
	29	Hearth & Bosh Clearfield
	29	Inwall Clearfield
	29	Top Clearfield
No. 2 Key	29	Clearfield S
	29	Hearth & Bosh Clearfield
	29	Top Clearfield
No. 3 Key	29	Clearfield S
No. 4 Key	29	Clearfield S
No. 1 Circle	31	Clearfield S
No. 2 Circle	31	Clearfield S
No. 1 End Skew	30	Clearfield S
No. 2 Side Skew	30	Clearfield S
No. 3 Edge Skew	30	Clearfield S
No. 1 Neck	30	Clearfield S
No. 2 Neck	30	Clearfield S
No. 3 Neck	30	Clearfield S
No. 1 Jamb	29	Clearfield S
No. 2 Jamb	00	Clearfield S. (No. illustration)
No. 3 Jamb	00	Clearfield S. (No illustration)
Featheredge	27	Clearfield S
13½" Straight	38	Hearth & Bosh Clearfield
	38	Inwall Clearfield
	38	Top Clearfield
13½" No. 2 Key	38	Hearth & Bosh Clearfield
	38	Inwall Clearfield
	38	Top Clearfield
13½" No. 4 Key	38	Hearth & Bosh Clearfield
	38	Top Clearfield
Velvetry Tile	00	Clearfield S. (No illustration)

Other shapes made to order

PHILIPSBURG FIRE BRICK WORKS

The Philipsburg Fire Brick Works make the following brands from choice Clearfield County flint clays :

"WIGTON STEEL" which is recognized as a standard brick for general mill work; it is also widely used in pottery kilns, etc.

"HEARTH & BOSH WIGTON," "INWALL WIGTON," "TOP WIGTON" which have long been standard brands for blast furnace linings.

STANDARD SHAPES—FIRE CLAY

Shapes	Page	Brands
9" Straight	26	Wigton Steel
	26	Hearth & Bosh Wigton
	26	Inwall Wigton
	26	Top Wigton
Large 9"	26	Wigton Steel
Small 9"	26	Wigton Steel
Soap	26	Wigton Steel
No. 1 Arch	26	Wigton Steel
No. 2 Arch	27	Wigton Steel
No. 1 Split	27	Wigton Steel
No. 2 Split	27	Wigton Steel
No. 1 Wedge	28	Wigton Steel
No. 2 Wedge	28	Wigton Steel
No. 3 Wedge	28	Wigton Steel
No. 1 Key	29	Wigton Steel
	29	Hearth & Bosh Wigton
	29	Inwall Wigton
	29	Top Wigton
No. 2 Key	29	Wigton Steel
	29	Hearth & Bosh Wigton
	29	Top Wigton
No. 3 Key	29	Wigton Steel
No. 4 Key	29	Wigton Steel
No. 1 Jamb	29	Wigton Steel
No. 2 Side Skew	30	Wigton Steel
No. 2 Neck	30	Wigton Steel
No. 3 Neck	30	Wigton Steel
Boiler Tile 12 x 12 x 2"	..	(No illustration)
Boiler Tile 15 x 12 x 2"	..	(No illustration)
Boiler Tile 18 x 12 x 2"	..	(No illustration)
Bung Arch	27	Wigton Steel
Featheredge	27	Wigton Steel
Flatback Arch	33	Wigton Steel
Flatback Straight	33	Wigton Steel
13½" Straight	38	Hearth & Bosh Wigton
	38	Inwall Wigton
	38	Top Wigton
	38	Wigton Steel
13½" No. 2 Key	38	Hearth & Bosh Wigton
	38	Inwall Wigton
	38	Top Wigton
13½" No. 4 Key	38	Hearth & Bosh Wigton
	38	Top Wigton
13½ x 4½ x 2½" Straights	35	Wigton Steel

Other shapes made to order

REESE CLAY AND SILICA BRICK WORKS

THE Isaac Reese & Sons Company has been favorably known to the consumers of fire brick for a long period. The various brands manufactured are made from high grade material, and are standard for general mill work, etc. The REESE brand of Silica Brick has an enviable reputation, backed up by some remarkable records, for Open-Hearth Steel, Continuous Glass Tank and Copper Reverberatory Furnaces.

The tables on pages 22 and 23 show the brands and standard shapes, with page of illustration.

REESE CLAY AND SILICA BRICK WORKS

STANDARD SHAPES—FIRE CLAY

Shapes	Page	Brands
9-inch Straight	26	Phoenix
	26	Wallace
	26	W. F. B.
Large 9-inch	26	Phoenix
	26	Wallace
Small 9-inch	26	Phoenix
	26	Wallace
Soap	26	Phoenix
	26	Wallace
	26	W. F. B.
Checker	26	Phoenix
No. 1 Arch	26	Phoenix
	26	Wallace
	26	W. F. B.
No. 2 Arch	27	Phoenix
		Wallace
		W. F. B.
No. 1 Split	27	Phoenix
		Wallace
		W. F. B.
No. 2 Split	27	Phoenix
	27	Wallace
No. 1 Wedge	28	Phoenix
	28	Wallace
	28	W. F. B.
No. 2 Wedge	28	Phoenix
	28	Wallace
	28	W. F. B.
No. 3 Wedge	28	Phoenix
	28	Wallace
No. 1 Key	29	Phoenix
	29	Wallace
	29	W. F. B.

Shapes	Page	Brands
No. 2 Key	29	Phoenix
	29	Wallace
	29	W. F. B.
No. 3 Key	29	Phoenix
	29	Wallace
No. 4 Key	29	Phoenix
	29	Wallace
No. 1 Jamb	29	Phoenix
	29	Wallace
No. 2 Side Skew	30	Phoenix
	30	Wallace
Featheredge	27	Phoenix
No. 2 Neck	30	Phoenix
	30	Wallace
No. 3 Neck	30	Phoenix
	30	Wallace
Regenerator Tile		
18 x 6 x 3 inch	44	
20 x 6 x 3 inch	44	
22 x 6 x 3 inch	44	
24 x 6 x 3 inch	44	
Large 9-inch / No. 1 Wedge	28	Phoenix
	28	Wallace
Large 9-inch / No. 2 Wedge	28	Phoenix
	28	Wallace
Stock Hole	32	Phoenix
Boiler Tile		
12 x 12 x 2 inch	00	Not shown
15 x 12 x 2 inch	00	
18 x 12 x 2 inch	00	

Other shapes made to order

REESE CLAY AND SILICA BRICK WORKS

STANDARD SHAPES—SILICA

Shapes	Page	Brands
9-inch Straight ...	26	Reese
	26	Basic
Large 9-inch.....	26	Reese
	26	Basic
Small 9-inch	26	Reese
	26	Basic
Soap	26	Reese
	26	Basic
No. 1 Arch.....	26	Reese
	26	Basic
No. 2 Arch.....	27	Reese
	27	Basic
No. 1 Split	27	Reese
	27	Basic
No. 2 Split	27	Reese
	27	Basic
No. 1 Wedge.....	28	Reese
	28	Basic
No. 2 Wedge.....	28	Reese
	28	Basic
No. 3 Wedge.....	28	Reese
	28	Basic
Large 9-inch.....	28	Reese
No. 1 Wedge ...	28	Basic
Large 9-inch.....	28	Reese
No. 2 Wedge....	28	Basic
No. 1 Key	29	Reese
	29	Basic
No. 2 Key.....	29	Reese
	29	Basic
No. 3 Key	29	Reese
	29	Basic
No. 1 Jamb.....	29	Basic
No. 2 Skew.....	30	Reese
	30	Basic
No. 3 Neck.....	30	Reese
	30	Basic
Featheredge	27	Reese
	27	Basic
12 x 6 x 3-inch Straight.....	35	Reese
12-inch No. 1 R. Wedge	34	Reese
12-inch No. 2 R. Wedge	34	Reese
12 x 9 x 3-inch Large Soap.....	35	Reese
12 x 3 x 3-inch Small Soap.....	34	Reese
12-inch No. 1 R. Large Wedge Soap.....	34	Reese
12-inch No. 2 R. Large Wedge Soap.....	34	Reese
12-inch No. 1 Arch	36	Reese
12-inch No. 1 Key	34	Reese
12-inch No. 2 Key	34	Reese

Other shapes made to order

CLINTON COUNTY FIRE BRICK WORKS

CLINTON County Fire Brick Works make the following brands from high grade Clinton County flint clays:

Munro	First quality brick for glass works, boiler settings, malleable furnaces, rolling mills, open hearth furnaces, heating furnaces, general mill work, gas plants, cupolas, lime kilns, digesters for paper mills, and for all other work where high grade first quality clay brick are required.
Eureka	No. 1 quality brick for use where brick of the highest refractoriness are not required.
Clinton	Second quality brick for use in boiler settings, flues, stacks, etc.
Hearth & Bosh Munro Inwall Munro Top Munro	Made especially for blast furnace linings.
Alusil	First quality brick for the discharge or hot end of rotary kilns.
C-Eureka	No. 1 quality brick for feed end of rotary kilns, hoods, etc.

The table on the following page shows the shapes and brands made, with page of illustrations.

CLINTON COUNTY FIRE BRICK WORKS

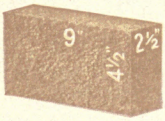
STANDARD SHAPES—FIRE CLAY

Shapes	Page	Brands
9-inch Straight	26	Munro
	26	Eureka
	26	Clinton
Large 9-inch	26	Munro
	26	Eureka
Small 9-inch	26	Munro
	26	Eureka
Soap	26	Munro
	26	Eureka
	26	Clinton
No. 1 Arch	26	Munro
	26	Eureka
	26	Clinton
No. 2 Arch	27	Munro
	27	Eureka
	27	Clinton
No. 1 Split	27	Munro
	27	Eureka
	27	Clinton
No. 2 Split	27	Munro
	27	Eureka
	27	Clinton
No. 1 Wedge	28	Munro
	28	Eureka
	28	Clinton
No. 2 Wedge	28	Munro
	28	Eureka
	28	Clinton
No. 3 Wedge	28	Munro
	28	Eureka
Bung Arch	27	Munro
Featheredge	27	Munro
No. 1 Key	29	Munro
	29	Eureka
	29	Clinton
No. 2 Key	29	Munro
	29	Eureka
	29	Clinton
No. 3 Key	29	Munro
	29	Eureka
No. 4 Key	29	Munro
No. 1 Jamb	29	Munro
No. 2 Side Skew	30	Munro
No. 3 Neck	30	Munro
No. 1 Circle	31	Munro
No. 2 Circle	31	Munro
No. 3 Circle	31	Munro
No. 5 Circle	31	Munro
No. 1 Cupola	31	Munro
No. 2 Cupola	31	Munro
No. 3 Cupola	32	Munro
No. 4 Cupola	32	Munro
Stock Hole	32	Munro
Boiler Tile 12 x 12 x 2" / 15 x 12 x 2" / 18 x 12 x 2"		(No illustration)
Rotary Kiln Shapes		
No. 66	45	Alusil
No. 72	45	Alusil
No. 78	45	Alusil
No. 84	45	Alusil
No. 90	45	Alusil
9-inch Straights	26	Hearth & Bosh Munro
	26	Inwall Munro
	26	Top Munro
9-inch No. 1 Keys	29	Hearth & Bosh Munro
	29	Inwall Munro
	29	Top Munro
9-inch No. 2 Keys	29	Hearth & Bosh Munro
	29	Top Munro
13½-inch Straights	38	Hearth & Bosh Munro
	38	Inwall Munro
	38	Top Munro
13½-inch No. 2 Keys	38	Hearth & Bosh Munro
	38	Inwall Munro
	38	Top Munro
13½-inch No. 4 Keys	38	Hearth & Bosh Munro
	38	Top Munro

Other shapes made to order

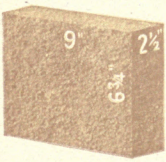
STANDARD SHAPES

OTHER SHAPES MADE TO ORDER



9-INCH STRAIGHT

9 x 4½ x 2½"



LARGE 9-INCH

9 x 6¾ x 2½"

SMALL 9-INCH

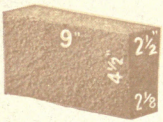
9 x 3½ x 2½"

SOAP

9 x 2¼ x 2½"

CHECKER

9 x 2¾ x 2¾"



NO. 1 ARCH

72 Brick to the Circle

4′ Inside Diameter

9 x 4½ x 2½ x 2⅛"

STANDARD SHAPES

NO. 2 ARCH
42 Brick to the Circle
2′ Inside Diameter
9 x 4½ x 2½ x 1¾″

NO. 3 ARCH
18 Brick to the Circle
6″ Inside Diameter
9 x 4½ x 2½ x 1″

BUNG ARCH
9 x 4½ x 2½ x 2⅜″

NO. 1 SPLIT
9 x 4½ x 1¼″

NO. 2 SPLIT
9 x 4½ x 2″

FEATHER-EDGE
9 x 4½ x 2½ x ⅛″

STANDARD SHAPES

NO. 1 WEDGE
102 Brick to the Circle
5′ Inside, 6′ 6″ Outside Diam.
9 x 4½ x 2½ x 1⅞″

NO. 2 WEDGE
63 Brick to the Circle
2′ 6″ Inside, 4′ Outside Diam.
9 x 4½ x 2½ x 1½″

NO. 3 WEDGE
56 Brick to the Circle
3′ Inside, 4′ 6″ Outside Diam.
9 x 4½ x 3 x 2″

LARGE 9-INCH NO. 1 WEDGE
102 Brick to the Circle
5′ Inside, 6′ 6″ Outside Diam.
9 x 6¾ x 2½ x 1⅞″

LARGE 9-INCH NO. 2 WEDGE
63 Brick to the Circle
2′ 6″ Inside, 4′ Outside Diam.
9 x 6¾ x 2½ x 1½″

KEY WEDGE
9 x 4½ x 3 x 2½ x 1½″

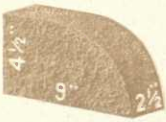
STANDARD SHAPES

NO. 1 KEY
112 Brick to the Circle
12′ Inside, 13′ 6″ Outside Diam.
9 x 4½ x 4 x 2½″

NO. 2 KEY
65 Brick to the Circle
6′ Inside, 7′ 6″ Outside Diam.
9 x 4½ x 3½ x 2½″

NO. 3 KEY
41 Brick to the Circle
3′ Inside, 4′ 6″ Outside Diam.
9 x 4½ x 3 x 2½″

NO. 4 KEY
26 Brick to the Circle
1′ 6″ Inside, 3′ Outside Diam.
9 x 4½ x 2¼ x 2½″



NO. 1 JAMB
9 x 4½ x 2½″

STANDARD SHAPES

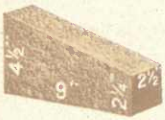
No. 1 NECK
9 x 4½ x 3½ x 2½ x ⅝"

No. 2 NECK
9 x 4½ x 2½ x 1½ x ⅝"

No. 3 NECK
9 x 4½ x 2½ x ⅝"

No. 1 END SKEW
9 x 6⅛ x 4½ x 2½"

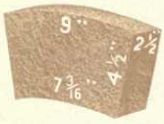
No. 2 SIDE SKEW
9 x 4½ x 2½ x 1¾"



No. 3 EDGE SKEW
9 x 4½ x 2¼ x 2½"

STANDARD SHAPES

NO. 1 OR 33-INCH CIRCLE BRICK
12 Brick to the Circle
24" Inside, 33" Outside Diam.
9 x 6 9/16 x 4½ x 2½"



NO. 2 OR 45-INCH CIRCLE BRICK
14 Brick to the Circle
36" Inside, 45" Outside Diam.
9 x 7 3/16 x 4½ x 2½"

NO. 3 OR 51-INCH CIRCLE BRICK
18 Brick to the Circle
42" Inside, 51" Outside Diam.
9 x 7 7/16 x 4½ x 2½"

NO. 5 OR 84-INCH CIRCLE BRICK
32 Brick to the Circle
84" Inside, 93" Outside Diam.
9 x 8⅛ x 4½ x 2½"

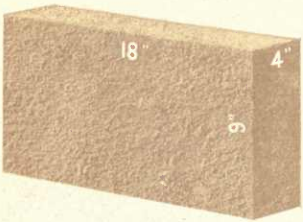
NO. 1 CUPOLA BRICK
15 Brick to the Circle
30" Inside, 42" Outside Diam.
9 x 6 7/16 x 6 x 3"
9 x 6 7/16 x 6 x 4"

NO. 2 CUPOLA BRICK
17 Brick to the Circle
36" Inside, 48" Outside Diam.
9 x 6¾ x 6 x 3"
9 x 6¾ x 6 x 4"

STANDARD SHAPES

NO. 3
CUPOLA BRICK
21 Brick to the Circle
48" Inside
60" Outside Diameter
$9 \times 7\frac{3}{16} \times 6 \times 3"$
$9 \times 7\frac{3}{16} \times 6 \times 4"$

NO. 4
CUPOLA BRICK
25 Brick to the Circle
60" Inside
72" Outside Diameter
$9 \times 7\frac{1}{2} \times 6 \times 3"$
$9 \times 7\frac{1}{2} \times 6 \times 4"$

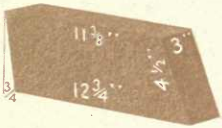


STOCK HOLE TILE
18 x 9 x 4"

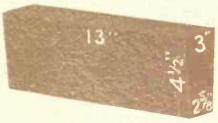
BRIDGE BLOCK
13 x 6½ x 3"

STANDARD SHAPES

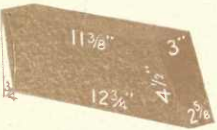
No. 101-A SPECIAL COVER
Used in Malleable Furnaces
13 x 4½ x 3"



No. 102-A SPECIAL COVER
Used in Malleable Furnaces
12¾ x 11⅜ x 4½ x 3"

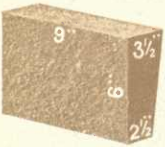


No. 103-A SPECIAL ARCH
Used in Malleable Furnaces
5' 3" Inside Diam.
13 x 4½ x 3 x 2⅝"



No. 104-A SPECIAL ARCH
Used in Malleable Furnaces
5' 3" Inside Diam.
12¾ x 11⅜ x 4½ x 3 x 2⅝"

POTTERY KILN TILE
STRAIGHT FLATBACK
9 x 6 x 2½"



FLATBACK ARCH
9 x 6 x 3½ x 2½"
2' 6" Inside Diam.

STANDARD SHAPES—SILICA

OTHER SHAPES MADE TO ORDER

3-INCH SERIES

12 x 3 x 3 INCH SOAP

12 x 3 INCH No. 1 WEDGE SOAP

12 x 9 x 3 x 2½"

10′ Inside Diameter

12 x 3 INCH No. 2 WEDGE SOAP

12 x 9 x 3 x 2"

4′ Inside Diameter

12 x 3 INCH No. 1 WEDGE

12 x 6 x 3 x 2½"

10′ Inside Diameter

12 x 3 INCH No. 2 WEDGE

12 x 6 x 3 x 2"

4′ Inside Diameter

12-INCH No. 1 KEY

12 x 6 x 5½ x 3"

22′ Inside Diameter

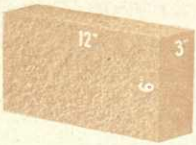
12-INCH No. 2 KEY

12 x 6 x 5 x 3"

10′ Inside Diameter

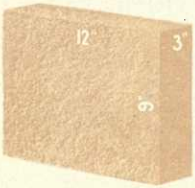
See 2½-Inch series, pages 35 and 36

STANDARD SHAPES—SILICA



3-INCH SERIES—CONTINUED

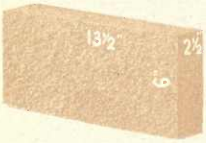
12x6x3 INCH STRAIGHT



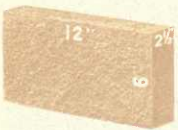
12x9x3 INCH SOAP

2½-INCH SERIES

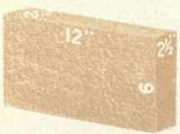
13½-INCH BINDER BRICK
13½ x 4½ x 2½"



13½-INCH STRAIGHT
13½ x 6 x 2½"



12x6x2½ INCH STRAIGHT



12x2½ INCH No. 1 WEDGE
12 x 6 x 2 11/16 x 2½"
24" Inside Diameter

State whether 2½ or 3-inch series is desired

STANDARD SHAPES—SILICA

2½-INCH SERIES—CONT.

12x2½ INCH No. 2 WEDGE

12′ Inside Diameter

12 x 6 x 2⅞ x 2½"

12x9x2½ INCH SOAP

12x2½ INCH No. 1 WEDGE SOAP

12 x 9 x 2 1/16 x 2½"

24′ Inside Diameter

12x2½ INCH No. 2 WEDGE SOAP

12 x 9 x 2⅞ x 2½"

12′ Inside Diameter

12-INCH No. 1 ARCH

75 Brick to the Circle

5′ Inside, 6′ Outside Diam.

12 x 6 x 3 x 2½"

12-INCH No. 2 ARCH

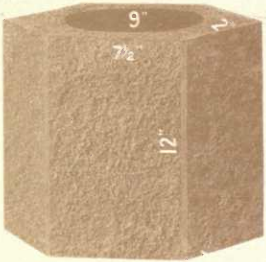
75 Brick to the Circle

4′ Inside, 5′ Outside Diam.

12 x 6 x 2½ x 2"

See 3-inch series, pages 34 and 35

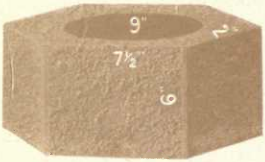
HEXAGON STOVE SHAPES



12x13 INCH HEXAGON

9" Diameter Flue

12 x 7½ x 9"



6x13 INCH HEXAGON

For Breaking Joints

6 x 7½ x 9"

6x13 INCH HEXAGON

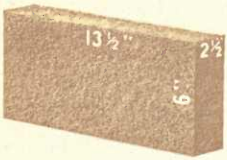
For Finishing Top

6 x 7½ x 9"

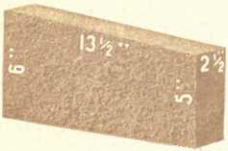
Typical of many shapes made—shapes for special stoves shown with cuts of stoves.

