Jan. 25, 1966 A. J. MANN 3,230,914

CIRCULAR FURNACE ROOF AND COMPONENT REFRACTORY BRICKS

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Fig. 1.

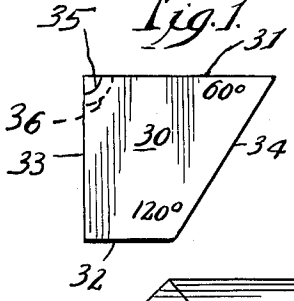


Fig. 2.

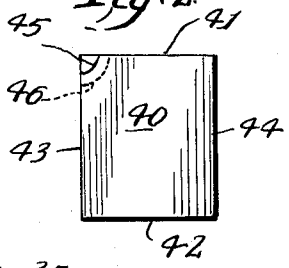


Fig. 3.

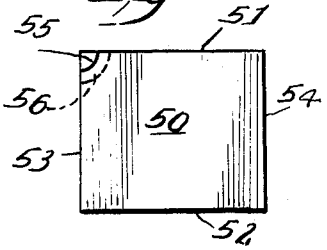


Fig. 4.

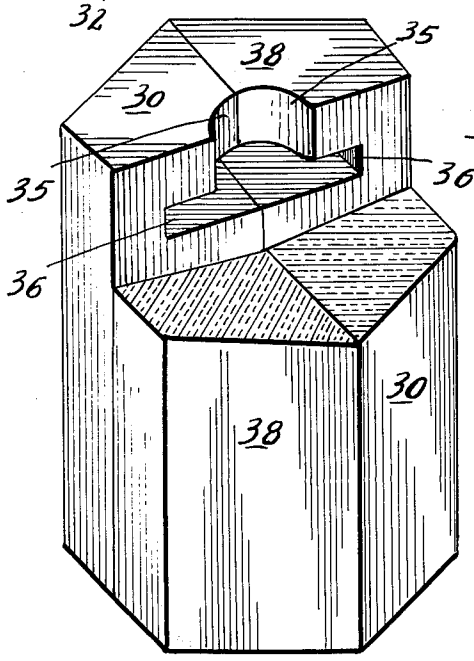


Fig. 5.

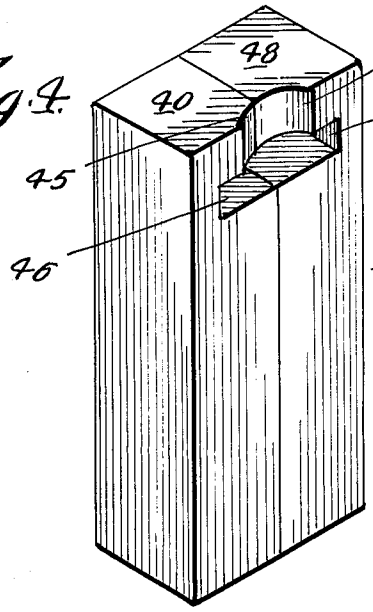


Fig. 6.

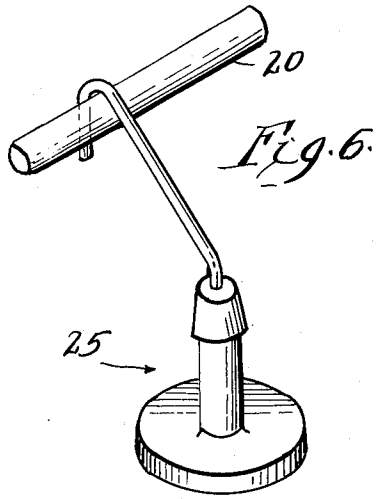
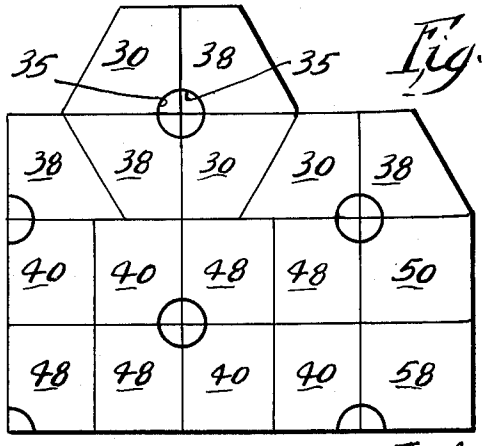


Fig. 7.