See pages 62 to 75 inclusive

BLAST FURNACE LINING BRICK
STANDARD SHAPES



13½-INCH STRAIGHT
13½ x 6 x 2½"

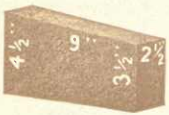


13½-INCH No. 2 KEY
90 Brick to the Circle
12′ Inside Diameter
13½ x 6 x 5 x 2½"

13½-INCH No. 4 KEY
52 Brick to the Circle
6′ Inside Diameter
13½ x 6 x 4⅜ x 2½"

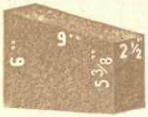
9-INCH STRAIGHT
9 x 4½ x 2½"

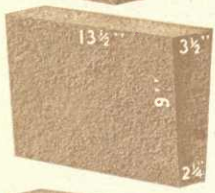
9-INCH No. 1 KEY
112 Brick to the Circle
12′ Inside Diameter
9 x 4½ x 4 x 2½"

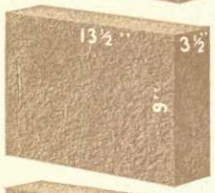


9-INCH No. 2 KEY
65 Brick to the Circle
6′ Inside Diameter
9 x 4½ x 3½ x 2½"

BLAST FURNACE LINING BRICK
STANDARD SHAPES







9 x 6 INCH KEY
For 12′ Circle
85 Brick to the Circle
9 x 6 x 5⅜ x 2½"

9 x 6 INCH STRAIGHT
For enlarging above circles
9 x 6 x 2½"

BLAST FURNACE ARCH BRICK FOR GAS FLUES

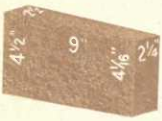
13½ x 9 INCH ARCH
For 3, 4 and 5′ Inside Diameter
For 3′—13½ x 9 x 3½ x 2¼"
For 4′—13½ x 9 x 3½ x $2\frac{17}{32}$"
For 5′—13½ x 9 x 3½ x $2\frac{11}{16}$"

13½ x 9 INCH STRAIGHT
For enlarging above circles
13½ x 9 x 3½"

9 x 9 INCH ARCH
For 3, 4 and 5′ Inside Diameter
For 3′—9 x 9 x 3½ x 2¼"
For 4′—9 x 9 x 3½ x $2\frac{17}{32}$"
For 5′—9 x 9 x 3½ x $2\frac{11}{16}$"

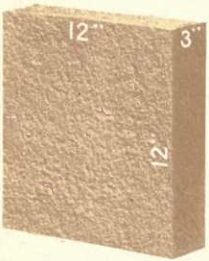
9 x 9 INCH STRAIGHT
For enlarging above circles
9 x 9 x 3½"

COKE OVEN SHAPES

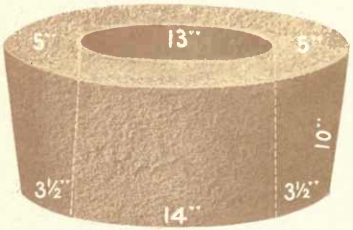


H.-W.
CROWN BRICK
9 x 4½ x 4 1/16 x 2½ x 2¼"

H.-W.
LINER BRICK
9 x 4½ x 4 x 2½"



BOTTOM TILE
No. 14
12 x 12 x 3"
also
12 x 12 x 4"

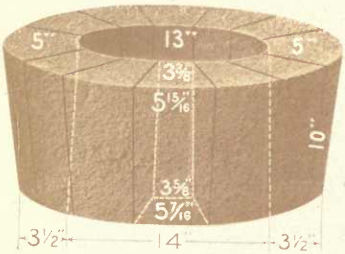


TRUNNEL HEAD
No. 42
23 x 21 x 10 x 13 x 14"

COKE OVEN SHAPES

DOOR BLOCK
5 x 4 x 4"

CROWN SOAP
9 x 2½ x 2¼ x 2 1/32"



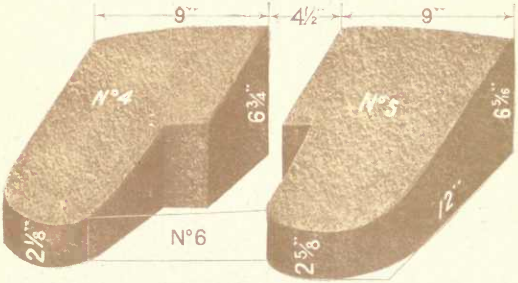
SHAPE No. 66 OR 12-PIECE TRUNNEL
23 x 21 x 10 x 13 x 14"
12-Piece Section
10 x 3⅜ x 5 15/16 and 3⅝ x 5 7/16"

RING
Either in 4 Sections or
1 Piece
24 x 8 with 12" hole

See pages 76 to 91 inclusive for coke oven plans

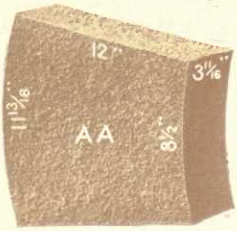
SIEMENS STEEL FURNACE BLOCKS

IN WOODLAND BRAND AND SILICA



See pages 100 to 104 inclusive for plans of crucible furnaces

SIEMENS STEEL FURNACE BLOCKS
IN WOODLAND BRAND AND SILICA



SIEMENS STEEL FURNACE COVER BRICK
MADE IN FIRE CLAY ONLY

BEVEL COVER
12 x 4 x 3¾ x 3"

SQUARE COVER
12 x 4 x 3"

ARCH COVER
12 x 4 x 3 x 2½"

SPECIAL COVER
12 x 4½ x 3 x 2½"

NO. 2
11⅜ x 4½ x 2½ x ⅜"

REGENERATOR TILE AND BRICK

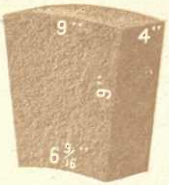
The following sizes are kept in stock:

16 x 6 x 3	21 x 6 x 3	24 x 9 x 3
18 x 6 x 3	22 x 6 x 3	26 x 9 x 3
20 x 6 x 3	24 x 6 x 3	

All other sizes made to order.

REGENERATOR OR CHECKER BRICK

SHAPES FOR ROTARY KILNS



9-INCH ROTARY KILN BLOCKS

No. 66

23 Brick to the Circle
66" Outside Diameter
H-W SPECIAL ALUMINOUS ALUSIL
9 x 9 x $6\frac{9}{16}$ x 4"

No. 72

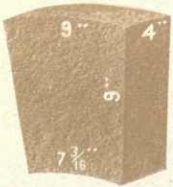
26 Brick to the Circle
72" Outside Diameter
H-W SPECIAL ALUMINOUS ALUSIL
9 x 9 x $6\frac{3}{4}$ x 4"

No. 78

28 Brick to the Circle
78" Outside Diameter
H-W SPECIAL ALUMINOUS ALUSIL
9 x 9 x $6\frac{15}{16}$ x 4"

No. 84

30 Brick to the Circle
84" Outside Diameter
H-W SPECIAL ALUMINOUS ALUSIL
9 x 9 x $7\frac{1}{16}$ x 4"



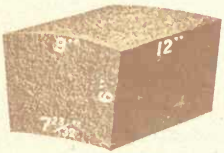
No. 90

31 Brick to the Circle
90" Outside Diameter
H-W SPECIAL ALUMINOUS ALUSIL
9 x 9 x $7\frac{3}{16}$ x 4"

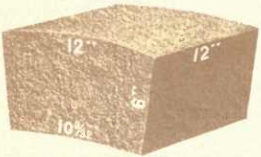
SHAPES FOR ROTARY KILNS

NO. 12
60" Outside Diameter
21 to a Circle
H.-W. Special Aluminous Alusil
9 x 6 x $7\frac{3}{16}$ x 4"

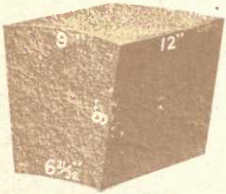
NO. 13
72" Outside Diameter
25 to a Circle
H.-W. Special Aluminous Alusil
9 x 6 x 7½ x 4"



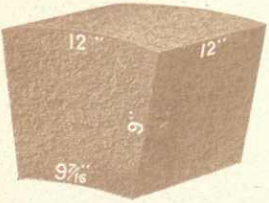
NO. 14
84" Outside Diameter
30 to a Circle
H.-W. Special Aluminous Alusil
9 x 6 x $7\frac{23}{32}$ x 12"



NO. 15
84" Outside Diameter
22 to a Circle
H.-W. Special Aluminous Alusil
12 x 6 x $10\frac{9}{32}$ x 12"

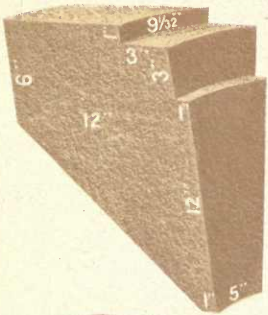


NO. 16
84" Outside Diameter
30 to a Circle
H.-W. Special Aluminous Alusil
9 x 9 x $6\frac{21}{32}$ x 12"

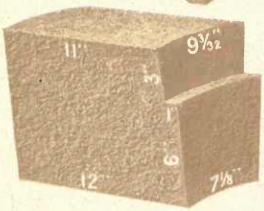


NO. 17
84" Outside Diameter
22 to a Circle
H.-W. Special Aluminous Alusil
12 x 9 x $9\frac{7}{16}$ x 12"

SHAPES FOR ROTARY KILNS



NO. 18
FEED END BLOCK
72" Outside Diameter
25 to a Circle
C. Tyrone
C. Eureka
12 x 12 x 6 x 1 x $9\frac{1}{32}$ x 5"



NO. 19
DISCHARGE END BLOCK
84" Outside Diameter
29 to a Circle
H.-W. Special Aluminous
Alusil
11 x 9 x 12 x $9\frac{3}{16}$ x $7\frac{1}{8}$"

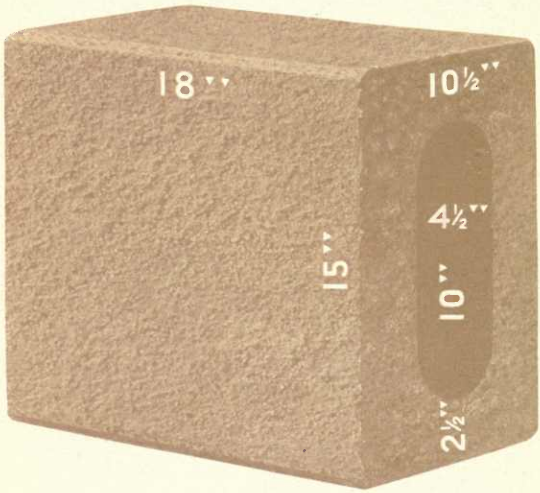
NO. 20
CEMENT KILN SHAPE
32" Inside Diameter
29 to a Circle
12 x 4 x $4\frac{1}{2}$ x $3\frac{1}{2}$"

NO. 21
CEMENT KILN SHAPE
5' 4" Inside Diameter
51 to a Circle
12 x 4 x $4\frac{1}{2}$ x 4"

NO. 22
CEMENT KILN SHAPE
8' 0" Inside Diameter
76 to a Circle
12 x 6 x $4\frac{1}{2}$ x 4"

Any shapes desired will be made to order

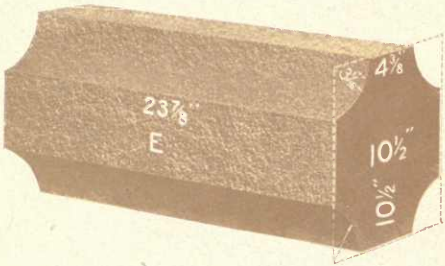
RECUPERATOR FLUE BRICK



Shapes similar to the above cut are largely used in various kinds of gas, melting and heating furnaces and recuperators, where a high grade of brick is required.

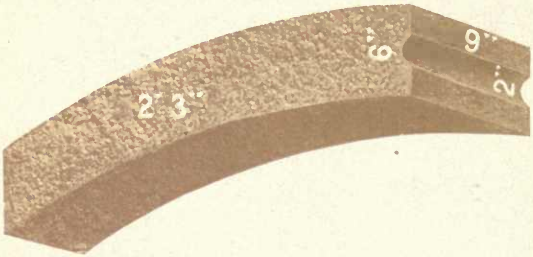
We are well equipped for doing such work, and where a large quantity are needed can get them out in the best possible shape and at a reasonable cost.

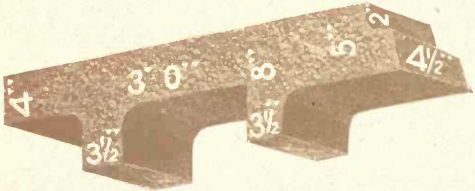
SHAPES FOR CONVERTER BOTTOMS



We illustrate above several shapes for converter bottoms; other shapes will be made to order.

TYPICAL LOCOMOTIVE FIRE BRICK





All types of locomotive tile made to order.

We furnish locomotive tile to many of the largest and most important railway systems in the country, having a total mileage of more than forty thousand miles.

CHROME SHAPES

STRAIGHT, STANDARD SIZE
H.-W. R. Co.
8¾ x 4⅜ x 2½"

NO. 1 WEDGE, STANDARD SIZE
H.-W. R. Co.
8¾ x 4⅜ x 2½ x 1⅞"

NO. 2 WEDGE, STANDARD SIZE
H.-W. R. Co.
8¾ x 4⅜ x 2½ x 1½"

NO. 1 KEY, STANDARD SIZE
H.-W. R. Co.
8¾ x 4⅜ x 3⅜ x 2½"

NO. 2 KEY, STANDARD SIZE
H.-W. R. Co.
8¾ x 4⅜ x 3⅜ x 2½"

THE shapes shown will generally answer all purposes for which chrome brick are required.

OTHER SHAPES WILL BE MADE TO ORDER.

MAGNESIA SHAPES

STRAIGHT, STANDARD SIZE
H.-W. R. Co.
8¾ x 4⅜ x 2⅜"

NO. 1 ARCH, STANDARD SIZE
75 Brick to the Circle
3′ 10" Inside Diameter
H.-W. R. Co.
8¾ x 4⅜ x 2⅜ x 2"

NO. 2 ARCH, STANDARD SIZE
54 Brick to the Circle
1′ 7" Inside Diameter
H.-W. R. Co.
8¾ x 4⅜ x 2⅜ x 1⅝"

NO. 3 ARCH, STANDARD SIZE
H.-W. R. Co.
8¾ x 4⅜ x 2⅜ x ⅞"

NO. 1 WEDGE, STANDARD SIZE
H.-W. R. Co.
8¾ x 4⅜ x 2⅜ x 1¾"

MAGNESIA SHAPES

NO. 2 WEDGE, STANDARD SIZE
57 Brick to the Circle
2′ Inside Diameter
H.-W. R. Co.
8¾ x 4⅜ x 2⅜ x 1⅜"

SOAP, STANDARD SIZE
H.-W. R. Co.
8¾ x $2\frac{3}{16}$ x 2⅜"

SPLIT, STANDARD SIZE
H.-W. R. Co.
8¾ x 4⅜ x $1\frac{3}{16}$"

NO. 1 KEY, STANDARD SIZE
110 Brick to the Circle
11′ 3" Inside Diameter
H.-W. R. Co.
8¾ x 4⅜ x 3⅞ x 2⅜"

NO. 2 KEY, STANDARD SIZE
H.-W. R. Co.
8¾ x 4⅜ x 3⅜ x 2⅜"

Other shapes made to order

BLAST FURNACE LININGS

WE have been making blast furnace linings for the last thirty-eight years, and have made more than 90 per cent. of all the linings used in the United States. Our linings have been used under every imaginable condition, under hundreds of different managers, in all types of furnaces, and with all classes of ore and fuel.

In addition to furnishing hundreds of linings for large modern furnaces running on lake ores and Connellsville coke, many linings have been supplied to smaller furnaces burdened with magnetite, limonite, brown zincy, cornwall, manganese and zinc residuum ores; and fuels such as high sulphur coke, anthracite and charcoal, which create conditions that are very hard on furnace linings.

We have been as successful in meeting the peculiar conditions under which many of these furnaces are operated as in the large modern furnaces in the Pittsburgh district running entirely on Bessemer iron.

In addition to the name of the brand, all of our blast furnace brick are now branded "HEARTH & BOSH," "INWALL" or "TOP." This is done to make it certain that the brick will be put into that part of the furnace for which they were made.

In order to get uniformly satisfactory results about a furnace, it is of great importance that the brick used for lining downcomers and flues be able to resist the cutting action of strong blasts charged with ore dust and cutting particles of coke. "PIPE BENEZET" and "PIPE WOODLAND" brick are made especially for this purpose and give good results.

Modern blast furnace practice, with closed tops, skip hoist, revolving tops and high-pressure blast, makes it more essential than ever before to use only the best blast furnace brick that can be manufactured. For thirty-eight years this branch of our business has received special attention, with the result that the records of tonnage made with our linings are not approached by the linings of any of our competitors. Some of these records are shown on pages 56 to 59 inclusive. The cut on page 60 shows 9-inch and 13½-inch brick as laid in a furnace wall.

BOTTOM BLOCKS

THE cuts on page 61 show the bottom blocks used at the present time. All blocks are rectangular, true to shape and form, close in bond, and made under heavy pressure.

All brands made of Pennsylvania clays are 18 x 12 x 8 inches. The Portsmouth Harbison-Walker brands are 18 x 9 x 4½ inches.

SOME RECORD AND GOOD RUNS "BENEZET" AND "WOODLAND" LININGS

PITTSBURGH DISTRICT AND VALLEYS

Size of Furnace	Product and Tonnage		Period in Blast	Lining
22 x 100		1,287,381	.....	Benezet
22 x 100		1,097,314	.....	Benezet
22 x 100		1,134,382	.....	Benezet
22 x 100		950,774	.....	Benezet
20 x 80	Bessemer,	1,296,192	.....	Benezet
20 x 80	Bessemer,	858,160	.....	Benezet
	Spiegel,	18,065	.....	Benezet
	Ferro,	19,635	.....	Benezet
	Total	895,860		
20 x 90	Bessemer,	942,365	.....	Benezet
20 x 90	Bessemer,	870,255	.....	Benezet
20 x 90	Bessemer,	635,741	.....	Benezet
20 x 80	Bessemer,	632,669	.....	Benezet
20 x 80	Bessemer,	608,103	.....	Benezet
20 x 80	Bessemer,	580,060	.....	Benezet
20 x 80	Bessemer,	793,892	.....	Benezet
20 x 80		600,957	.....	Benezet
20 x 80		596,491	.....	Benezet
20 x 80	Mill iron,	380,000		
	Bessemer,	117,000		
	Spiegel,	25,000		
	Total,	522,000	6 yrs. 1 mo.	Benezet
20 x 80	Bess'r and Mill	550,000	6 yrs. 1 mo.	Benezet
18 x 78		327,000	5 yrs. 7 mos.	Benezet
23 x 105⅔		572,000	3 yrs. 3 mos.	
		565,000	3 yrs. 4 mos.	
20 x 80	Bessemer,	520,356	.....	Woodland
20 x 80	Bess'r, 322,617			
	Ferro, 5,026			
	Spiegel, 36,503			
	Ferro Sil., 688			
	Total,	364,834	.....	Woodland

OTHER DISTRICTS

18 x 74′	Foundry,	152,462	3 yrs.	Woodland
16 x 76′ 10″	Foundry,	235,000	4 yrs. 3½ mos.	Woodland
16 x 63′ 10″	Foundry,	202,354	3 yrs. 10 mos.	Woodland
15 x 66′ 9″	Foundry,	196,392	5 yrs. 3 mos.	Woodland
16 x 63′ 10″	F'dry & Bess'r	306,290	5 yrs. 3 mos.	Woodland
17 x 83′	Foundry,	275,000	3 yrs. 6 mos.	Woodland
18′6″ x 91′	Bess'r, over	700,000	4 yrs. 6 mos.	Benezet

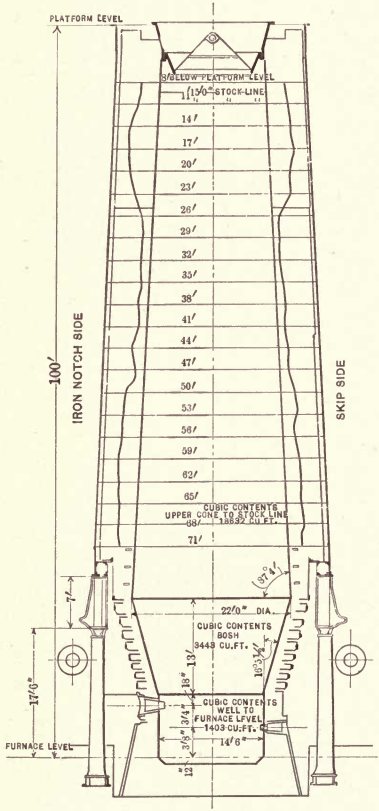
Fifty-three (53) of our best records show a production of 34,519,189 tons of iron, an average of 651,305 tons per lining.

SOME RECENT RECORD AND GOOD RUNS

District	Size of Furnace	Product and Tonnage		Period in Blast	Linings
Chicago	17′ 6″ x 80′ 0″	Bessemer	1,250,000	8 years	P-Ky
Chicago	18′ 6″ x 78′ 0″	Foundry	521,168	7 yrs. 3 mos. 11 days	Woodland
Pittsburgh	22′ 0″ x 100′ 0″	Bessemer and basic	935,000	5 years	Benezet
Pittsburgh	22′ 0″ x 100′ 0″	Basic	931,026	5 years	Benezet
Pittsburgh	22′ 0″ x 100′ 0″	Basic	1,202,056	7 yrs. 11 mos. 9 days	Benezet
Pittsburgh	22′ 0″ x 100′ 0″	Basic	1,023,000	7 years	Benezet
Pittsburgh	14′ 0″ x 76′ 0″	Bessemer	770,000	9 yrs. 2 mos.	Benezet
Pittsburgh	23′ 0″ x 100′ 0″	Bessemer over	900,000	4 yrs. 4 mos.	Benezet
Pittsburgh	21′ 0″ x 90′ 0″	Bessemer	668,000	5 yrs. 2 mos.	Benezet
Pittsburgh	23′ 0″ x 100′ 0″	Bessemer	902,900	4 yrs. 3 mos. 2 days	Benezet
Pittsburgh	19′ 6″ x 93′ 0″	Bessemer and Spiegel	369,197	5 yrs. 4 mos.	Woodland
Pittsburgh	19′ 6″ x 93′ 0″	Bessemer	520,000	6 yrs. 9 mos.	Woodland
Pittsburgh	20′ 0″ x 96′ 0″	Bessemer	850,000	6 yrs. 6 mos.	Clfd
Pittsburgh	23′ 0″ x 100′ 0″	Bessemer	1,327,000	6 yrs. 8 mos.	Benezet
Wheeling	19′ 0″ x 75′ 2″	Bessemer over	600,000	6 years	Benezet
Wheeling	17′ 0″ x 75′ 0″	Bessemer	600,000	7 years	Benezet
Wheeling	21′ 6″ x 106′ 9″	Bessemer over	500,000	4 yrs. 5 mos.	Benezet
*Wheeling	23′ 0″ x 103′ 4″	Bessemer	453,240	5 years	Benezet
*Valleys	23′ 0″ x 106′ 6″	Bessemer	800,000	5 yrs. (nearly)	Benezet
*Valleys	23′ 0″ x 106′ 6″	Bessemer	600,000	4 years	Benezet
Valleys	19′ 0″ x 80′ 0″	Bessemer and basic	411,381	4 yrs. 11 mos.	Benezet
Valleys	16′ 5″ x 75′ 0″	Bessemer	229,008	5 yrs. 8 mos. 28 days	Benezet
Valleys	14′ 1″ x 64′ 0″	Bessemer	400,000	4 years	Benezet
Valleys	20′ 0″ x 97′ 0″	Bessemer	900,000	4 years	Clfd
Valleys	20′ 0″ x 96′ 0″	Bessemer	827,000	6 yrs. 2 mos.	Clfd
Valleys	19′ 0″ x 77′ 0″	Foundry	709,717	6 yrs. 5 mos.	Woodland
Eastern Pa.	18′ 0″ x 70′ 0″	Basic	220,000	5 years	Woodland
Eastern Pa.	18′ 0″ x 70′ 0″	Basic	180,283	3 yrs. 8 mos. 7 days	Woodland
Eastern Pa.	17′ 6″ x 76′ 0″	Foundry and basic	219,910	5 years	Woodland
†Virginia	17′ 0″ x 75′ 0″	Foundry over	200,000	3 yrs. 2 mos.	Woodland
*Canada	15′ 6″ x 80′ 0″	Basic	170,000		Woodland
Alabama	17′ 0″ x 76′ 0″	Foundry	254,356	3 yrs. 7 mos. 20 days	P-Ky

* Still running.
† Best record ever made in Virginia.

JONES & LAUGHLIN STEEL CO.
ELIZA FURNACE NO. 4



The irregular lines shown on this page and page 59 are an exact reproduction of the lines of the Jones & Laughlin Steel Company's Eliza Furnace No. 4, after a run of 1,202,056 tons. On account of remodeling the works, the furnace had to be dismantled, but the condition of the lining was such as to indicate that the tonnage might have been doubled, had it not been necessary to dismantle the furnace for reasons independent of the condition of the lining.

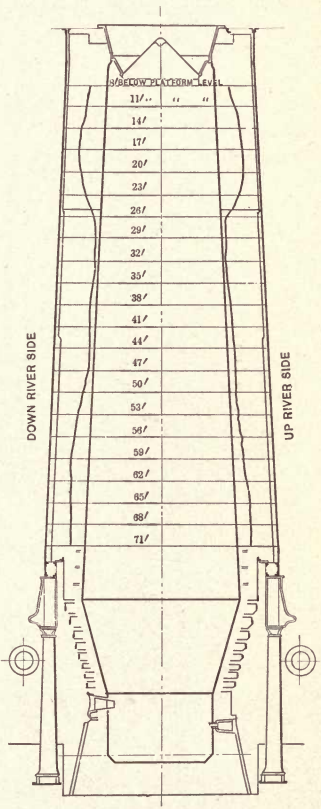
JONES & LAUGHLIN STEEL CO.
ELIZA FURNACE NO. 4

The irregular lines on this page and page 58 are an exact reproduction of the Jones & Laughlin Steel Company's Eliza Furnace No. 4, after a run of 1,202,056 tons.

No. 1 Furnace of Jones & Laughlin on last run, without patching, made 931,026 tons of pig iron. She was then patched for 10 feet above the mantel, and has since produced 99,163 tons of pig iron, and at the present time is still on.

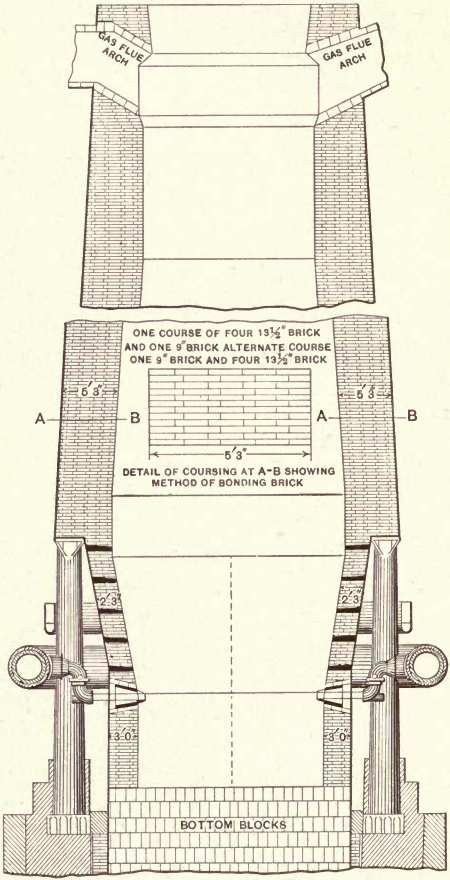
No. 2 Furnace on last run made 733,163 tons.

No. 3 Furnace on last run made 1,023,107 tons of pig iron without any repairs. A new bosh was then put in her, but no repairing above the mantel, since which time she has made 78,398 tons of pig iron, and is still running.

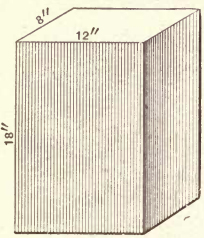


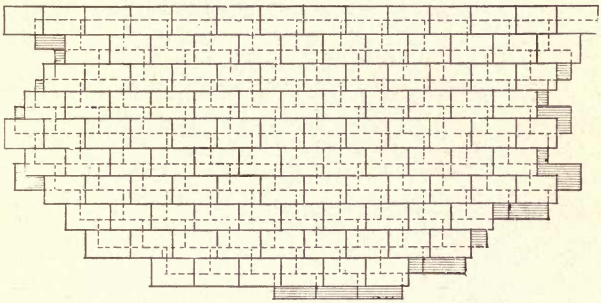
This, in connection with the remarkable run on No. 4, shows the good results BENEZET brick are giving at Jones & Laughlin's Eliza Furnaces.

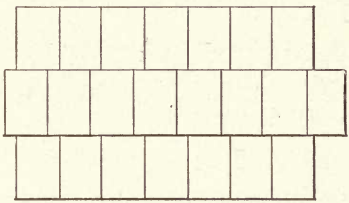
MODERN BLAST FURNACE



FURNACE BOTTOM BLOCKS







Above cuts show method of setting blocks and breaking joints in construction of furnace hearth.

See page 55 for description of blocks and page 135 for number required for different diameters.

BLAST FURNACE STOVE BRICK

BLAST furnace stove brick are only second in importance to the furnace lining, for the reason that it is not as costly to cut a stove out for repairs as to shut down a furnace for a new lining; but, owing to the heavy burden carried and the disintegrating tendency of hot gases constantly varying in temperature, the difficulties to contend with in making a good stove brick are equal, though different, to those met with in making a good lining.

The essential qualities in blast furnace stove brick are, capacity to absorb heat readily from the combustion of waste furnace gases, readiness to give off this heat rapidly to the air that is blown into the stove, and strength of bond between the particles of fire clay to resist the disintegrating action of the hot gases. These qualities can only be obtained by making the brick of high grade fire clay that will stand sufficient heat to bond thoroughly without vitrifying. In service, although stove brick are not subjected to the intense heat of the melting zone of the blast furnace, the weight carried and the long continued heat are apt to cause a gradual fusing, unless high grade clay with a

liberal margin of refractoriness is used in making the brick. Glazed or vitrified brick will neither absorb nor give off heat as rapidly as porous or non-vitrified material. If brick are made of sufficiently refractory clay, but not well bonded, or made by any modification of the dry process, and are not well burned, they are apt to disintegrate.

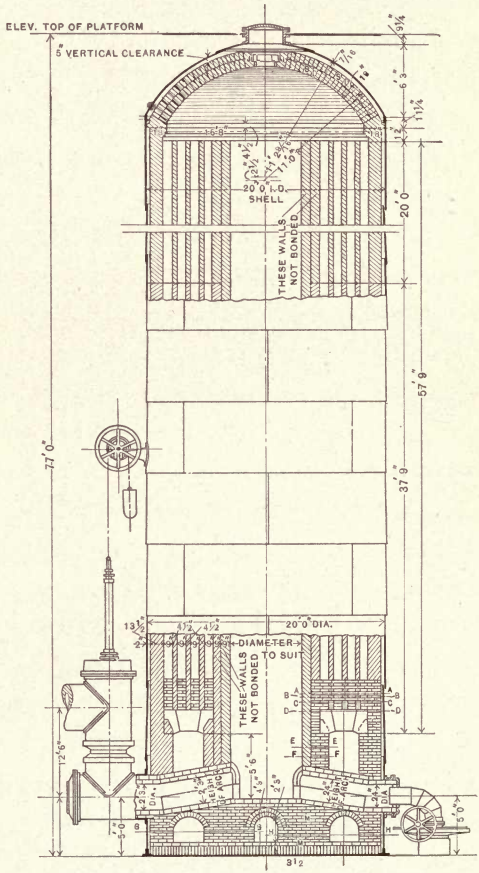
Through lack of attention to the above requirements, we have been called upon several times to replace stove linings in less than one year from date of construction. Records and non-vitrified bats from old stove linings show that our stove lining brick are perfectly adapted to the service required.

In connection with illustrations of typical stoves in use, a cut of the special shape used in each of several types is shown; these, and all similar shapes for stoves, are made from good clay, burned at a high temperature in order to enable the brick to resist the disintegrating action of the hot gases.

For cuts of stoves in general use, see pages 64 to 75 inclusive.

JULIAN KENNEDY STOVE

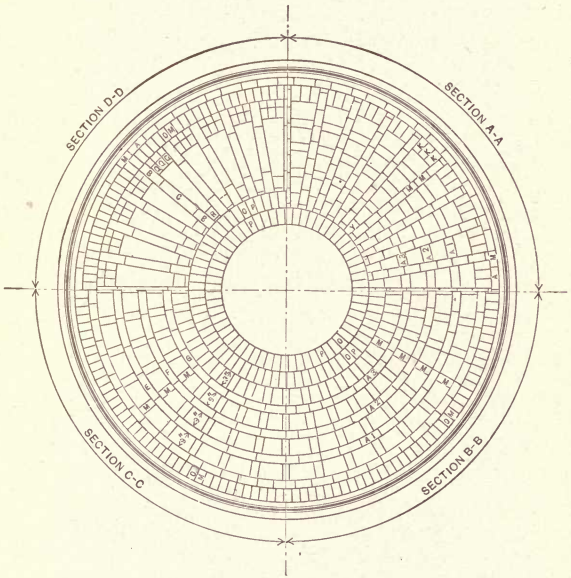
Julian Kennedy, Pittsburgh, Pa., Engineer



SECTION THROUGH GAS BURNER AND HOT BLAST VALVE

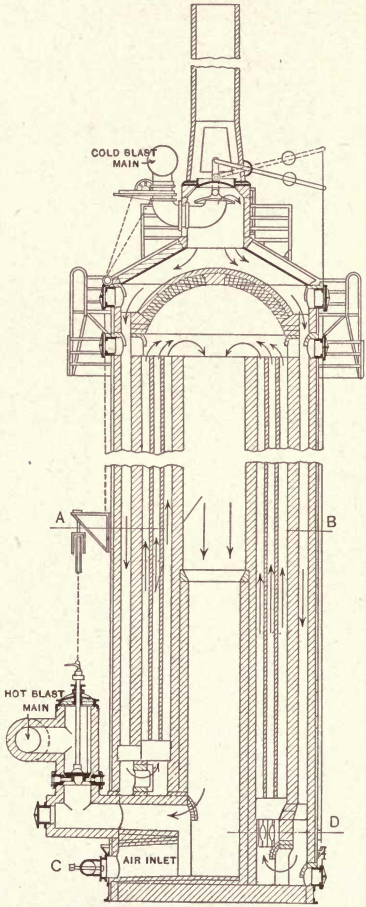
JULIAN KENNEDY STOVE

Julian Kennedy, Pittsburgh, Pa., Engineer.



McCLURE PATENT STOVE

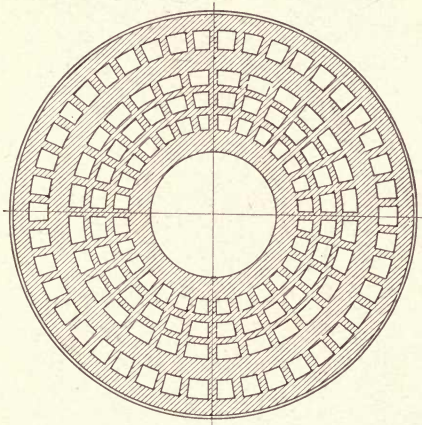
G. W. McClure, Son & Co., Pittsburgh, Pa., Engineers



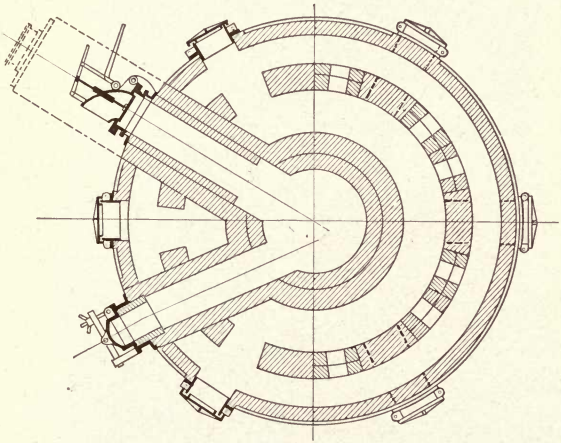
SECTIONAL ELEVATION

McCLURE PATENT STOVE

G. W. McClure, Son & Co., Pittsburgh, Pa., Engineers



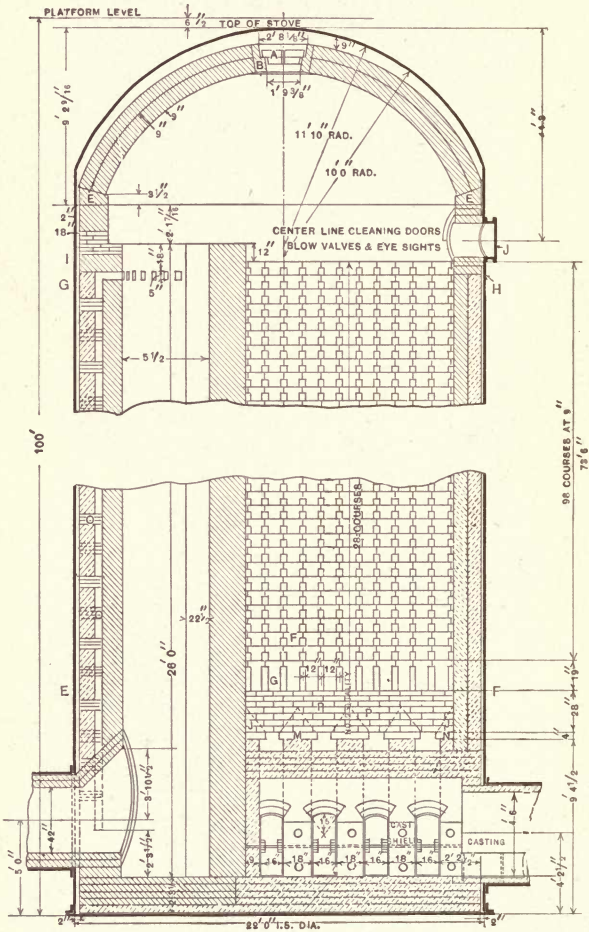
Section Through A B



Section Through C D

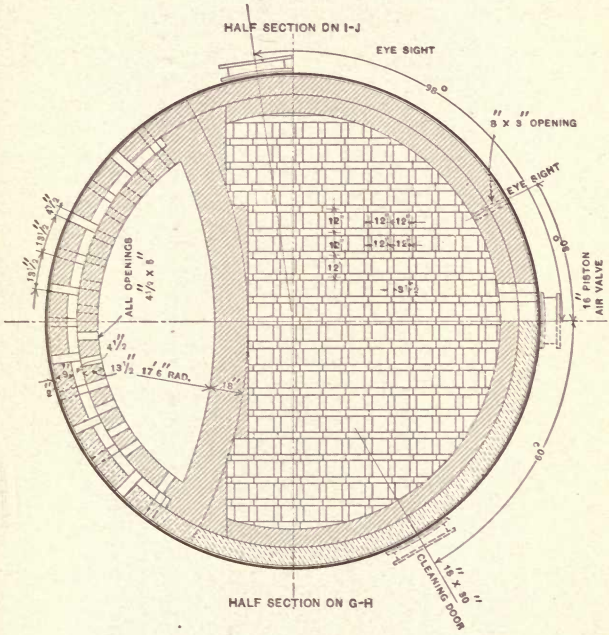
ROBERTS PATENT STOVE

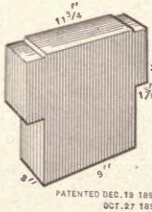
F. C. Roberts & Co., Philadelphia, Pa., Engineers



ROBERTS PATENT STOVE

F. C. Roberts & Co., Philadelphia, Pa., Engineers

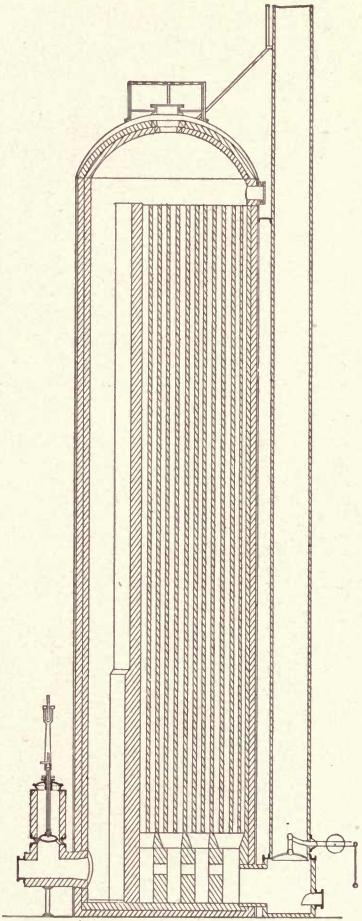




Checker Brick

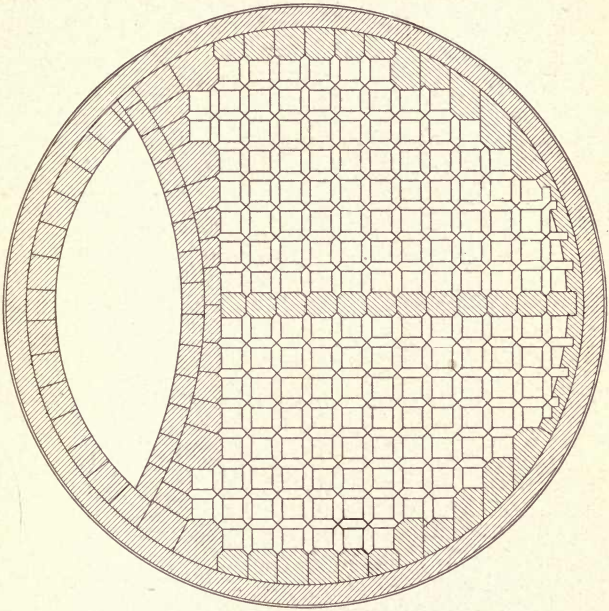
FOOTE PATENT STOVE

D. Lamond & Son, Ferguson Block, Pittsburgh, Pa., Engineers

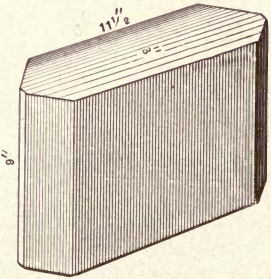


FOOTE STOVE

D. Lamond & Son, Ferguson Block, Pittsburgh, Pa., Engineers



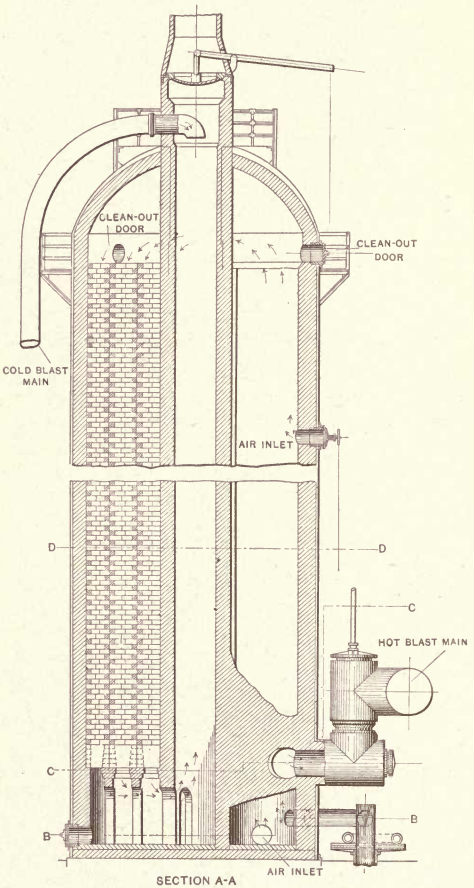
Enlarged Cross Section



Checker Brick

HOT BLAST STOVE

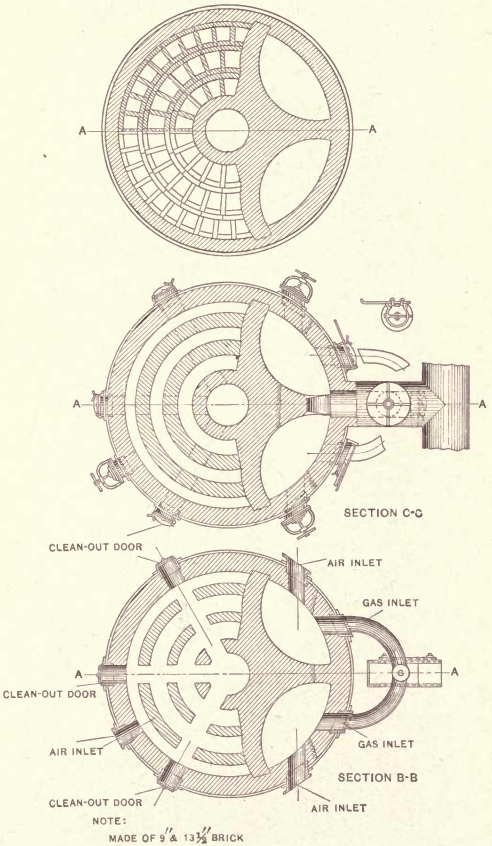
J. W. Calder, Pittsburgh, Pa.



SECTION A-A

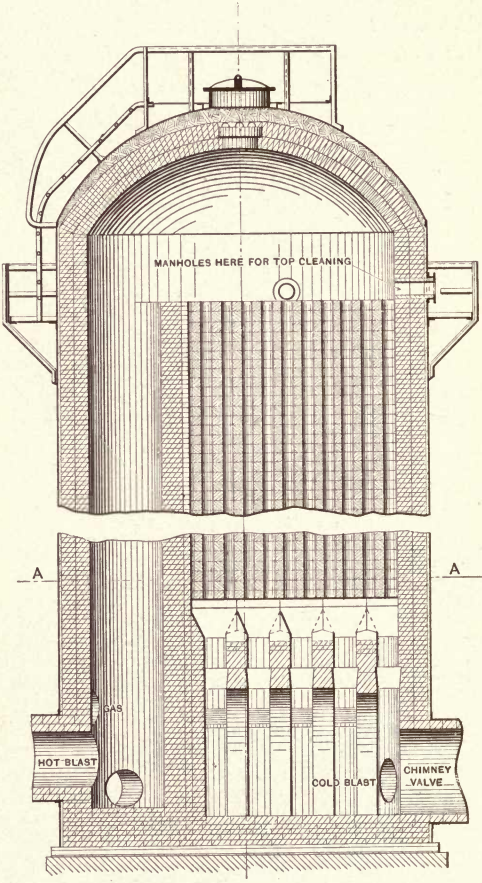
HOT BLAST STOVE

J. W. Calder, Pittsburgh, Pa.



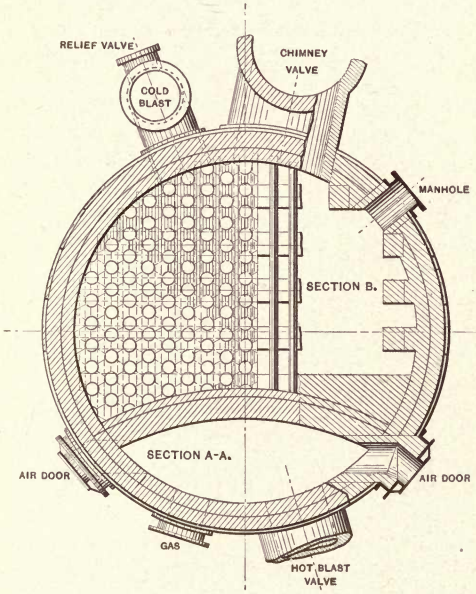
WHITE & KERNAN HOT BLAST STOVE

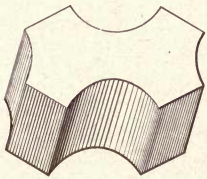
F. L. White. Patented Feb. 21, 1905, No. 783,234



WHITE & KERNAN HOT BLAST STOVE

F. L. White. Patented Feb. 21, 1905, No. 783,234





COKE OVEN BRICK

COKE oven construction has changed radically in recent years. Where formerly any cheap clay brick were deemed good enough for the purpose, of late the tendency has been to use the highest grade brick.

The excellent results recently obtained from the use of silica brick in the severe service of by-product ovens, and from the old beehive ovens in the Connellsville region and other districts, have clearly demonstrated that our silica brick are the most economical that can be used in this work, due entirely to the increased length of service obtained by their use.

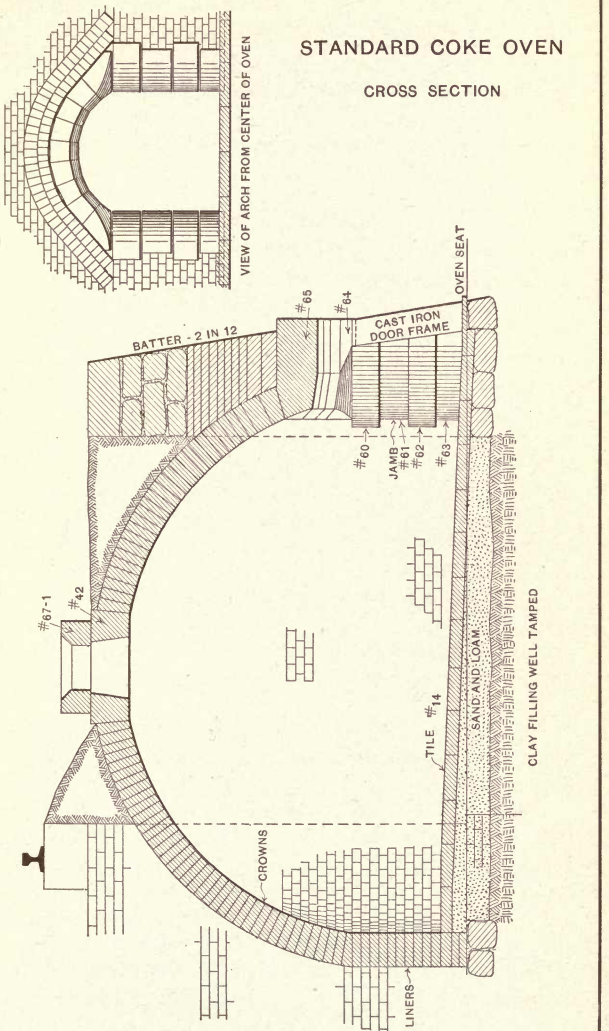
Our "H-W Crown" lime bond silica brick are made for the crowns of beehive ovens, and in addition to their extreme refractory qualities are especially adapted to hold the crown rigid and true to shape through varying temperatures, making in all a more thorough construction physically than can be obtained by the use of clay brick.

We also manufacture "XX Silica," a lime bond silica brick which is being widely used with the best of results in flues leading from beehive ovens to stacks and also to boilers where waste heat from the ovens is utilized.

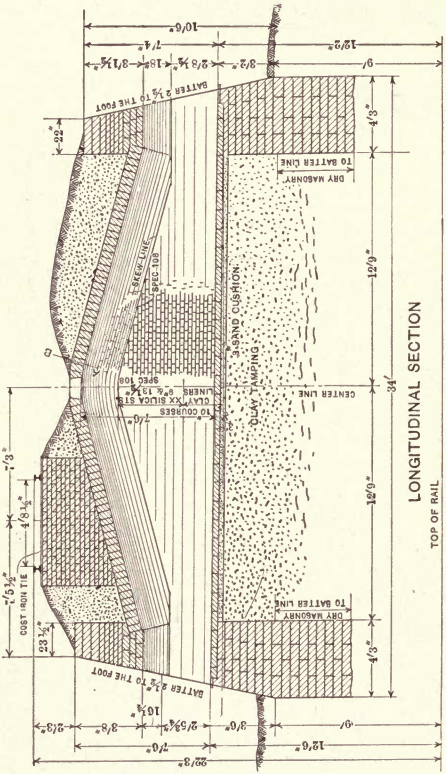
The fronts and floor tile are made of fire clay. Trunnel heads are made of either silica or fire clay, as may be desired.

The Longitudinal or Belgian type of coke oven has been coming into favor recently. Having furnished all the brick that have been made for ovens of this type, we can supply brick most suitable for such ovens. See cut for standard coke oven on page 77. Longitudinal oven is shown on pages 78 and 79.

See pages 80 to 91 inclusive for description of by-product coke ovens.

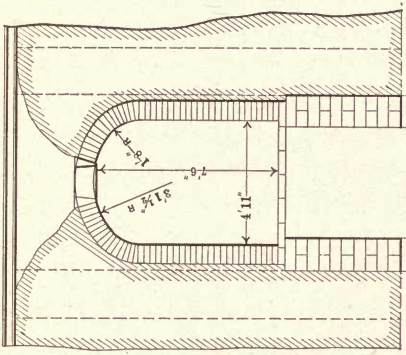

STANDARD COKE OVEN
CROSS SECTION
VIEW OF ARCH FROM CENTER OF OVEN
OVEN SEAT
#65
#64
CAST IRON DOOR FRAME
BATTER - 2 IN 12
#60
JAMB #61
#62
#63
#67-1
#42
TILE #14
SAND LOAM
CLAY FILLING WELL TAMPED
CROWNS
LINERS

LONG OR BELGIAN OVEN

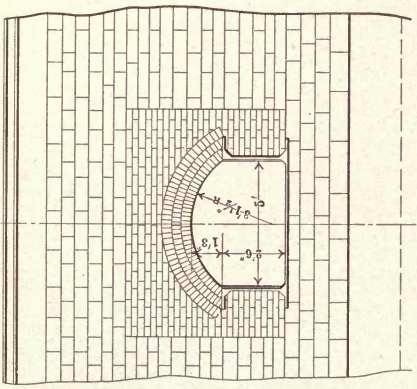


See page 79 for cross sections

SECTIONAL VIEW OF LONG OR BELGIAN COKE OVEN



SECTION ON CENTER LINE



FRONT ELEVATION

See page 78 for longitudinal section

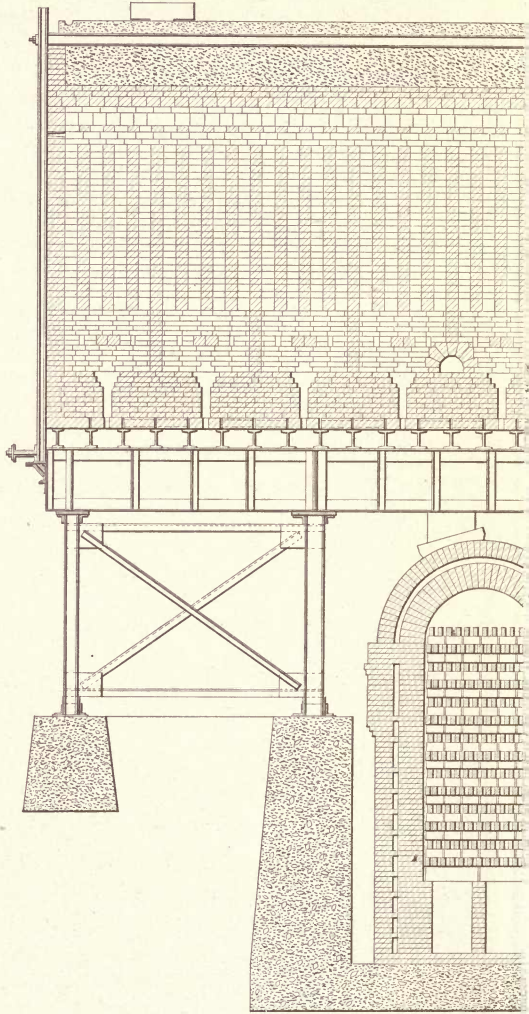
BY-PRODUCT COKE OVENS

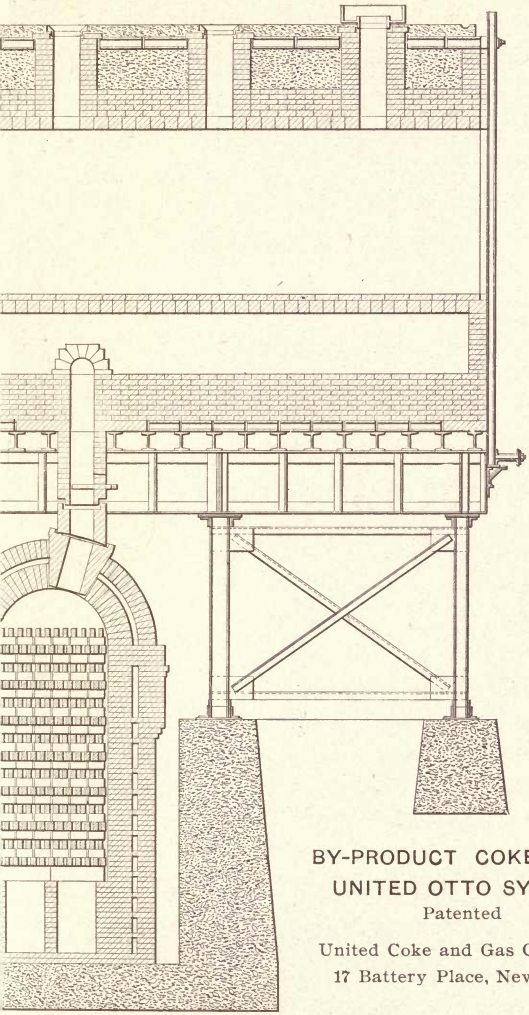
COKE was first manufactured on a small scale in the United States about 1850, increasing slowly for a few years, then with great rapidity as the production of iron increased. At this date about 36,000,000 tons are manufactured annually, approximately 15 per cent. of which is made in BY-PRODUCT Ovens. Only BEEHIVE Oven Coke was made until about 1893. The striking increase in the production of BY-PRODUCT Coke is shown by comparing the production in 1897, when it was approximately 262,000 tons, and in 1906, when it was over 4,500,000 tons. We have furnished approximately 85 per cent. of the entire requirements of high grade refractories used in the construction of BY-PRODUCT Ovens in the United States and Canada. When we first went into this business we conducted a long, expensive, and carefully planned series of experiments to determine the proper mixes and methods of manufacturing and burning the various shapes used in BY-PRODUCT Coke Oven construction, and possess at this time more detailed and specific information and records than all of our competitors combined. The fact that we have furnished over 85 per cent. of the entire requirements of Brick

used in the construction of BY-PRODUCT Ovens is conclusive proof of the quality of our material and the confidence that owners of BY-PRODUCT Plants have in it.

In the Plants first constructed a special Quartzite mix was used in the flues and other portions of the Oven where gas-tight joints were required. In recent construction Silica Brick has supplanted Quartzite Brick, and we have no hesitation in recommending the use of Silica Brick as a superior material to Quartzite Brick for those portions of the Oven where Quartzite, either foreign or imported, was previously employed. Silica Brick and shapes have a slight, uniform, known expansion and when built with the proper allowance for expansion joints, make an extremely durable Oven. Silica Brick are better conductors of heat than Fire Clay Brick. The use of Silica Brick in BY-PRODUCT construction increases the coking capacity of the Oven by decreasing the time required for coking the coal by reason of the greater conductivity of Silica Brick over Fire Clay or Quartzite Brick, and permitting a greater initial heat in the coking chamber.

Illustrations of the various BY-PRODUCT Ovens now in use in the United States are shown on the following pages.

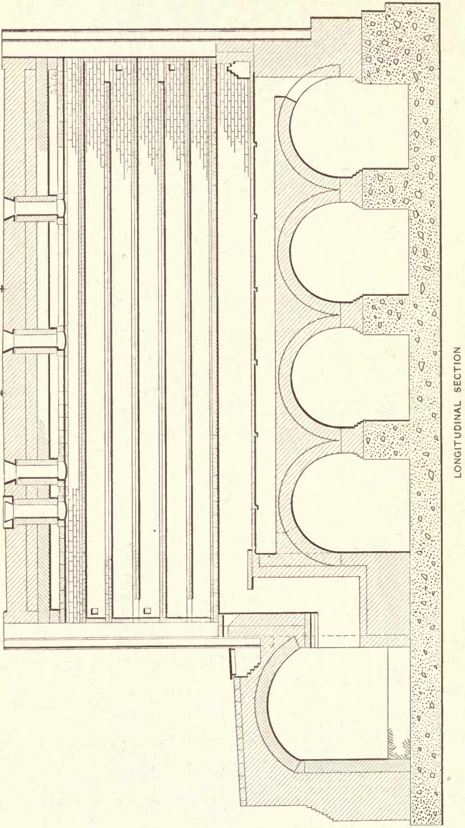




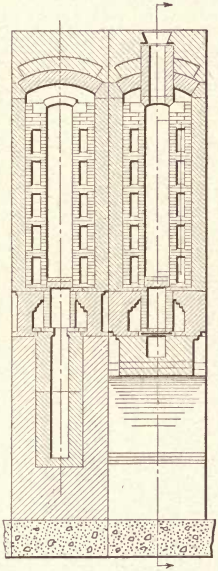
BY-PRODUCT COKE OVEN
UNITED OTTO SYSTEM
Patented

United Coke and Gas Company
17 Battery Place, New York

SEMET-SOLVAY CO. TYPICAL SECTIONS OF COKE OVENS

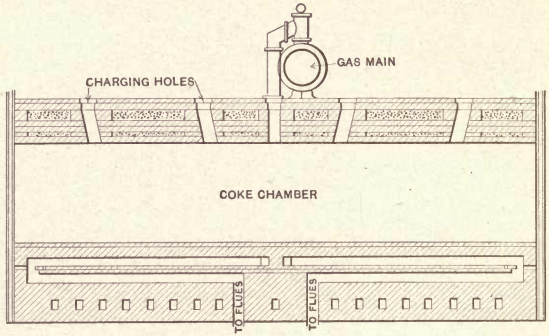


SEMET-SOLVAY CO.
TYPICAL SECTIONS OF COKE OVENS

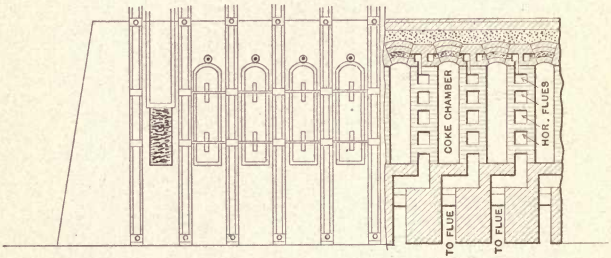


VERTICAL CROSS SECTION

ROTHBERG BY-PRODUCT COKE OVEN

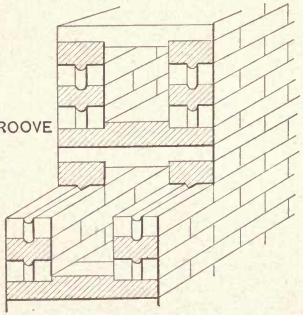


SECTIONAL ELEVATION THROUGH COKE CHAMBER

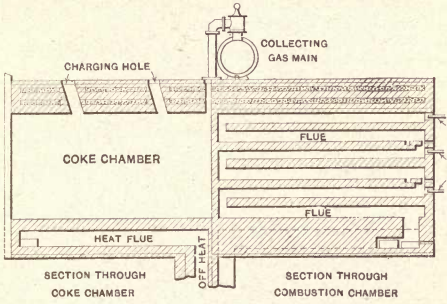


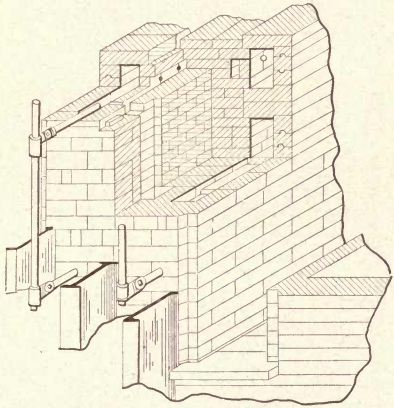
FRONT ELEVATION CROSS SECTION

SECTION OF WALL
SHOWING TONGUE AND GROOVE

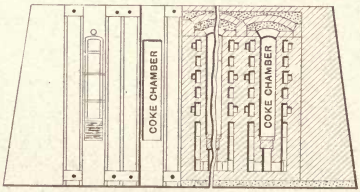


ROTHBERG & ERNST BY-PRODUCT COKE OVEN





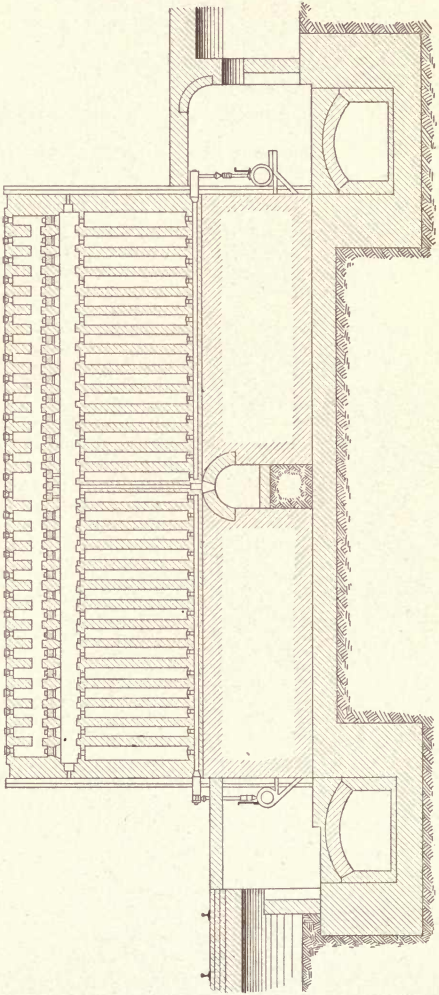
SECTION THROUGH WALL



FRONT ELEVATION CROSS SECTION

KOPPERS' REGENERATOR COKE OVEN

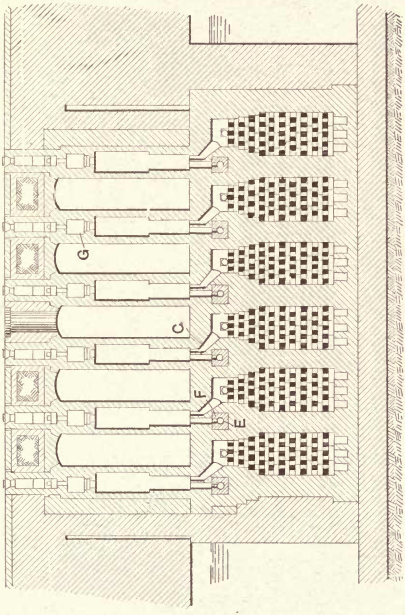
SEPARATE REGENERATORS FOR EACH OVEN

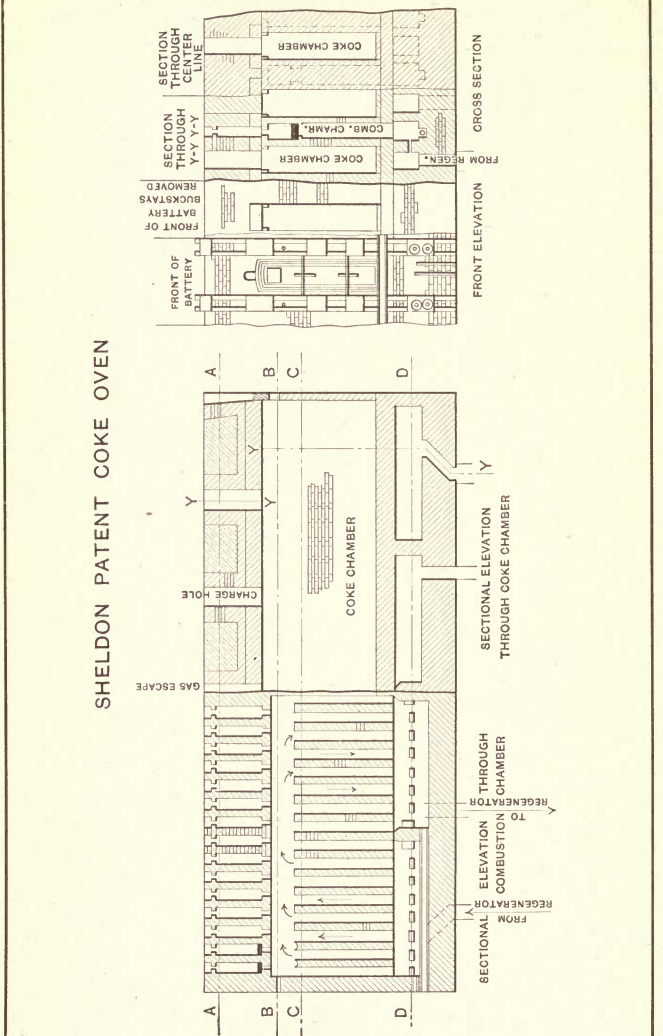


LONGITUDINAL SECTION THROUGH HEATING FLUES

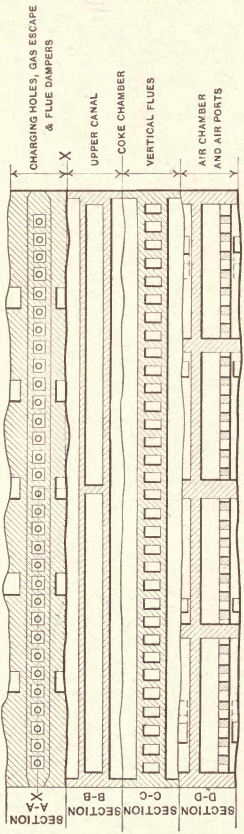
KOPPERS' REGENERATOR COKE OVEN

SEPARATE REGENERATORS FOR EACH OVEN




SHELDON PATENT COKE OVEN
SECTION THROUGH CENTER LINE
SECTION THROUGH Y-Y Y-Y
FRONT OF BATTERY BUCKSTAYS REMOVED
FRONT OF BATTERY
COKE CHAMBER
COMB. CHAMR.
COKE CHAMBER
FROM REGEN.
CROSS SECTION
FRONT ELEVATION
GAS ESCAPE
CHARGE HOLE
COKE CHAMBER
SECTIONAL ELEVATION THROUGH COKE CHAMBER
SECTIONAL ELEVATION THROUGH COMBUSTION CHAMBER
FROM REGENERATOR
TO REGENERATOR
A
B
C
D
Y

SHELDON PATENT COKE OVEN



MALLEABLE FURNACES

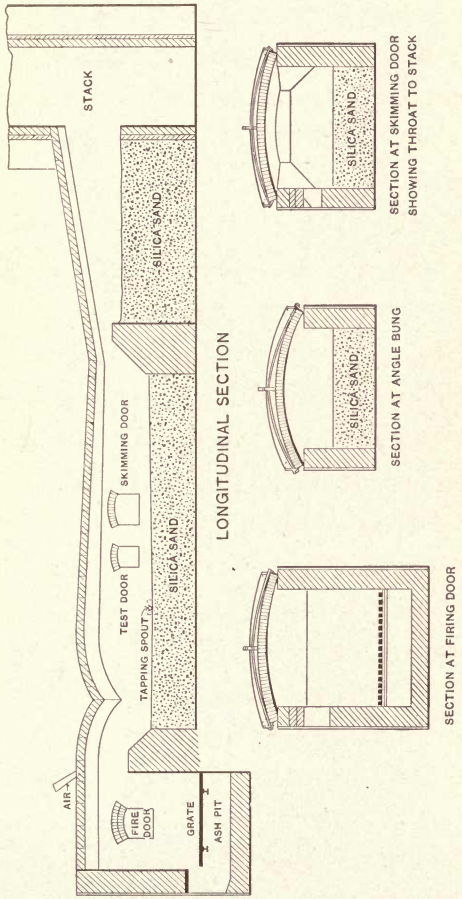
THE question of fire brick is of the utmost importance to managers and owners of Malleable Furnace plants, as in no other type of furnace do brick have to be renewed so frequently, or are brick costs so high per ton of output.

We supply over 75 per cent. of the high grade brick used in malleable furnace bungs, sidewalls and stacks. We have secured and maintained our position against all competitors by using carefully selected high grade clays, care and knowledge in the manufacture of brick, and thorough inspection and selection of the finished product.

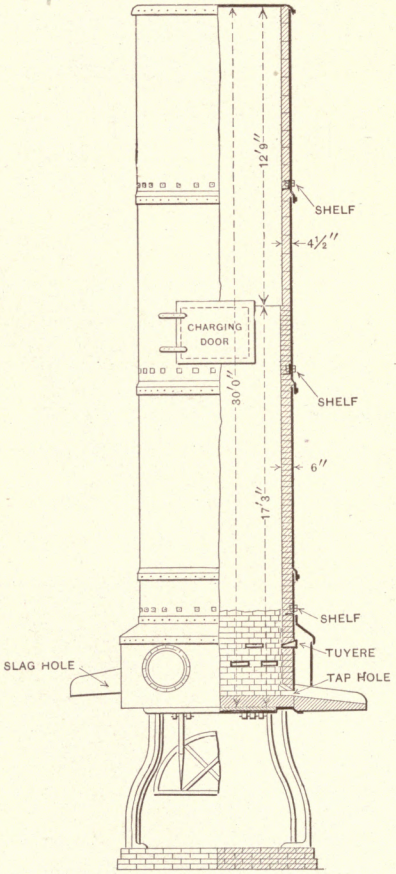
We have customers who have bought from us for from fifteen to thirty-three years. Our "WOODLAND," "WIGTON STEEL," "CLEARFIELD," "MUNRO," "MALLEABLE" and "HIGH GRADE" brands are known and used wherever there are Malleable Furnaces.

The cut on page 93 shows one type of Malleable Furnace.

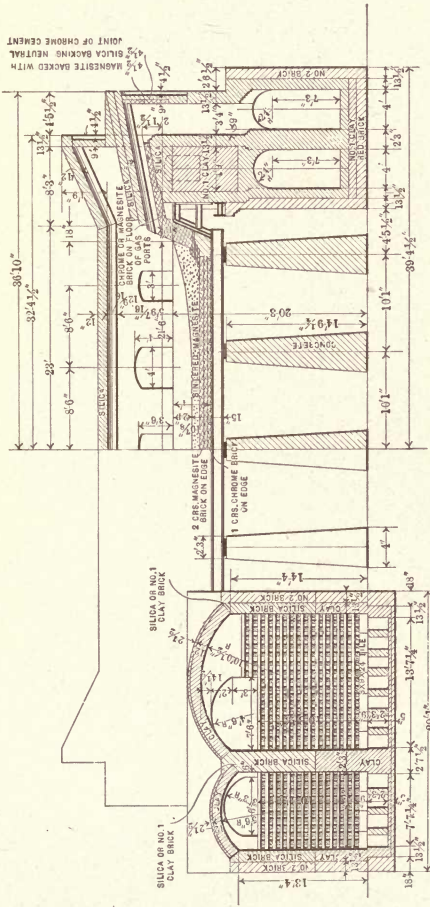
HARBISON-WALKER REFRACTORIES CO.
MALLEABLE FURNACE



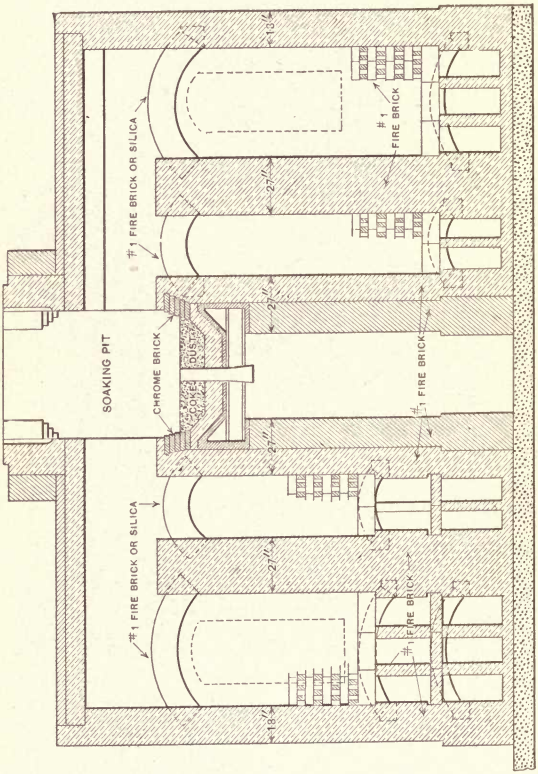
SECTION OF TYPICAL CUPOLA



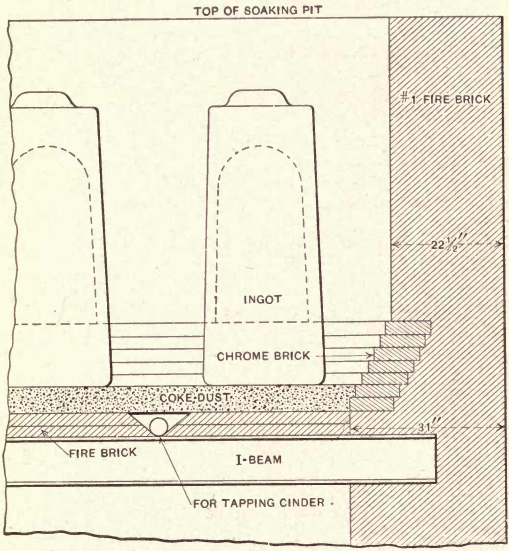
MODERN OPEN HEARTH FURNACE
43′ 0″ X 16′ 9″ BED



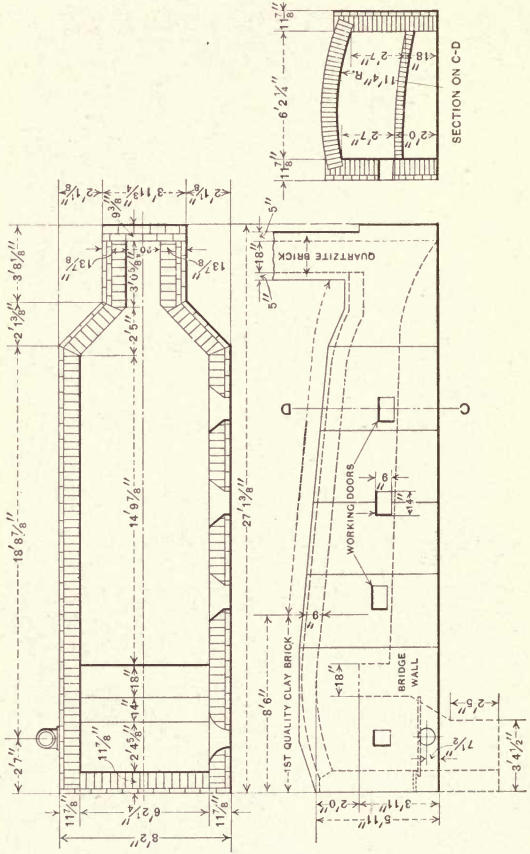
FOUR-HOLE SOAKING PIT FURNACE



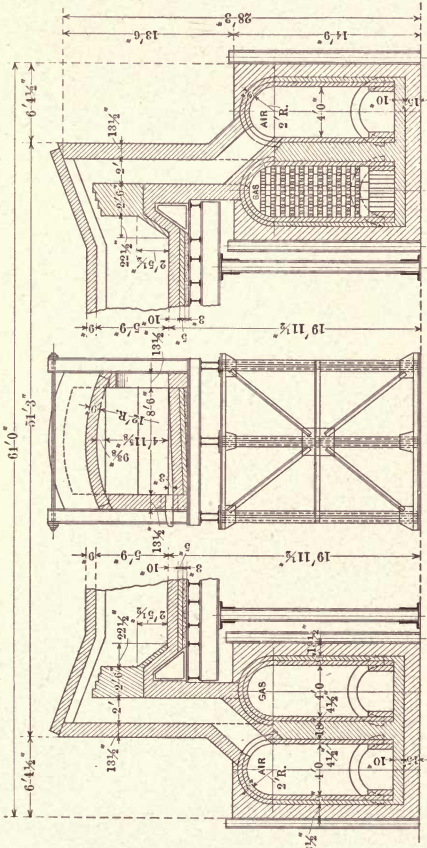
SKETCH OF SOAKING PIT SHOWING USE OF CHROME BRICK



TYPICAL COAL-FIRED HEATING FURNACE SHOWING BRANDS OF BRICK USED



GAS HEATING FURNACE



SIEMENS CRUCIBLE STEEL MELTING FURNACE

ON page 101 is a cut of this furnace, showing the shapes of brick commonly used in building it, and on pages 42 and 43 will be found cuts of each special shape indicated in this drawing, all of which we keep in stock.

Our "STAR SILICA" holds an enviable reputation as the best brick in the country for steel melting furnaces. The "WOODLAND" fire brick secured the greater part of this trade when it was first introduced, and held 90 per cent. of it for 25 years, on its merits, until the "STAR SILICA" gradually replaced it. "WOODLAND" brand is still used by some companies who prefer clay brick to silica brick in crucible steel melting furnaces.

LIST OF SHAPES REQUIRED FOR ONE 6-POT FURNACE

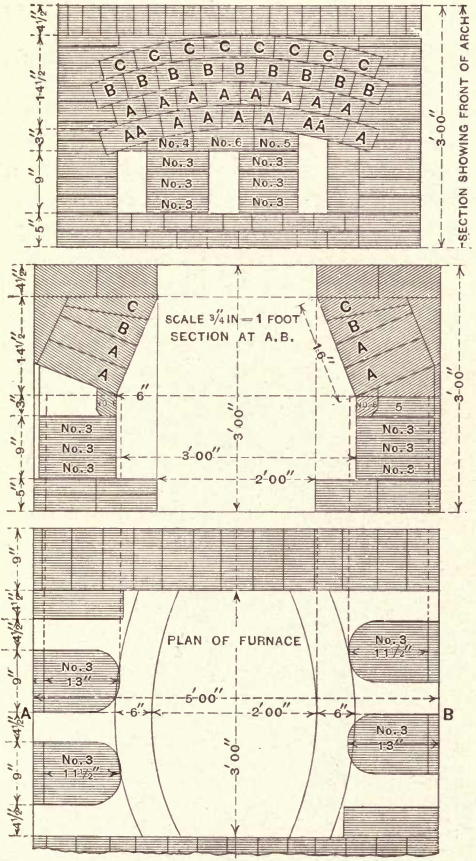
Shape No.	No. Pieces	Where Used
A	30	1st and 2d courses in wall
A A	4	Over port openings
B	18	3d course in wall
C	20	4th course in wall
2	6	Between piers
3	12	Pier brick
4	2	On tops of piers
5	2	On tops of piers
6	2	On tops of piers

9-inch straights, 800

Customers should always order any 9-inch straights needed with these shapes.

We carry the above shapes in "STAR SILICA" and "WOODLAND" brands.

PLAN OF SIEMENS STEEL FURNACE.



OUR PLAN OF SHAPES

FOR SIEMENS CRUCIBLE STEEL MELTING FURNACE

ON page 103 will be found a system of shapes for above furnace designed by ourselves. The plan differs from any heretofore used in having the side walls, or walls over the ports, built with horizontal joints, thus doing away with the arched side walls.

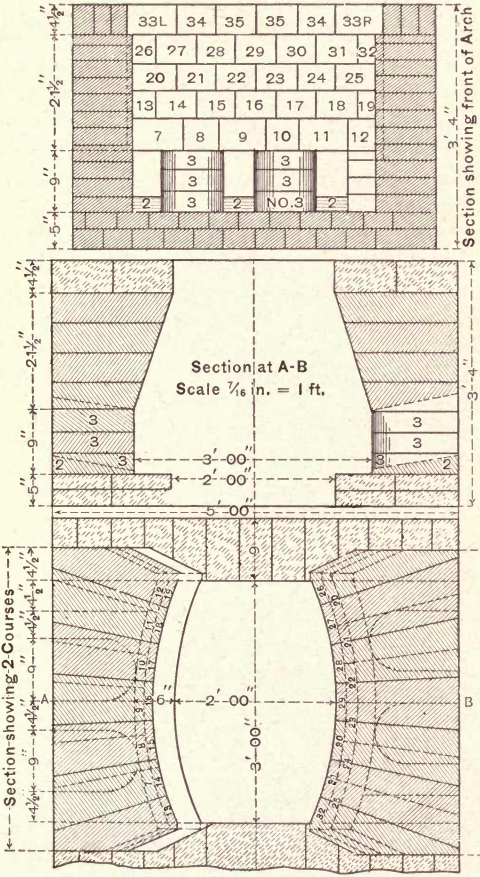
The advantages are, that having all joints or courses of brick horizontal, the side walls are not inclined to pitch into the furnace, as with the old style of shapes; all the shapes extend back to the breast wall, thus making a tight joint the full height of the furnace and preventing the gas from working up between the breast wall and the furnace wall. All of the walls having a straight, solid bearing, the settling will be uniform throughout the furnace, thus avoiding the opening or shattering of the walls by unequal settling. The shapes being of simple pattern, a mason can build a furnace with these shapes in less time than is required with others.

IT REQUIRES THE FOLLOWING SHAPES TO BUILD ONE SIX-POT HOLE

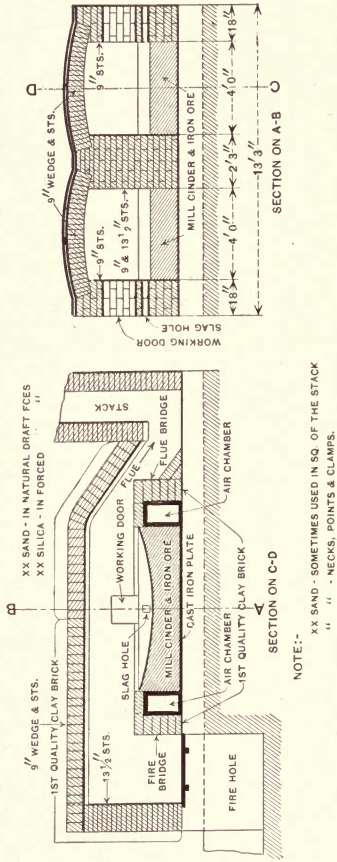
No. 2	6	pieces
No. 3	12	"
Nos. 7 to 32 inclusive	2	" each
No. 33	4	"
No. 34	4	"
No. 35	4	"
9-inch	800	"

Customers should always order extra as many 9-inch as required.

OUR PLAN OF SHAPES FOR SIEMENS CRUCIBLE STEEL MELTING FURNACE



SECTION OF TYPICAL DOUBLE PUDDLING FURNACE



COPPER REVERBERATORIES, CONVERTERS, SETTLERS, ETC.

THE use of the highest grade refractory material is imperative in furnaces smelting and refining copper, because of the severe conditions prevailing in such furnaces.

Practically all of the copper companies in the United States, Canada and Mexico have used large quantities of our "STAR" and "REESE" silica brick, our "WOODLAND," "WIGTON" and other brands of fire-clay brick and "H.-W. R. Co." magnesia and chrome brick.

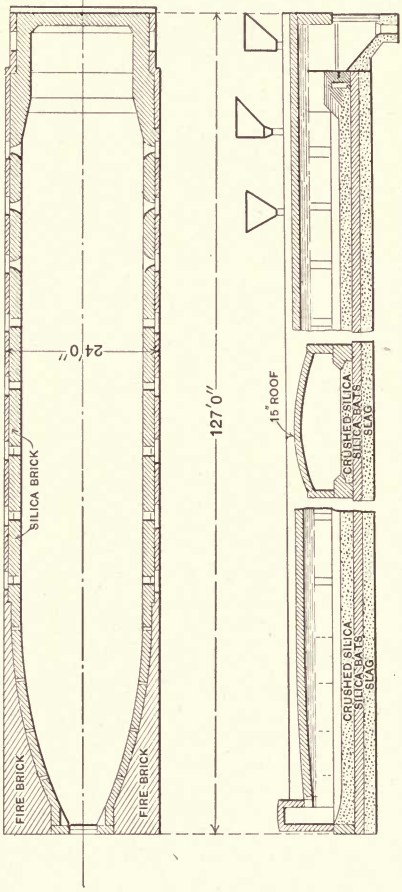
We manufacture silica brick in 9, 12, 15 and 18-inch sizes, especially adapted for roofs and sidewalls of reverberatories; magnesia and chrome brick and shapes for bottoms, side walls and bridge walls of reverberatories; also shapes for converters and settlers, including tuyere blocks.

We make highest grade fire-clay brick for all purposes.

A cut of a reverberatory furnace is shown on page 106.

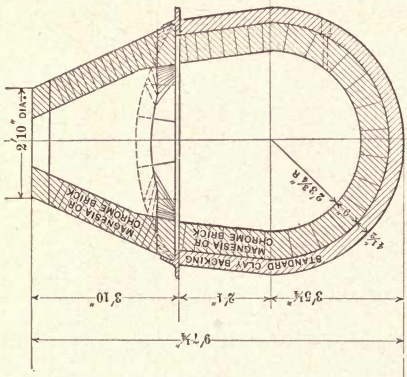
A cut of copper converter is shown on page 107.

REVERBERATORY FURNACE FOR COPPER SMELTING

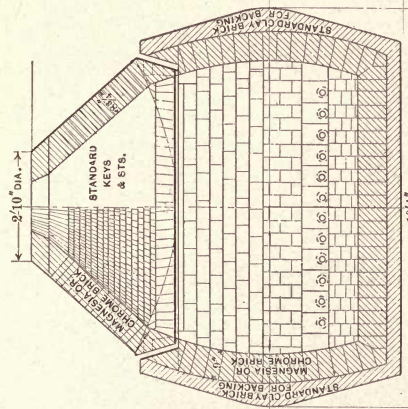


AN INCREASING NUMBER OF REVERBERATORY SMELTING AND REFINING FURNACES ARE USING MAGNESIA BRICK IN SIDE AND BRIDGE WALLS, AND PUTTING IN INVERTED BOTTOMS OF MAGNESIA BRICK.

COPPER CONVERTER

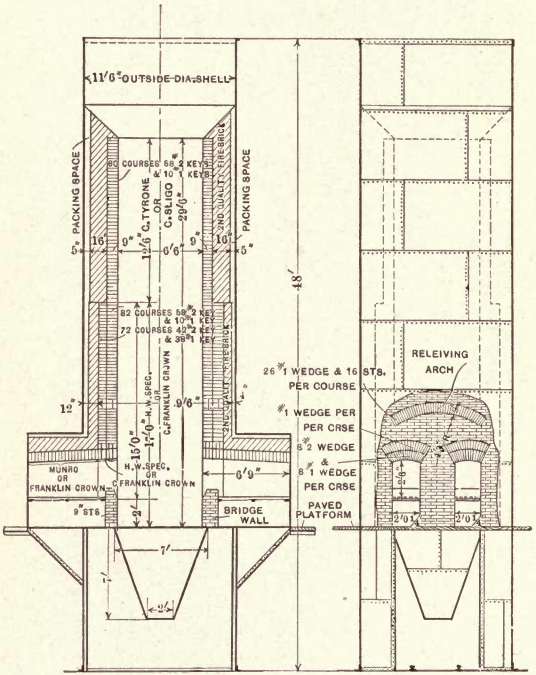


SECTION THROUGH CENTER

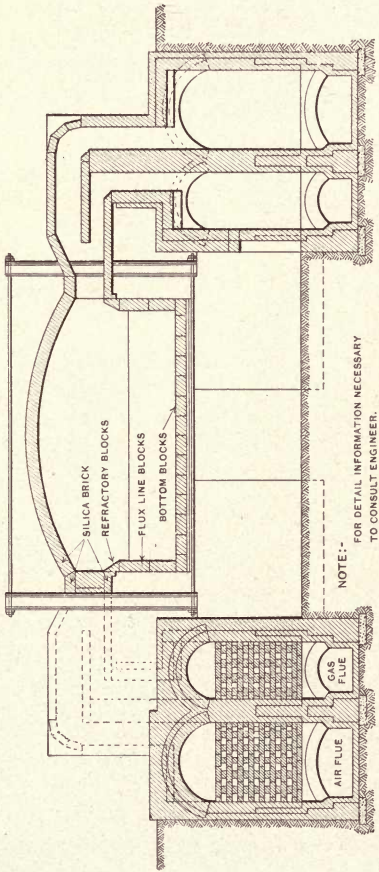


LONGITUDINAL SECTION THROUGH CENTER

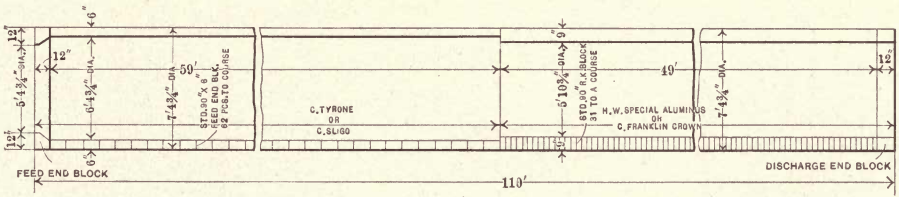
TYPICAL LIME KILN

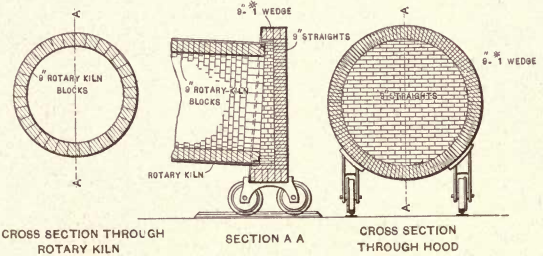


CROSS SECTION OF TYPICAL PRODUCER GAS GLASS TANK



STANDARD ROTARY CEMENT KILN AND LINING





TYPICAL LINING FOR CEMENT KILN HOOD

BOILER SETTINGS

WE make a special feature of manufacturing brick for boiler settings.

The different types of boilers and the different fuels in use require varied properties in the brick used in different sections of the brickwork; in some cases the best brick to use depends entirely upon the heat-resisting quality; in others, upon resistance to the impinging action of flame and spawling; while in others, upon the ability to resist the action of clinker and poker, together with heat-resisting qualities.

The large units of the modern boiler, such as the Sterling, Babcock & Wilcox, Cahall, Heine, Wickes, Rust, Maxim and other types, require the best possible grade of brick in the setting, *especially in the arches.*

In boiler setting, it is important that the workmanship and material be such that interruptions in the steam supply occur as seldom as possible.

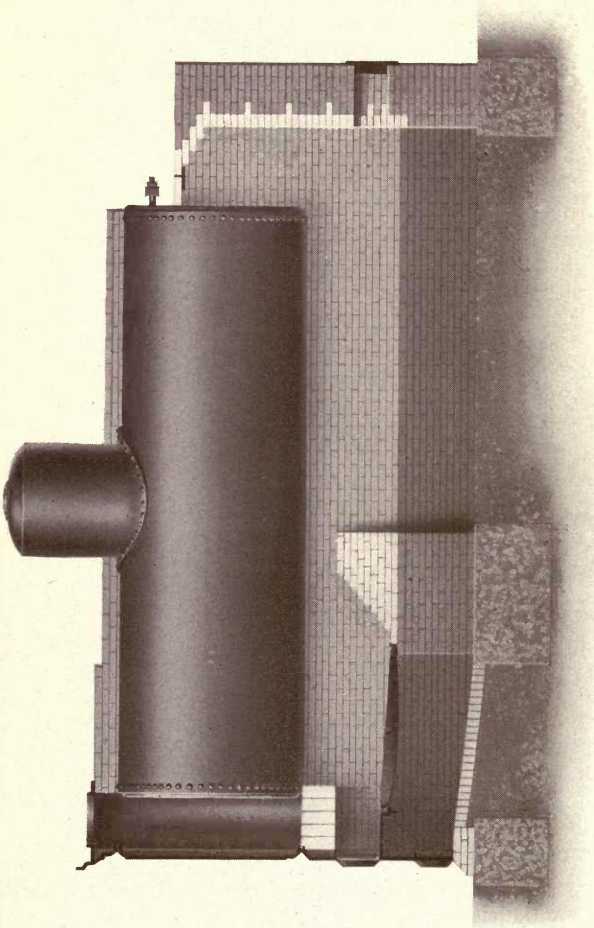
Numerous changes have been made in boiler settings at our suggestion, particularly with regard to the kind of brick used at critical points. These changes were followed with marked improvement in the steam records of the boiler plants.

Whenever called upon to do so, we will have our engineering department get out blueprints and counts, showing the number and most suitable brick required for different sections of the furnace walls for any type of boiler.

Different types of boiler settings are shown on pages 112 to 121 inclusive.

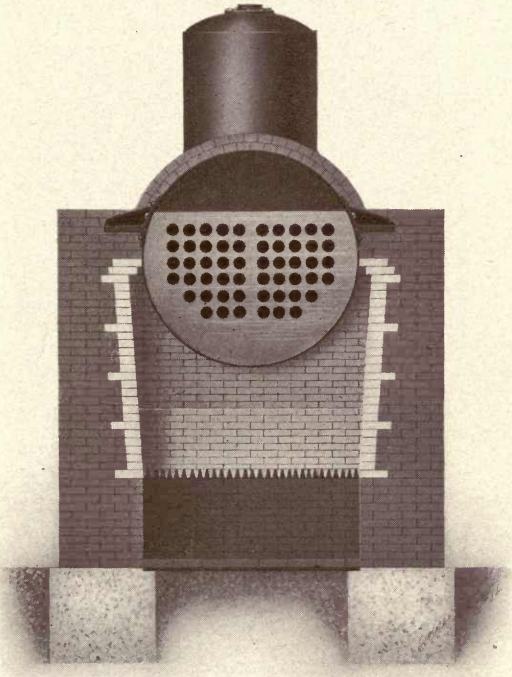
TYPICAL RETURN TUBULAR BOILER

LONGITUDINAL SECTIONAL ELEVATION

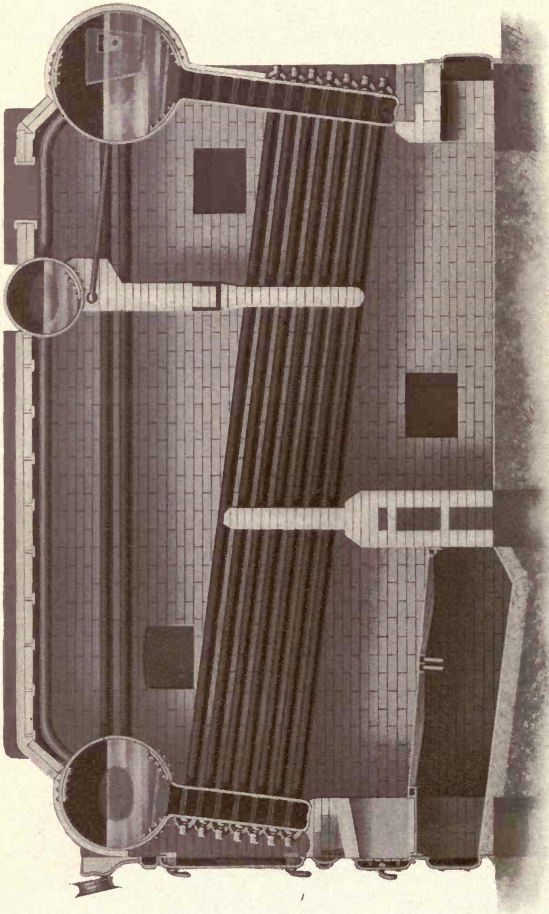


TYPICAL RETURN TUBULAR BOILER

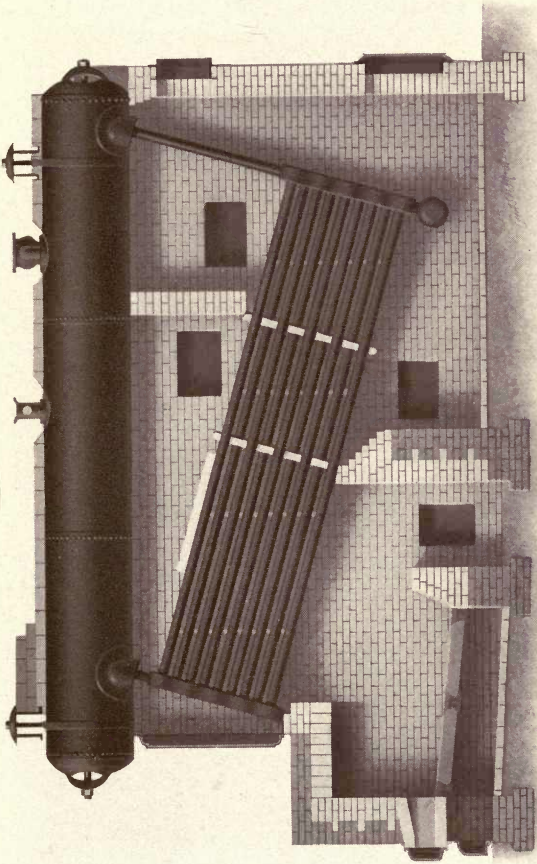
SECTION THROUGH FURNACE



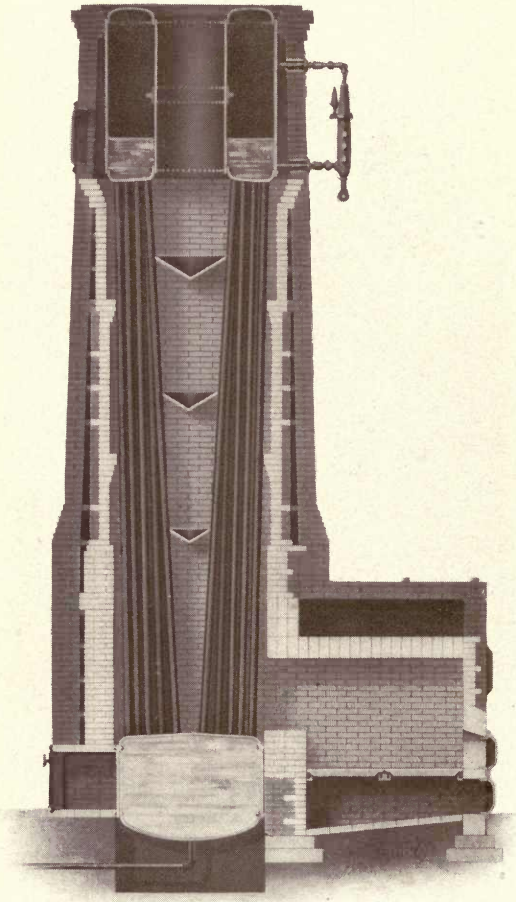
ATLAS HORIZONTAL WATER TUBE BOILER



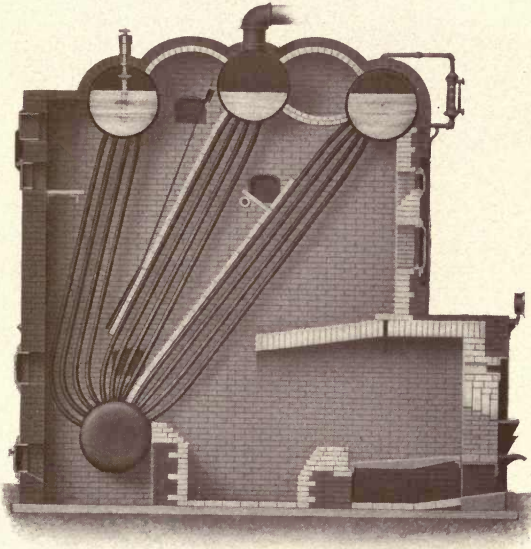
BABCOCK & WILCOX WATER TUBE BOILER



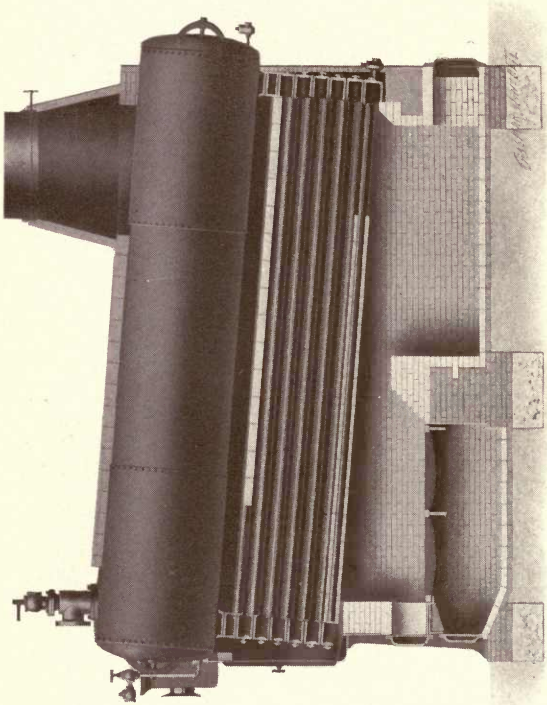
CAHALL VERTICAL WATER TUBE BOILER



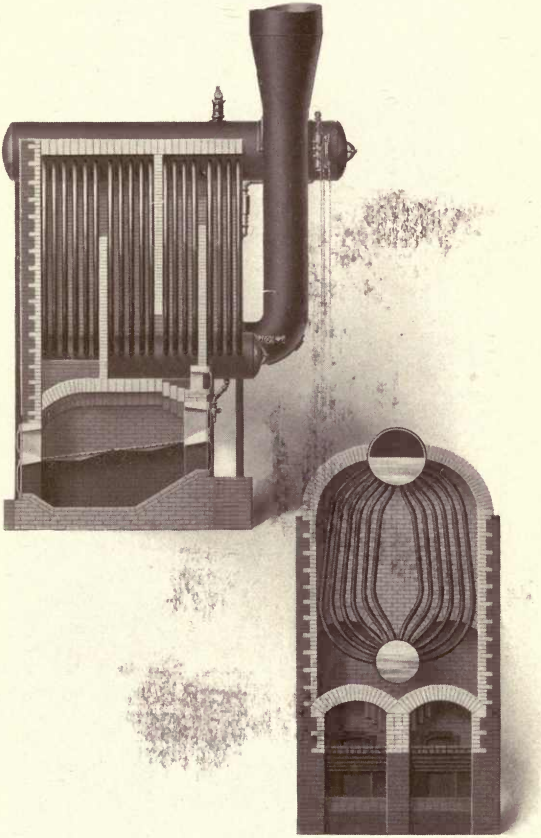
STERLING WATER TUBE BOILER



HEINE HORIZONTAL WATER TUBE BOILER

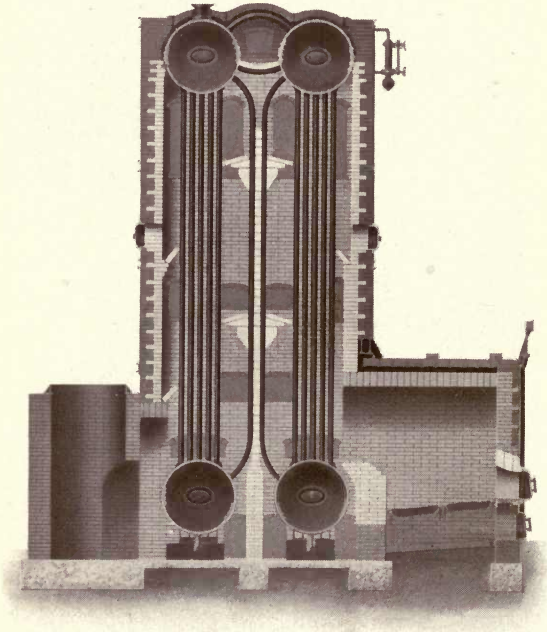


MAXIM WATER TUBE BOILER

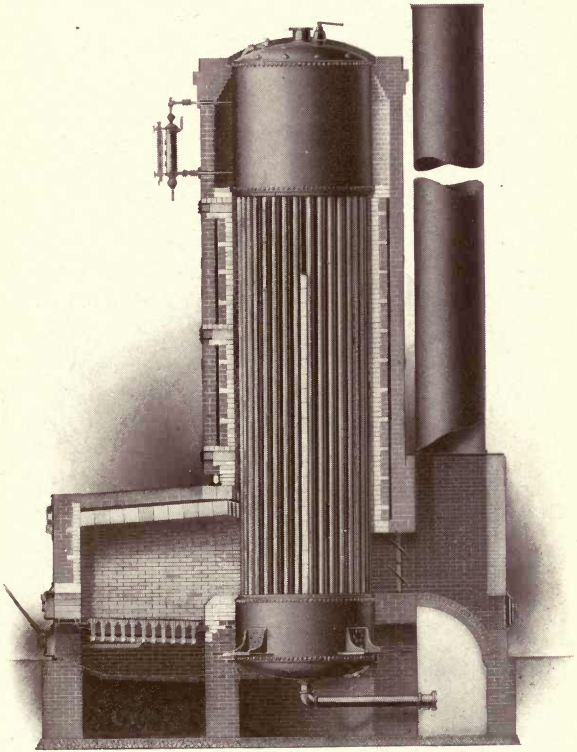


THE RUST WATER TUBE BOILER

SECTION THROUGH BOILER



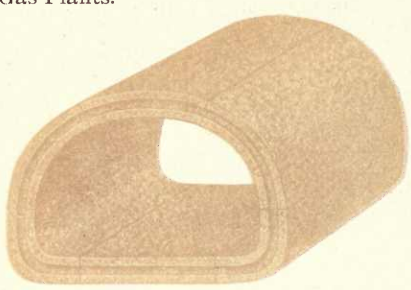
WICKES VERTICAL WATER TUBE SAFETY STEAM BOILER



COAL GAS BENCHES AND WATER GAS PLANTS

THE question of the quality of refractory materials is becoming one of increasing importance to managers of Gas Plants. In the past, the limit of endurance of refractory materials used has been the controlling factor in limiting the output per unit of capacity. We are now making Sectional Retorts and Setting Shapes of "H. W. RICON" (our Special High Silica) which is so high in heat resisting qualities that the only limit to rapidity of operation is the heat at which the gas would disintegrate or decompose. This has effected a decrease in the time of carbonizing, thus increasing the number of charges in a given time and consequently showing an actual increase in production per retort of from 40 to 50 per cent. Sectional retorts have previously been unsatisfactory, due to shrinkage; "H. W. RICON" expands with heat, making a durable retort which is permanently gas tight.

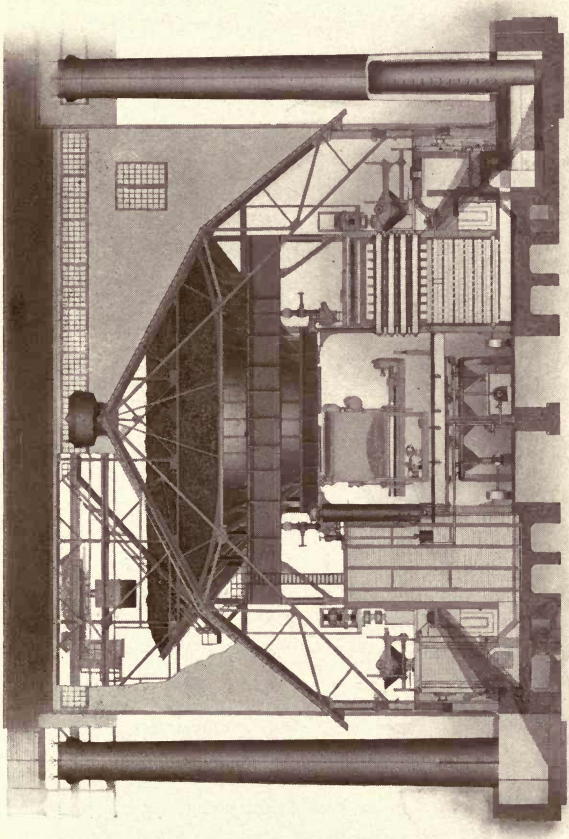
In addition to "H. W. RICON," mentioned above, we also manufacture fire clay shapes for use in regenerators, fixers, carburetors and checkers. Our material has been found to be particularly suitable for all purposes in Coal Gas Benches and Regenerators and in Water Gas Plants.



SECTION OF RETORT

STANDARD RETORT GAS HOUSE

Riter-Conley Mfg. Co., Pittsburgh, Pa.



GENERAL INFORMATION ABOUT FIRE BRICK

ALL FIRE BRICK SHOULD BE KEPT IN A DRY PLACE

Moisture, especially in cold weather, will greatly injure any brick.

To obtain the best results from brickwork, observe the following precautions:

Use good fire clay equal in refractoriness to the brick itself.

Apply very thin with dipped joints and brick rubbed to make a brick to brick joint.

Warm up slowly to expel moisture.

Bear in mind that fire clay brick contract, and silica, chrome and magnesia brick expand under high temperatures.

Sudden variations of temperature cause silica brick to spawl, and also reduce their refractoriness. All furnaces in which silica brick are used should therefore be heated up and cooled down slowly and uniformly.

From 250 to 350 pounds of fire clay or silica cement are enough to lay up one thousand brick. Fine ground fire clay should be used for laying up fire clay brick, and silica cement for silica brick.

For estimating on fire brick work, use the following figures:

1 square foot 4½-inch wall requires 7 brick
1 square foot 9-inch wall requires 14 brick
1 square foot 13½-inch wall requires 21 brick
1 cubic foot brick work requires 17 nine-inch straight brick
1 cubic foot fire clay brick work weighs 150 pounds
1 cubic foot silica brick work weighs 130 pounds
1,000 brick (closely stacked) occupy 56 cubic feet
1,000 brick (loosely stacked) occupy 72 cubic feet

For estimating on red brick work, figure on nine cubic feet of sand and three bushels of lime for laying 1,000 brick.

BRICK TABLES

THE following tables show how a circle or arch of any diameter may be laid up with a combination of the standard size fire brick, as designated in this catalogue.

TABLE OF WEDGE BRICK

Inside Diameter	No. 2 Wedge	No. 1 Wedge	Straight	Total
2 ft. 0 in.	.....	.....	.....	
2 " 6 "	60.5	.....	.....	60.5
3 " 0 "	48.	19.6	.....	68.
3 " 6 "	36.	40.	.....	76.
4 " 0 "	24.	59.	.....	83.
4 " 6 "	12.0637	79.	.....	91.
5 " 0 "	.....	98.	.....	98.
5 " 6 "	.....	98.	7.5	106.
6 " 0 "	.....	98.	15.	113.
6 " 6 "	.....	98.	23.	121.
7 " 0 "	.....	98.	30.	128.
7 " 6 "	.....	98.	38.	136.
8 " 0 "	.....	98.	46.	144.
8 " 6 "	.....	98.	53.	151.
9 " 0 "	.....	98.	61.	159.
9 " 6 "	.....	98.	68.	166.
10 " 0 "	.....	98.	76.	174.
10 " 6 "	.....	98.	83.	181.
11 " 0 "	.....	98.	91.	189.
11 " 6 "	.....	98.	98.	196.
12 " 0 "	.....	98.	106.	204.

TABLE OF ARCH BRICK

Inside Diameter	No. 3 Arch	No. 2 Arch	No. 1 Arch	Straight	Total
0 ft. 6 in.	18.	.....	.....	.....	18.
1 " 0 "	13.	13.	.....	.....	26.
1 " 6 "	4.	29.	.....	.....	33.
2 " 0 "	.....	41.5	.....	.....	41.5
2 " 6 "	.....	31.	18.	.....	49.
3 " 0 "	.....	21.	36.	.....	57.
3 " 6 "	.....	10.3673	54.	.....	64.
4 " 0 "	.....	.....	72.	.....	72.
4 " 6 "	.....	.....	72.	7.5	80.
5 " 0 "	.....	.....	72.	15.	87.
5 " 6 "	.....	.....	72.	23.	95.
6 " 0 "	.....	.....	72.	30.	102.
6 " 6 "	.....	.....	72.	38.	110.
7 " 0 "	.....	.....	72.	45.	117.
7 " 6 "	.....	.....	72.	53.	125.
8 " 0 "	.....	.....	72.	60.	132.
8 " 6 "	.....	.....	72.	68.	140.
9 " 0 "	.....	.....	72.	75.	147.
9 " 6 "	.....	.....	72.	83.	155.
10 " 0 "	.....	.....	72.	90.	162.
10 " 6 "	.....	.....	72.	98.	170.
11 " 0 "	.....	.....	72.	105.	177.
11 " 6 "	.....	.....	72.	113.	185.
12 " 0 "	.....	.....	72.	121.	193.

TABLE OF 9-INCH KEY BRICK

Inside Diameter	No. 4 Key	No. 3 Key	No. 2 Key	No. 1 Key	Total
1 ft. 6 in.	25.1328	.....	.....	.....	25.
2 " 0 "	17.	12.5	.....	.....	30.
2 " 6 "	8.3776	25.	.....	.....	34.
3 " 0 "	.....	38.	.....	.....	38.
3 " 6 "	.....	32.	10.5	.....	42.
4 " 0 "	.....	25.	21.	.....	46.
4 " 6 "	.....	19.	32.	.....	51.
5 " 0 "	.....	13.	42.	.....	55.
5 " 6 "	.....	6.	53.	.....	59.
6 " 0 "	.....	.....	63.	.....	63.
6 " 6 "	.....	.....	58.	9.5	67.
7 " 0 "	.....	.....	52.	19.	71.
7 " 6 "	.....	.....	47.	29.	76.
8 " 0 "	.....	.....	42.	38.	80.
8 " 6 "	.....	.....	37.	47.	84.
9 " 0 "	.....	.....	31.	57.	88.
9 " 6 "	.....	.....	26.	66.	92.
10 " 0 "	.....	.....	21.	76.	97.
10 " 6 "	.....	.....	16.	85.	101.
11 " 0 "	.....	.....	11.	94.	105.
11 " 6 "	.....	.....	5.236	104.	109.
12 " 0 "	.....	.....	.....	113.	113.

TABLE OF 9-INCH KEY BRICK
CONTINUED

Inside Diameter	No. 1 Key	Straight	Total
12 ft. 6 in.	113.	4.	117.
13 " 0 "	113.	9.	122.
13 " 6 "	113.	13.	126.
14 " 0 "	113.	17.	130.
14 " 6 "	113.	21.	134.
15 " 0 "	113.	26.	139.
15 " 6 "	113.	30.	143.
16 " 0 "	113.	34.	147.
16 " 6 "	113.	38.	151.
17 " 0 "	113.	42.	155.
17 " 6 "	113.	46.	159.
18 " 0 "	113.	51.	164.
18 " 6 "	113.	55.	168.
19 " 0 "	113.	59.	172.
19 " 6 "	113.	63.	176.
20 " 0 "	113.	67.	180.
20 " 6 "	113.	72.	185.
21 " 0 "	113.	76.	189.
21 " 6 "	113.	80.	193.
22 " 0 "	113.	84.	197.
22 " 6 "	113.	88.	201.
23 " 0 "	113.	93.	206.
23 " 6 "	113.	97.	210.

TABLE OF 9-INCH KEY BRICK

CONTINUED

Inside Diameter	No. 1 Key	Straight	Total
24 ft. 0 in.	113.	101.	214.
24 " 6 "	113.	105.	218.
25 " 0 "	113.	109.	222.
25 " 6 "	113.	113.	226.
26 " 0 "	113.	117.	230.
26 " 6 "	113.	121.	234.
27 " 0 "	113.	126.	239.
27 " 6 "	113.	130.	243.
28 " 0 "	113.	134.	247.
28 " 6 "	113.	138.	251.
29 " 0 "	113.	142.	255.
29 " 6 "	113.	147.	260.
30 " 0 "	113.	151.	264.
30 " 6 "	113.	155.	268.
31 " 0 "	113.	159.	272.
31 " 6 "	113.	163.	276.
32 " 0 "	113.	168.	281.
32 " 6 "	113.	172.	285.
33 " 0 "	113.	176.	289.
33 " 6 "	113.	180.	293.
34 " 0 "	113.	184.	297.
34 " 6 "	113.	188.	301.
35 " 0 "	113.	193.	306.

TABLE OF 13½-INCH KEY BRICK

Inside Diameter	No. 4 Key	No. 2 Key	Straight	Total
6 ft. 0 in.	52.	.....	.....	52.
6 " 6 "	48.	7.5	.....	55.
7 " 0 "	44.	15.	.....	59.
7 " 6 "	39.	23.	.....	62.
8 " 0 "	35.	30.	.....	65.
8 " 6 "	30.	38.	.....	68.
9 " 0 "	26.	45.	.....	71.
9 " 6 "	22.	52.	.....	74.
10 " 0 "	17.	60.	.....	77.
10 " 6 "	13.	67.	.....	80.
11 " 0 "	9.	75.	.....	84.
11 " 6 "	4.5	82.	.....	87.
12 " 0 "	.....	90.	.....	90.
12 " 6 "	.....	90.	3.5	93.5
13 " 0 "	.....	90.	7.	97.
13 " 6 "	.....	90.	10.	100.
14 " 0 "	.....	90.	13.	103.
14 " 6 "	.....	90.	16.	106.
15 " 0 "	.....	90.	20.	110.
15 " 6 "	.....	90.	23.	113.
16 " 0 "	.....	90.	26.	116.
16 " 6 "	.....	90.	29.	119.

TABLE OF 13½-INCH KEY BRICK
CONTINUED

Inside Diameter	No. 2 Key	Straight	Total
17 ft. 0 in.....	90.	32.	122.
17 " 6 "	90.	35.	125.
18 " 0 "	90.	38.	128.
18 " 6 "	90.	42.	132.
19 " 0 "	90.	45.	135.
19 " 6 "	90.	48.	138.
20 " 0 "	90.	51.	141.
20 " 6 "	90.	54.	144.
21 " 0 "	90.	57.	147.
21 " 6 "	90.	60.	150.
22 " 0 "	90.	63.	153.
22 " 6 "	90.	66.	156.
23 " 0 "	90.	70.	160.
23 " 6 "	90.	73.	163.
24 " 0 "	90.	76.	166.
24 " 6 "	90.	79.	169.
25 " 0 "	90.	82.	172.
25 " 6 "	90.	85.	175.
26 " 0 "	90.	88.	178.
26 " 6 "	90.	92.	182.
27 " 0 "	90.	95.	185.
27 " 6 "	90.	98.	188.
28 " 0 "	90.	101.	191.

TABLE OF 13½-INCH KEY BRICK

CONTINUED

Inside Diameter	No. 2 Key	Straight	Total
28 ft. 6 in.....	90.	104.	194.
29 " 0 "	90.	107.	197.
29 " 6 "	90.	110.	200.
30 " 0 "	90.	114.	204.
30 " 6 "	90.	117.	207.
31 " 0 "	90.	120.	210.
31 " 6 "	90.	123.	213.
32 " 0 "	90.	126.	216.
32 " 6 "	90.	129.	219.
33 " 0 "	90.	132.	222.
33 " 6 "	90.	136.	226.
34 " 0 "	90.	139.	229.
34 " 6 "	90.	142.	232.
35 " 0 "	90.	145.	235.

TABLE OF 9 x 6 INCH KEY BRICK

Inside Diameter	Key 9 x 6 x 5⅜ x 2½"	Straight 9 x 6 x 2½"	Total
12 ft. 0 in.	85.	0.	85.
12 " 6 "	85.	3.	88.
13 " 0 "	85.	6.	91.
13 " 6 "	85.	9.	94.
14 " 0 "	85.	12.	97.
14 " 6 "	85.	15.	100.
15 " 0 "	85.	18.	103.
15 " 6 "	85.	21.	106.
16 " 0 "	85.	24.	109.
16 " 6 "	85.	28.	113.
17 " 0 "	85.	31.	116.
17 " 6 "	85.	34.	119.
18 " 0 "	85.	37.	122.
18 " 6 "	85.	40.	125.
19 " 0 "	85.	43.	128.
19 " 6 "	85.	46.	131.
20 " 0 "	85.	49.	134.
20 " 6 "	85.	53.	138.
21 " 0 "	85.	56.	141.
21 " 6 "	85.	59.	144.
22 " 0 "	85.	62.	147.
22 " 6 "	85.	65.	150.
23 " 0 "	85.	68.	153.
23 " 6 "	85.	71.	156.
24 " 0 "	85.	75.	160.
24 " 6 "	85.	78.	163.
25 " 0 "	85.	81.	166.
25 " 6 "	85.	84.	169.
26 " 0 "	85.	87.	172.

TABLE OF GAS FLUE ARCH BRICK
FOR BLAST FURNACE DOWN COMER

Inside Diameter Openings	Shapes Required			
	No. 3	No. 4	No. 5	Straight
3 ft. 0 in.	49			
3 ft. 6 in.	23	31		
4 ft. 0 in.	.....	60		
4 ft. 6 in.	.....	26	39	
5 ft. 0 in.	.....	.....	70	
5 ft. 6 in.	.....	.....	70	6
6 ft. 0 in.	.....	.....	70	11
6 ft. 6 in.	.....	.....	70	16
7 ft. 0 in	.....	.....	70	22
7 ft. 6 in.	.....	.....	70	27
8 ft. 0 in.	.....	.....	70	33
8 ft. 6 in.	.....	.....	70	38
9 ft. 0 in.	.....	.....	70	43

CUPOLA BLOCKS

Inside Diameter Cupola	Shapes Required			
	No. 1	No. 2	No. 3	No. 4
2 ft. 6 in.	15			
2 ft. 9 in.	8	8		
3 ft. 0 in.	.....	17		
3 ft. 3 in.	.....	12	6	
3 ft. 6 in.	.....	8	11	
3 ft. 9 in.	.....	4	16	
4 ft. 0 in.	.....	.....	21	
4 ft. 3 in.	.....	.....	15	7
4 ft. 6 in.	.....	.....	10	13
4 ft. 9 in.	.....	.....	5	19
5 ft. 0 in.	.....	.....	.....	25

STANDARD BOTTOM BLOCKS

IN ONE COURSE OF FOLLOWING DIAMETERS

Blocks 18 x 12 x 8"		Blocks 18 x 9 x 4½"	
Diameter	No. Blocks	Diameter	No. Blocks
8′ 0″	86	8′ 0″	197
8′ 6″	97	8′ 6″	223
9′ 0″	108	9′ 0″	250
9′ 6″	121	9′ 6″	279
10′ 0″	134	10′ 0″	308
10′ 6″	148	10′ 6″	339
11′ 0″	162	11′ 0″	372
11′ 6″	177	11′ 6″	407
12′ 0″	194	12′ 0″	444
12′ 6″	209	12′ 6″	481
13′ 0″	226	13′ 0″	520
13′ 6″	244	13′ 6″	560
14′ 0″	263	14′ 0″	603
14′ 6″	282	14′ 6″	647
15′ 0″	301	15′ 0″	692
15′ 6″	322	15′ 6″	739
16′ 0″	343	16′ 0″	787
16′ 6″	364	16′ 6″	838
17′ 0″	387	17′ 0″	888
17′ 6″	410	17′ 6″	942
18′ 0″	434	18′ 0″	996
18′ 6″	459	18′ 6″	1052
19′ 0″	484	19′ 0″	1109
19′ 6″	509	19′ 6″	1169
20′ 0″	536	20′ 0″	1229
20′ 6″	563	20′ 6″	1292
21′ 0″	591	21′ 0″	1356
21′ 6″	619	21′ 6″	1421
22′ 0″	648	22′ 0″	1488
22′ 6″	677	22′ 6″	1556
23′ 0″	709	23′ 0″	1626
23′ 6″	740	23′ 6″	1698
24′ 0″	771	24′ 0″	1770
24′ 6″	804	24′ 6″	1845
25′ 0″	837	25′ 0″	1920
25′ 6″	871	25′ 6″	1998

TABLE OF SILICA 12-INCH WEDGE BRICK

2½-INCH SERIES

Inside Diameter	2½" No. 2 Wedge 12 x 6 x 2⅞ x 2½"	2½" No. 1 Wedge 12 x 6 x 2 1/16 x 2½"	Straight 12 x 6 x 2½	Total
12 ft. 0 in.	181	.....	.....	181
12 " 6 "	173	15	.....	188
13 " 0 "	166	30	.....	196
13 " 6 "	158	45	.....	203
14 " 0 "	151	60	.....	211
14 " 6 "	143	75	.....	218
15 " 0 "	136	90	.....	226
15 " 6 "	128	106	.....	234
16 " 0 "	121	121	.....	242
16 " 6 "	113	136	.....	249
17 " 0 "	106	151	.....	257
17 " 6 "	98	166	.....	264
18 " 0 "	91	181	.....	272
18 " 6 "	83	196	.....	279
19 " 0 "	76	211	.....	287
19 " 6 "	68	226	.....	294
20 " 0 "	61	241	.....	302
20 " 6 "	53	256	.....	309
21 " 0 "	46	271	.....	317
21 " 6 "	38	287	.....	325
22 " 0 "	31	302	.....	333
22 " 6 "	23	317	.....	340
23 " 0 "	16	332	.....	348
23 " 6 "	8	347	.....	355
24 " 0 "	.....	362	.....	362
24 " 6 "	.....	362	8	370
25 " 0 "	.....	362	15	377
25 " 6 "	.....	362	23	385
26 " 0 "	.....	362	30	392
26 " 6 "	.....	362	38	400
27 " 0 "	.....	362	45	407
27 " 6 "	.....	362	53	415
28 " 0 "	.....	362	60	422
28 " 6 "	.....	362	68	430
29 " 0 "	.....	362	75	437
29 " 6 "	.....	362	83	445
30 " 0 "	.....	362	90	452
30 " 6 "	.....	362	98	460
31 " 0 "	.....	362	105	467
31 " 6 "	.....	362	113	475
32 " 0 "	.....	362	120	482
32 " 6 "	.....	362	128	490
33 " 0 "	.....	362	135	497
33 " 6 "	.....	362	143	505
34 " 0 "	.....	362	150	512
34 " 6 "	.....	362	158	520
35 " 0 "	.....	362	165	527
35 " 6 "	.....	362	173	535
36 " 0 "	.....	362	181	543

See page 137 for 3-inch series. In ordering state whether you desire 2½-inch or 3-inch series.

TABLE OF SILICA 12-INCH WEDGE BRICK

3-INCH SERIES

Inside Diameter	3" No. 2 Wedge 12 x 6 x 3 x 2"	3" No. 1 Wedge 12 x 6 x 3 x 2½"	Straight 12 x 6 x 3"	Total
4 ft. 0 in.	75	.....	.....	75
4 " 6 "	69	13	.....	82
5 " 0 "	63	25	.....	88
5 " 6 "	56	38	.....	94
6 " 0 "	51	50	.....	101
6 " 6 "	44	63	.....	107
7 " 0 "	38	75	.....	113
7 " 6 "	31	88	.....	119
8 " 0 "	25	101	.....	126
8 " 6 "	19	113	.....	132
9 " 0 "	12	126	.....	138
9 " 6 "	7	138	.....	145
10 " 0 "	.....	151	.....	151
10 " 6 "	.....	151	6	157
11 " 0 "	.....	151	13	164
11 " 6 "	.....	151	19	170
12 " 0 "	.....	151	25	176
12 " 6 "	.....	151	31	182
13 " 0 "	.....	151	38	189
13 " 6 "	.....	151	44	195
14 " 0 "	.....	151	50	201
14 " 6 "	.....	151	57	208
15 " 0 "	.....	151	63	214
15 " 6 "	.....	151	69	220
16 " 0 "	.....	151	75	226
16 " 6 "	.....	151	82	233
17 " 0 "	.....	151	88	239
17 " 6 "	.....	151	94	245
18 " 0 "	.....	151	101	252
18 " 6 "	.....	151	107	258
19 " 0 "	.....	151	113	264
19 " 6 "	.....	151	120	271
20 " 0 "	.....	151	126	277
20 " 6 "	.....	151	132	283
21 " 0 "	.....	151	139	190
21 " 6 "	.....	151	145	196
22 " 0 "	.....	151	151	302

See page 136 for 2½-inch series. In ordering state whether you desire 2½-inch or 3-inch series.

TABLE OF STANDARD CIRCLE BRICK

Inside Diameter	No. 1	No. 2	No. 3	No. 4	Variation
2 ft. 0 in.	12	....	....	....	.....
2 " 3 "	9	4	....	....	¼ in.
2 " 6 "	6	8	....	....	9/16 "
2 " 9 "	3	12	....	....	9/16 "
3 " 0 "	....	16	....	....	.....
3 " 3 "	....	8	9	....	1/16 "
3 " 6 "	....	2	16	....	¼ "
3 " 9 "	....	....	17	2	1⅛ "
4 " 0 "	....	....	15	5	11/16 "
4 " 3 "	....	....	13	8	7/16 "
4 " 6 "	....	....	12	10	½ "
4 " 9 "	....	....	10	13	7/16 "
5 " 0 "	....	....	9	15	⅝ "
5 " 3 "	....	....	8	18	5/16 "
5 " 6 "	....	....	6	21	1¼ "
5 " 9 "	....	....	5	23	1⅝ "
6 " 0 "	....	....	3	26	2½ "
6 " 3 "	....	....	2	28	3½ "
6 " 6 "	....	....	....	31	.....

NOTE—"Variation" is the amount that a course varies from a true circle when laid up without cutting any brick. This can be eliminated by slight chipping. Unless customer understands that chipping will be necessary, these combinations should only be used on rough work.

TEMPERATURES

Below we give the temperatures of iron, steel and other metals, under various conditions, according to the latest scientific investigations.

	Centigrade Degrees	Fahrenheit Degrees
Tin.....melts	229	445
Lead.....melts	322	612
Lead.....boils	1040	1904
Zinc.....melts	412	775
Zinc.....boils	1040	1904
Aluminum.....melts	700	1252
Silver.....melts	957	1775
Brass.....melts	1021	1870
Copper.....melts	1029	1885
Gold.....melts	1038	1900
Cobalt.....melts	1100	2012
Cast Iron, white.....melts	1135	2075
Cast Iron, gray.....melts	1222	2230
Steel.....melts	1300	2372
Iron, wrought.....melts	1500	2732
Nickel.....melts	1500	2732
Platinum.....melts	2533	4593
Glass Furnace, between the pots.	1375	2507
In the pots, refining.....	1310	2390
In the pots, working.....	1045	1913
Tanks melted for casting	1310	2390
Annealing Glassware.....	444 to 555	800 to 1000
Siemens Crucible Steel Furnace varies from	1460 to 1590	2660 to 2894

TEMPERATURES—CONTINUED

	Centigrade Degrees	Fahrenheit Degrees
BESSEMER PROCESS		
Running the slag	1580	2876
Running steel into ladle	1640	2984
Running steel into mould	1580	2876
Soaking pit furnace, ingot in	1200	2192
Ingot under hammer	1080	1976
OPEN HEARTH PROCESS		
Gas from producers	720	1328
Gas entering generator	400	752
Gas leaving generator	1200	2192
Air leaving generator	1000	1832
Fumes passing to shaft	300	572
End of fusion of charge	1420	2588
Refining the steel	1500	2732
Running into ladle, first	1580	2876
Running into ladle, last	1490	2714
BLAST FURNACE—GRAY BESSEMER		
Front of tuyere	1930	3506
At tapping	1570	2858

The following table affords a somewhat rough method of estimating high temperature.

	Centigrade Degrees	Fahrenheit Degrees
Just glowing in the dark	525	977
Dark red	700	1252
Cherry red	908	1666
Bright cherry red	1000	1832
Orange	1150	2102
White	1300	2372
Dazzling white	1500	2732

FUSING POINTS OF SEGER CONES

Number of Cone	Fusing Point		Number of Cone	Fusing Point	
	Degrees Fahr.	Degrees Centig.		Degrees Fahr.	Degrees Centig.
.022	1,094	590	10	2,426	1,330
.021	1,148	620	11	2,462	1,350
.020	1,202	650	12	2,498	1,370
.019	1,256	680	13	2,534	1,390
.018	1,310	710	14	2,570	1,410
.017	1,364	740	15	2,606	1,430
.016	1,418	770	16	2,642	1,450
.015	1,472	800	17	2,678	1,470
.014	1,526	830	18	2,714	1,490
.013	1,580	860	19	2,750	1,510
.012	1,634	890	20	2,786	1,530
.011	1,688	920	21	2,822	1,550
.010	1,742	950	22	2,858	1,570
.09	1,778	970	23	2,894	1,590
.08	1,814	990	24	2,930	1,610
.07	1,850	1,010	25	2,966	1,630
.06	1,886	1,030	26	3,002	1,650
.05	1,922	1,050	27	3,038	1,670
.04	1,958	1,070	28	3,074	1,690
.03	1,994	1,090	29	3,110	1,710
.02	2,030	1,110	30	3,146	1,730
.01	2,066	1,130	31	3,182	1,750
1	2,102	1,150	32	3,218	1,770
2	2,138	1,170	33	3,254	1,790
3	2,174	1,190	34	3,290	1,810
4	2,210	1,210	35	3,326	1,830
5	2,246	1,230	36	3,362	1,850
6	2,282	1,250	37	3,398	1,870
7	2,318	1,270	38	3,434	1,890
8	2,354	1,290	39	3,470	1,910
9	2,390	1,310			

COMPARISON OF CENTIGRADE AND FAHRENHEIT THERMOMETERS

Centigrade	Fahrenheit	Centigrade	Fahrenheit	Centigrade	Fahrenheit
1815	3299	1770	3218	1725	3137
1814	3297.2	1769	3216.2	1724	3135.2
1813	3295.4	1768	3214.4	1723	3133.4
1812	3293.6	1767	3212.6	1722	3131.6
1811	3291.8	1766	3210.8	1721	3129.8
1810	3290	1765	3209	1720	3128
1809	3288.2	1764	3207.2	1719	3126.2
1808	3286.4	1763	3205.4	1718	3124.4
1807	3284.6	1762	3203.6	1717	3122.6
1806	3282.8	1761	3201.8	1716	3120.8
1805	3281	1760	3200	1715	3119
1804	3279.2	1759	3198.2	1714	3117.2
1803	3277.4	1758	3196.4	1713	3115.4
1802	3275.6	1757	3194.6	1712	3113.6
1801	3273.8	1756	3192.8	1711	3111.8
1800	3272	1755	3191	1710	3110
1799	3270.2	1754	3189.2	1709	3108.2
1798	3268.4	1753	3187.4	1708	3106.4
1797	3266.6	1752	3185.6	1707	3104.6
1796	3264.8	1751	3183.8	1706	3102.8
1795	3263	1750	3182	1705	3101
1794	3261.2	1749	3180.2	1704	3099.2
1793	3259.4	1748	3178.4	1703	3097.4
1792	3257.6	1747	3176.6	1702	3095.6
1791	3255.8	1746	3174.8	1701	3093.8
1790	3254	1745	3173	1700	3092
1789	3252.2	1744	3171.2	1699	3090.2
1788	3250.4	1743	3169.4	1698	3088.4
1787	3248.6	1742	3167.6	1697	3086.6
1786	3246.8	1741	3165.8	1696	3084.8
1785	3245	1740	3164	1695	3083
1784	3243.2	1739	3162.2	1694	3081.2
1783	3241.4	1738	3160.4	1693	3079.4
1782	3239.6	1737	3158.6	1692	3077.6
1781	3237.8	1736	3156.8	1691	3075.8
1780	3236	1735	3155	1690	3074
1779	3234.2	1734	3153.2	1689	3072.2
1778	3232.4	1733	3151.4	1688	3070.4
1777	3230.6	1732	3149.6	1687	3068.6
1776	3228.8	1731	3147.8	1686	3066.8
1775	3227	1730	3146	1685	3065
1774	3225.2	1729	3144.2	1684	3063.2
1773	3223.4	1728	3142.4	1683	3061.4
1772	3221.6	1727	3140.6	1682	3059.6
1771	3219.8	1726	3138.8	1681	3057.8

COMPARISON OF CENTIGRADE AND FAHRENHEIT THERMOMETERS—CONTINUED

Centigrade	Fahrenheit	Centigrade	Fahrenheit	Centigrade	Fahrenheit
1680	3056	1635	2975	1590	2894
1679	3054.2	1634	2973.2	1589	2892.2
1678	3052.4	1633	2971.4	1588	2890.4
1677	3050.6	1632	2969.6	1587	2888.6
1676	3048.8	1631	2967.8	1586	2886.8
1675	3047	1630	2966	1585	2885
1674	3045.2	1629	2964.2	1584	2883.2
1673	3043.4	1628	2962.4	1583	2881.4
1672	3041.6	1627	2960.6	1582	2879.6
1671	3039.8	1626	2958.8	1581	2877.8
1670	3038	1625	2957	1580	2876
1669	3036.2	1624	2955.2	1579	2874.2
1668	3034.4	1623	2953.4	1578	2872.4
1667	3032.6	1622	2951.6	1577	2870.6
1666	3030.8	1621	2949.8	1576	2868.8
1665	3029	1620	2948	1575	2867
1664	3027.2	1619	2946.2	1574	2865.2
1663	3025.4	1618	2944.4	1573	2863.4
1662	3023.6	1617	2942.6	1572	2861.6
1661	3021.8	1616	2940.8	1571	2859.8
1660	3020	1615	2939	1570	2858
1659	3018.2	1614	2937.2	1569	2856.2
1658	3016.4	1613	2935.4	1568	2854.4
1657	3014.6	1612	2933.6	1567	2852.6
1656	3012.8	1611	2931.8	1566	2850.8
1655	3011	1610	2930	1565	2849
1654	3009.2	1609	2928.2	1564	2847.2
1653	3007.4	1608	2926.4	1563	2845.4
1652	3005.6	1607	2924.6	1562	2843.6
1651	3003.8	1606	2922.8	1561	2841.8
1650	3002	1605	2921	1560	2840
1649	3000.2	1604	2919.2	1559	2838.2
1648	2998.4	1603	2917.4	1558	2836.4
1647	2996.6	1602	2915.6	1557	2834.6
1646	2994.8	1601	2913.8	1556	2832.8
1645	2993	1600	2912	1555	2831
1644	2991.2	1599	2910.2	1554	2829.2
1643	2989.4	1598	2908.4	1553	2827.4
1642	2987.6	1597	2906.6	1552	2825.6
1641	2985.8	1596	2904.8	1551	2823.8
1640	2984	1595	2903	1550	2822
1639	2982.2	1594	2901.2	1549	2820.2
1638	2980.4	1593	2899.4	1548	2818.4
1637	2978.6	1592	2897.6	1547	2816.6
1636	2976.8	1591	2895.8	1546	2814.8

COMPARISON OF CENTIGRADE AND FAHRENHEIT THERMOMETERS—CONTINUED

Centigrade	Fahrenheit	Centigrade	Fahrenheit	Centigrade	Fahrenheit
1545	2813	1500	2732	1455	2651
1544	2811.2	1499	2730.2	1454	2649.2
1543	2809.4	1498	2728.4	1453	2647.4
1542	2807.6	1497	2726.6	1452	2645.6
1541	2805.8	1496	2724.8	1451	2643.8
1540	2804	1495	2723	1450	2642
1539	2802.2	1494	2721.2	1449	2640.2
1538	2800.4	1493	2719.4	1448	2638.4
1537	2798.6	1492	2717.6	1447	2636.6
1536	2796.8	1491	2715.8	1446	2634.8
1535	2795	1490	2714	1445	2633
1534	2793.2	1489	2712.2	1444	2631.2
1533	2791.4	1488	2710.4	1443	2629.4
1532	2789.6	1487	2708.6	1442	2627.6
1531	2787.8	1486	2706.8	1441	2625.8
1530	2785	1485	2705	1440	2624
1529	2784.2	1484	2703.2	1439	2622.2
1528	2782.4	1483	2701.4	1438	2620.4
1527	2780.6	1482	2699.6	1437	2618.6
1526	2778.8	1481	2697.8	1436	2616.8
1525	2777	1480	2696	1435	2615
1524	2775.2	1479	2694.2	1434	2613.2
1523	2773.4	1478	2692.4	1433	2611.4
1522	2771.6	1477	2690.6	1432	2609.6
1521	2769.8	1476	2688.8	1431	2607.8
1520	2768	1475	2687	1430	2606
1519	2766.2	1474	2685.2	1429	2604.2
1518	2764.4	1473	2683.4	1428	2602.4
1517	2762.6	1472	2681.6	1427	2600.6
1516	2760.8	1471	2679.8	1426	2598.8
1515	2759	1470	2678	1425	2597
1514	2757.2	1469	2676.2	1424	2595.2
1513	2755.4	1468	2674.4	1423	2593.4
1512	2753.6	1467	2672.6	1422	2591.6
1511	2751.8	1466	2670.8	1421	2589.8
1510	2750	1465	2669	1420	2588
1509	2748.2	1464	2667.2	1419	2586.2
1508	2746.4	1463	2665.4	1418	2584.4
1507	2744.6	1462	2663.6	1417	2582.6
1506	2742.8	1461	2661.8	1416	2580.8
1505	2741	1460	2660	1415	2579
1504	2739.2	1459	2658.2	1414	2577.2
1503	2737.4	1458	2656.4	1413	2575.4
1502	2735.6	1457	2654.6	1412	2573.6
1501	2733.8	1456	2652.8	1411	2571.8

COMPARISON OF CENTIGRADE AND FAHRENHEIT THERMOMETERS—CONTINUED

Centigrade	Fahrenheit	Centigrade	Fahrenheit	Centigrade	Fahrenheit
1410	2570	1320	2408	870	1598
1409	2568.2	1310	2390	860	1580
1408	2566.4	1300	2372	850	1562
1407	2564.6	1290	2354	840	1544
1406	2562.8	1280	2336	830	1526
1405	2561	1270	2318	820	1508
1404	2559.2	1260	2300	810	1490
1403	2557.4	1250	2282	800	1472
1402	2555.6	1240	2264	790	1454
1401	2553.8	1230	2246	780	1436
1400	2552	1220	2228	770	1418
1399	2550.2	1210	2210	760	1400
1398	2548.4	1200	2192	750	1382
1397	2546.6	1190	2174	740	1364
1396	2544.8	1180	2156	730	1346
1395	2543	1170	2138	720	1328
1394	2541.2	1160	2120	710	1310
1393	2539.4	1150	2102	700	1292
1392	2537.6	1140	2084	690	1274
1391	2535.8	1130	2066	680	1256
1390	2534	1120	2048	670	1238
1389	2532.2	1110	2030	660	1220
1388	2530.4	1100	2012	650	1202
1387	2528.6	1090	1994	640	1184
1386	2526.8	1080	1976	630	1166
1385	2525	1070	1958	620	1148
1384	2523.2	1060	1940	610	1130
1383	2521.4	1050	1922	600	1112
1382	2519.6	1040	1904	590	1094
1381	2517.8	1030	1886	580	1076
1380	2516	1020	1868	570	1058
1379	2514.2	1010	1850	560	1040
1378	2512.4	1000	1832	550	1022
1377	2510.6	990	1814	540	1004
1376	2508.8	980	1796	530	986
1375	2507	970	1778	520	968
1374	2505.2	960	1760	510	950
1373	2503.4	950	1742	500	932
1372	2501.6	940	1724	490	914
1371	2499.8	930	1706	480	896
1370	2498	920	1688	470	878
1360	2480	910	1670	460	860
1350	2462	900	1652	450	842
1340	2444	890	1634	440	824
1330	2426	880	1616	430	806

COMPARISON OF CENTIGRADE AND FAHRENHEIT THERMOMETERS—CONTINUED

Centigrade	Fahrenheit	Centigrade	Fahrenheit	Centigrade	Fahrenheit
420	788	220	428	20	68
410	770	210	410	10	50
400	752	200	392	0	32
390	734	190	374	1	30.2
380	716	180	356	2	28.4
370	698	170	338	3	26.6
360	680	160	320	4	24.8
350	662	150	302	5	23
340	644	140	284	6	21.2
330	626	130	266	7	19.4
320	608	120	248	8	17.6
310	590	110	230	9	15.8
300	572	100	212	10	14
290	554	90	194	11	12.2
280	536	80	176	12	10.4
270	518	70	158	13	8.6
260	500	60	140	14	6.8
250	482	50	122	15	5
240	464	40	104	16	3.2
230	446	30	86	17	1.4
				18	0.4

Zero in Centigrade is the freezing point of water.

1 degree Centigrade equals $1\frac{4}{5}$ degrees Fahrenheit.

To change degrees Centigrade to Fahrenheit, multiply by 9, divide by 5 and add 32.

To change degrees Fahrenheit to Centigrade, subtract 32, divide by 9 and multiply by 5.

CIRCUMFERENCES AND AREAS OF CIRCLES

FROM 1-64 TO 50

Diam.	Circum.	Area	Diam.	Circum.	Area
1/64	.04909	.000192	4	12.5664	12.5664
1/32	.09818	.000767	4 1/8	12.9591	13.3641
1/16	.19635	.003068	4 1/4	13.3518	14.1863
1/8	.3927	.012272	4 3/8	13.7445	15.033
3/16	.589	.027612	4 1/2	14.1372	15.9043
1/4	.7854	.049087	4 5/8	14.5299	16.8002
5/16	.98175	.076699	4 3/4	14.9226	17.7206
3/8	1.1781	.110447	4 7/8	15.3153	18.6555
7/16	1.37445	.15033			
1/2	1.5708	.19635	5	15.708	19.635
9/16	1.76715	.248505	5 1/8	16.1007	20.629
5/8	1.9635	.306796	5 1/4	16.4934	21.6476
11/16	2.15985	.371224	5 3/8	16.8861	22.6907
3/4	2.3562	.441787	5 1/2	17.2788	23.7583
13/16	2.55255	.518487	5 5/8	17.6715	24.8505
7/8	2.7489	.601322	5 3/4	18.0642	25.9673
15/16	2.94525	.690292	5 7/8	18.4569	27.1086
1	3.1416	.7854	6	18.8496	28.2744
1 1/8	3.5343	.99402	6 1/8	19.2423	29.4648
1 1/4	3.927	1.2272	6 1/4	19.635	30.6797
1 3/8	4.3197	1.4849	6 3/8	20.0277	31.9191
1 1/2	4.7124	1.7671	6 1/2	20.4204	33.1831
1 5/8	5.1051	2.0739	6 5/8	20.8131	34.4717
1 3/4	5.4978	2.4053	6 3/4	21.2058	35.7848
1 7/8	5.8905	2.7612	6 7/8	21.5985	37.1224
2	6.2832	3.1416	7	21.9912	38.4846
2 1/8	6.6759	3.5466	7 1/8	22.3839	39.8713
2 1/4	7.0686	3.9761	7 1/4	22.7766	41.2826
2 3/8	7.4613	4.4301	7 3/8	23.1693	42.7184
2 1/2	7.854	4.9087	7 1/2	23.562	44.1787
2 5/8	8.2467	5.4119	7 5/8	23.9547	45.6636
2 3/4	8.6394	5.9396	7 3/4	24.3474	47.1731
2 7/8	9.0321	6.4918	7 7/8	24.7401	48.7071
3	9.4248	7.0686	8	25.1328	50.2656
3 1/8	9.8175	7.6699	8 1/8	25.5255	51.8487
3 1/4	10.2102	8.2958	8 1/4	25.9182	53.4563
3 3/8	10.6029	8.9462	8 3/8	26.3109	55.0884
3 1/2	10.9956	9.6211	8 1/2	26.7036	56.7451
3 5/8	11.3883	10.3206	8 5/8	27.0963	58.4264
3 3/4	11.781	11.0447	8 3/4	27.489	60.1322
3 7/8	12.1737	11.7933	8 7/8	27.8817	61.8625

CIRCUMFERENCES AND AREAS OF CIRCLES CONTINUED

Diam.	Circum.	Area	Diam.	Circum.	Area
9	28.2744	63.6174	15	47.124	176.715
9⅛	28.6671	65.3968	15⅛	47.5167	179.673
9¼	29.0598	67.2008	15¼	47.9094	182.655
9⅜	29.4525	69.0293	15⅜	48.3021	185.661
9½	29.8452	70.8823	15½	48.6948	188.692
9⅝	30.2379	72.7599	15⅝	49.0875	191.748
9¾	30.6306	74.6621	15¾	49.4802	194.828
9⅞	31.0233	76.5888	15⅞	49.8729	197.933
10	31.416	78.54	16	50.2656	201.062
10⅛	31.8087	80.5158	16⅛	50.6583	204.216
10¼	32.2014	82.5161	16¼	51.051	207.395
10⅜	32.5941	84.5409	16⅜	51.4437	210.598
10½	32.9868	86.5903	16½	51.8364	213.825
10⅝	33.3795	88.6643	16⅝	52.2291	217.077
10¾	33.7722	90.7628	16¾	52.6218	220.354
10⅞	34.1649	92.8858	16⅞	53.0145	223.655
11	34.5576	95.0334	17	53.4072	226.981
11⅛	34.9503	97.2055	17⅛	53.7999	230.331
11¼	35.343	99.4022	17¼	54.1926	233.906
11⅜	35.7357	101.6234	17⅜	54.5853	237.105
11½	36.1284	103.8691	17½	54.978	240.529
11⅝	36.5211	106.1394	17⅝	55.3707	243.977
11¾	36.9138	108.4343	17¾	55.7634	247.45
11⅞	37.3065	110.7537	17⅞	56.1561	250.948
12	37.6992	113.098	18	56.5488	254.47
12⅛	38.0919	115.466	18⅛	56.9415	258.016
12¼	38.4846	117.859	18¼	57.3342	261.587
12⅜	38.8773	120.277	18⅜	57.7269	265.183
12½	39.27	122.719	18½	58.1196	268.803
12⅝	39.6627	125.185	18⅝	58.5123	272.448
12¾	40.0554	127.677	18¾	58.905	276.117
12⅞	40.4481	130.192	18⅞	59.2977	279.811
13	40.8408	132.733	19	59.6904	283.529
13⅛	41.2335	135.297	19⅛	60.0831	287.272
13¼	41.6262	137.887	19¼	60.4758	291.04
13⅜	42.0189	140.501	19⅜	60.8685	294.832
13½	42.4116	143.139	19½	61.2612	298.648
13⅝	42.8043	145.802	19⅝	61.6539	302.489
13¾	43.197	148.49	19¾	62.0466	306.355
13⅞	43.5897	151.202	19⅞	62.4393	310.245
14	43.9824	153.938	20	62.832	314.16
14⅛	44.3751	156.7	20⅛	63.2247	318.099
14¼	44.7678	159.485	20¼	63.6174	322.063
14⅜	45.1605	162.296	20⅜	64.0101	326.051
14½	45.5532	165.13	20½	64.4028	330.064
14⅝	45.9459	167.99	20⅝	64.7955	334.102
14¾	46.3386	170.874	20¾	65.1882	338.164
14⅞	46.7313	173.782	20⅞	65.5809	342.25

CIRCUMFERENCES AND AREAS OF CIRCLES CONTINUED

Diam.	Circum.	Area	Diam.	Circum.	Area
21	65.9736	346.361	27	84.8232	572.557
21 1/8	66.3663	350.497	27 1/8	85.2159	577.87
21 1/4	66.759	354.657	27 1/4	85.6086	583.209
21 3/8	67.1517	358.842	27 3/8	86.0013	588.571
21 1/2	67.5444	363.051	27 1/2	86.394	593.959
21 5/8	67.9379	367.285	27 5/8	86.7867	599.371
21 3/4	68.3298	371.543	27 3/4	87.1794	604.807
21 7/8	68.7225	375.826	27 7/8	87.5729	610.268
22	69.1152	380.134	28	87.9648	615.754
22 1/8	69.5079	384.466	28 1/8	88.3575	621.264
22 1/4	69.9006	388.822	28 1/4	88.7502	626.798
22 3/8	70.2933	393.203	28 3/8	89.1429	632.357
22 1/2	70.686	397.609	28 1/2	89.5356	637.941
22 5/8	71.0787	402.038	28 5/8	89.9283	643.549
22 3/4	71.4714	406.494	28 3/4	90.321	649.182
22 7/8	71.8641	410.973	28 7/8	90.7137	654.84
23	72.2568	415.477	29	91.1064	660.521
23 1/8	72.6495	420.004	29 1/8	91.4991	666.228
23 1/4	73.0422	424.558	29 1/4	91.8918	671.959
23 3/8	73.4349	429.135	29 3/8	92.2845	677.714
23 1/2	73.8276	433.737	29 1/2	92.6772	683.494
23 5/8	74.2203	438.364	29 5/8	93.0699	689.299
23 3/4	74.613	443.015	29 3/4	93.4626	695.128
23 7/8	75.0057	447.69	29 7/8	93.8553	700.982
24	75.3984	452.39	30	94.248	706.86
24 1/8	75.7911	457.115	30 1/8	94.6407	712.763
24 1/4	76.1838	461.864	30 1/4	95.0334	718.69
24 3/8	76.5765	466.638	30 3/8	95.4261	724.642
24 1/2	76.9692	471.436	30 1/2	95.8188	730.618
24 5/8	77.3619	476.259	30 5/8	96.2115	736.619
24 3/4	77.7546	481.107	30 3/4	96.6042	742.645
24 7/8	78.1473	485.979	30 7/8	96.9969	748.695
25	78.54	490.875	31	97.3896	754.769
25 1/8	78.9327	495.796	31 1/8	97.7823	760.869
25 1/4	79.9254	500.742	31 1/4	98.175	766.992
25 3/8	79.7181	505.712	31 3/8	98.5677	773.14
25 1/2	80.1108	510.706	31 1/2	98.9604	779.313
25 5/8	80.5035	515.726	31 5/8	99.3531	785.51
25 3/4	80.8962	520.769	31 3/4	99.7458	791.732
25 7/8	81.4889	525.838	31 7/8	100.1385	797.979
26	81.6816	530.93	32	100.5312	804.25
26 1/8	82.0743	536.048	32 1/8	100.9239	810.545
26 1/4	82.476	541.19	32 1/4	101.3166	816.865
26 3/8	82.8597	546.356	32 3/8	101.7093	823.21
26 1/2	83.2524	551.547	32 1/2	102.102	829.579
26 5/8	83.6451	556.763	32 5/8	102.4947	835.972
26 3/4	84.0378	562.003	32 3/4	102.8874	842.391
26 7/8	84.4305	567.267	32 7/8	103.2801	848.833

CIRCUMFERENCES AND AREAS OF CIRCLES CONTINUED

Diam.	Circum.	Area	Diam.	Circum.	Area
33	103.673	855.301	39	122.522	1194.593
33 1/8	104.065	861.792	39 1/8	122.915	1202.263
33 1/4	104.458	868.309	39 1/4	123.308	1209.958
33 3/8	104.851	874.85	39 3/8	123.7	1217.677
33 1/2	105.344	881.415	39 1/2	124.093	1225.42
33 5/8	105.636	888.005	39 5/8	124.486	1233.188
33 3/4	106.029	894.62	39 3/4	124.879	1240.981
33 7/8	106.422	901.259	39 7/8	125.271	1248.798
34	106.814	907.922	40	125.664	1256.64
34 1/8	107.207	914.611	40 1/8	126.057	1264.51
34 1/4	107.6	921.323	40 1/4	126.449	1272.4
34 3/8	107.992	928.061	40 3/8	126.842	1280.31
34 1/2	108.385	934.822	40 1/2	127.235	1288.25
34 5/8	108.778	941.609	40 5/8	127.627	1296.22
34 3/4	109.171	948.42	40 3/4	128.02	1304.21
34 7/8	109.563	955.255	40 7/8	128.413	1312.22
35	109.956	962.115	41	128.806	1320.26
35 1/8	110.349	969.	41 1/8	129.198	1328.32
35 1/4	110.741	975.909	41 1/4	129.591	1336.41
35 3/8	111.134	982.842	41 3/8	129.984	1344.52
35 1/2	111.527	989.8	41 1/2	130.376	1352.66
35 5/8	111.919	996.783	41 5/8	130.769	1360.82
35 3/4	112.312	1003.79	41 3/4	131.162	1369.
35 7/8	112.705	1010.822	41 7/8	131.554	1377.21
36	113.098	1017.878	42	131.947	1385.45
36 1/8	113.49	1024.96	42 1/8	132.34	1393.7
36 1/4	113.883	1032.065	42 1/4	132.733	1401.99
36 3/8	114.276	1039.195	42 3/8	133.125	1410.3
36 1/2	114.668	1046.349	42 1/2	133.518	1418.63
36 5/8	115.061	1053.528	42 5/8	133.911	1426.99
36 3/4	115.454	1060.732	42 3/4	134.303	1435.37
36 7/8	115.846	1067.96	42 7/8	134.696	1443.77
37	116.239	1075.213	43	135.089	1452.2
37 1/8	116.632	1082.49	43 1/8	135.481	1460.66
37 1/4	117.025	1089.792	43 1/4	135.874	1469.14
37 3/8	117.417	1097.118	43 3/8	136.267	1477.64
37 1/2	117.81	1104.469	43 1/2	136.66	1486.17
37 5/8	118.203	1111.844	43 5/8	137.052	1494.73
37 3/4	118.595	1119.244	43 3/4	137.445	1503.3
37 7/8	118.988	1126.669	43 7/8	137.838	1511.91
38	119.381	1134.118	44	138.23	1520.53
38 1/8	119.773	1141.591	44 1/8	138.623	1529.19
38 1/4	120.166	1149.089	44 1/4	139.016	1537.86
38 3/8	120.559	1156.612	44 3/8	139.408	1546.56
38 1/2	120.952	1164.159	44 1/2	139.801	1555.29
38 5/8	121.344	1171.731	44 5/8	140.194	1564.04
38 3/4	121.737	1179.327	44 3/4	140.587	1572.81
38 7/8	122.13	1186.948	44 7/8	140.979	1581.61

CIRCUMFERENCES AND AREAS OF CIRCLES CONTINUED

Diam.	Circum.	Area	Diam.	Circum.	Area
45	141.372	1590.43	48	150.797	1809.56
45 1/8	141.765	1599.28	48 1/8	151.189	1819.
45 1/4	142.157	1608.16	48 1/4	151.582	1828.46
45 3/8	142.55	1617.05	48 3/8	151.975	1837.95
45 1/2	142.943	1625.97	48 1/2	152.368	1847.46
45 5/8	143.335	1634.92	48 5/8	152.76	1856.99
45 3/4	143.728	1643.89	48 3/4	153.153	1866.55
45 7/8	144.121	1652.89	48 7/8	153.546	1876.14
46	144.514	1661.91	49	153.938	1885.75
46 1/8	144.906	1670.95	49 1/8	154.331	1895.38
46 1/4	145.299	1680.02	49 1/4	154.724	1905.04
46 3/8	145.692	1689.11	49 3/8	155.116	1914.72
46 1/2	146.084	1698.23	49 1/2	155.509	1924.43
46 5/8	146.477	1707.37	49 5/8	155.902	1934.16
46 3/4	146.87	1716.54	49 3/4	156.295	1943.91
46 7/8	147.262	1725.73	49 7/8	156.687	1953.69
47	147.655	1734.95	50	157.08	1963.5
47 1/8	148.048	1744.19			
47 1/4	148.441	1753.45			
47 3/8	148.833	1762.74			
47 1/2	149.226	1772.06			
47 5/8	149.619	1781.4			
47 3/4	150.011	1790.76			
47 7/8	150.404	1800.15			

TABLE FOR CIRCLE BRICK

FOR LENGTH OF CHORD MULTIPLY SINE BY DIAMETER

No. to Circle	Sine of Half Angle	Diameter for 9" Chord	No. to Circle	Sine of Half Angle	Diameter for 9" Chord
5	.58779	15.311"	28	.11196	80.385"
6	.50000	18.000"	29	.10811	83.248"
7	.43386	20.740"	30	.10453	86.099"
8	.38268	23.518"	31	.10044	89.605"
9	.34202	26.314"	32	.09802	91.818"
10	.30902	29.124"	33	.09507	94.667"
11	.28173	31.945"	34	.09225	97.560"
12	.25882	34.773"	35	.08965	100.390"
13	.23932	37.606"	36	.08716	103.257"
14	.22251	40.447"	37	.08481	106.119"
15	.20791	43.287"	38	.08258	108.985"
16	.19509	46.132"	39	.08046	111.856"
17	.18428	48.833"	40	.07846	114.708"
18	.17365	51.828"	41	.07655	117.570"
19	.16459	54.681"	42	.07472	120.449"
20	.15643	57.533"	43	.07300	123.287"
21	.14904	60.386"	44	.07136	127.102"
22	.14230	63.246"	45	.06976	129.014"
23	.13617	66.094"	46	.06825	131.868"
24	.13053	68.949"	47	.06679	134.750"
25	.12534	71.805"	48	.06540	137.614"
26	.12054	74.664"	49	.06407	140.471"
27	.11609	77.526"	50	.06279	143.334"

WEIGHT OF VARIOUS MATERIALS

Material	Average Per Cu. Ft. Pounds
BRICK	
Common red	100
Fire clay	150
Silica	128
Chrome	175
Magnesia as brick or fused in furnace	160
GRAIN	
Magnesite as shipped	112
CEMENT	
Portland	78
Hydraulic	60
CORK	15
COAL AND COKE	
Anthracite	60
Bituminous	49
Charcoal	18.5
Coke	26.3
CONCRETE	
Cement, fine	137
Rubble, coarse	119
EARTH	
Loam, dry, loose	76
Loam, packed	95
Loam, soft, loose mud	108
Loam, dense mud	125
GLASS	
Common window	157
Plate	172
Flint	192
Floor or skylight	158
GRAIN	
Corn	45
Oats	24
Wheat	48
LIME	
Quick, loose lumps	53
Quick, fine	75
Stone, large rocks	168
Stone, irregular lumps	96
MASONRY	
Granite or limestone	165
Mortar, rubble	154
Dry	138
Sandstone, dressed	144
METALS	
Aluminum	166
Brass, cast	524
Bronze	534
Copper, cast	537
Copper, rolled or wire	555
Iron, cast	450
Iron, wrought	482

WEIGHT OF VARIOUS MATERIALS
CONTINUED

Material	Average Per Cu. Ft. Pounds
METALS—Continued	
Lead, cast	708
Lead, rolled	711
Steel, cast	490
Steel, rolled	495
Tin, cast	459
Zinc, cast	438
OILS	
Engine	55
Crude	48
Petroleum	55
Gasoline	43
ROCK	
Chalk	145
Granite	165
Gypsum	143
Sandstone	144
Pumice stone	57
Quartz	165
Salt, coarse	45
Salt, fine	49
Shales	162
Slate, American	175
SAND	
Dry and loose	100
Dry and packed	110
Wet and packed	130
Gravel packed	118
WATER	
Water as ice	58.7
Water at 32 degrees Fahrenheit	62.4
Water at 212 degrees Fahrenheit	59.6
WOODS, DRY	
Apple	48
Beech	43
Birch	45
Cedar, American	35
Chestnut	41
Ebony	76
Elm	35
Hemlock	25
Hickory	53
Ironwood	114
Mahogany	35 to 53
Maple	49
Oak, live	59
Oak, white	50
Pine, white	25
Pine, yellow northern	34
Pine, yellow southern	45
Spruce	25
Walnut	35

DECIMALS OF AN INCH FOR EACH 1-64TH

1-64	.015625	33-64	.515625
1-32	.03125	17-32	.53125
3-64	.046875	35-64	.546875
1-16	.0625	9-16	.5625
5-64	.078125	37-64	.578125
3-32	.09375	19-32	.59375
7-64	.109375	39-64	.609375
1-8	.125	5-8	.625
9-64	.140625	41-64	.640625
5-32	.15625	21-32	.65625
11-64	.171875	43-64	.671875
3-16	.1875	11-16	.6875
13-64	.203125	45-64	.703125
7-32	.21875	23-32	.71875
15-64	.234375	47-64	.734375
1-4	.250	3-4	.75
17-64	.265625	49-64	.765625
9-32	.28125	25-32	.78125
19-64	.296875	51-64	.796875
5-16	.3125	13-16	.8125
21-64	.328125	53-64	.828125
11-32	.34375	27-32	.84375
23-64	.359375	55-64	.859375
3-8	.375	7-8	.875
25-64	.390625	57-64	.890625
13-32	.40625	29-32	.90625
27-64	.421875	59-64	.921875
7-16	.4375	15-16	.9375
29-64	.453125	61-64	.953125
15-32	.46875	31-32	.96875
31-64	.484375	63-64	.984375
1-2	.500	1	.1

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