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CIRCULAR FURNACE ROOF AND COMPONENT REFRACTORY BRICKS

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Fig. 8

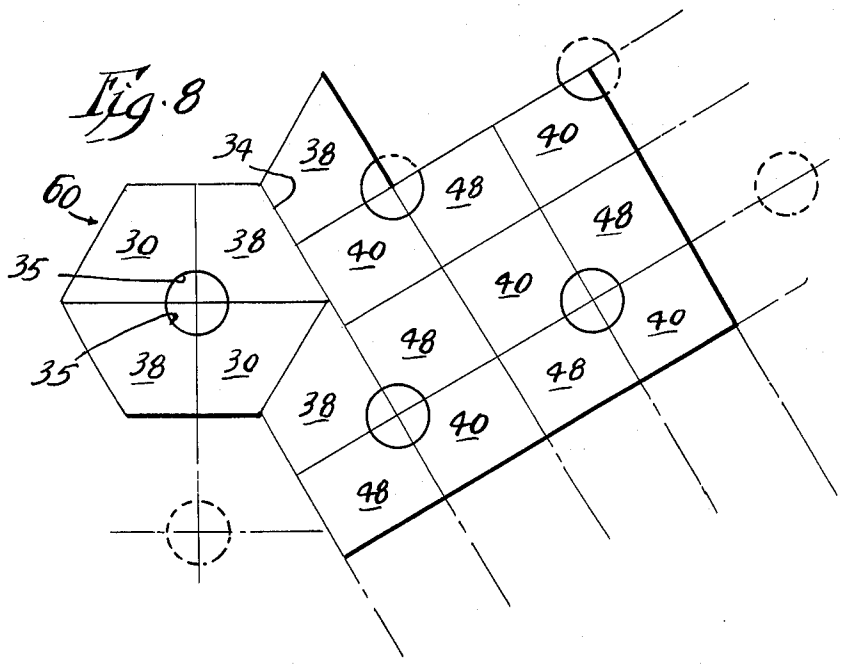
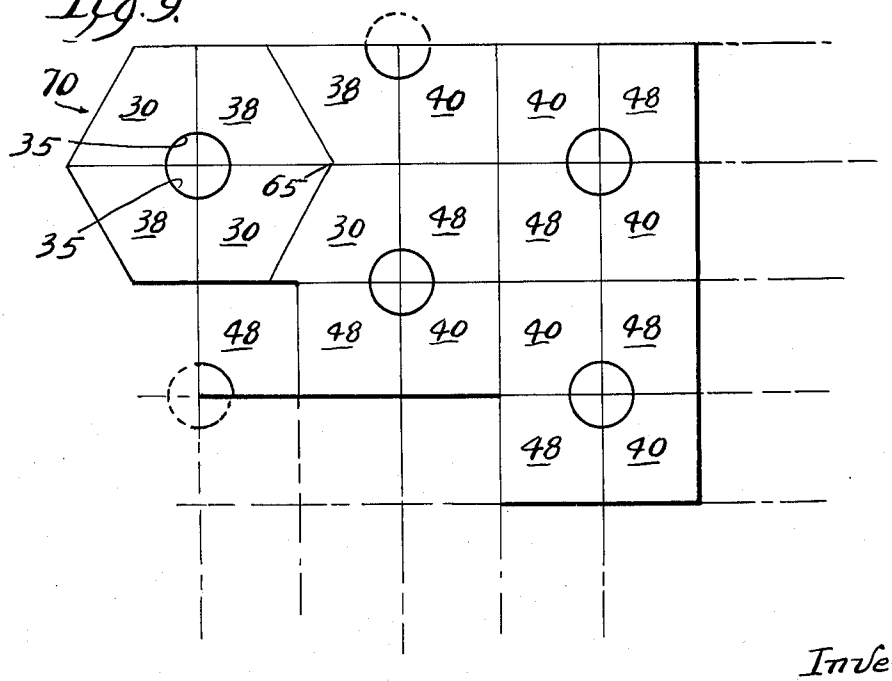


Fig. 9



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CIRCULAR FURNACE ROOF AND COMPONENT REFRACTORY BRICKS

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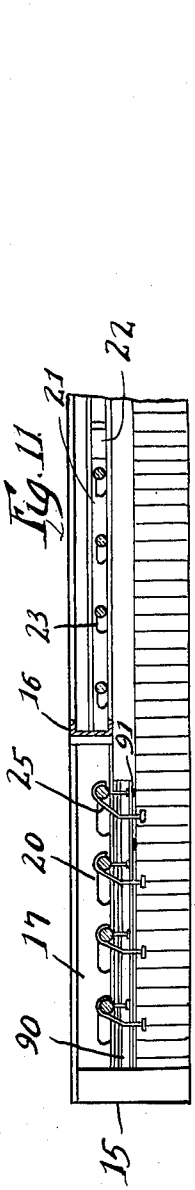

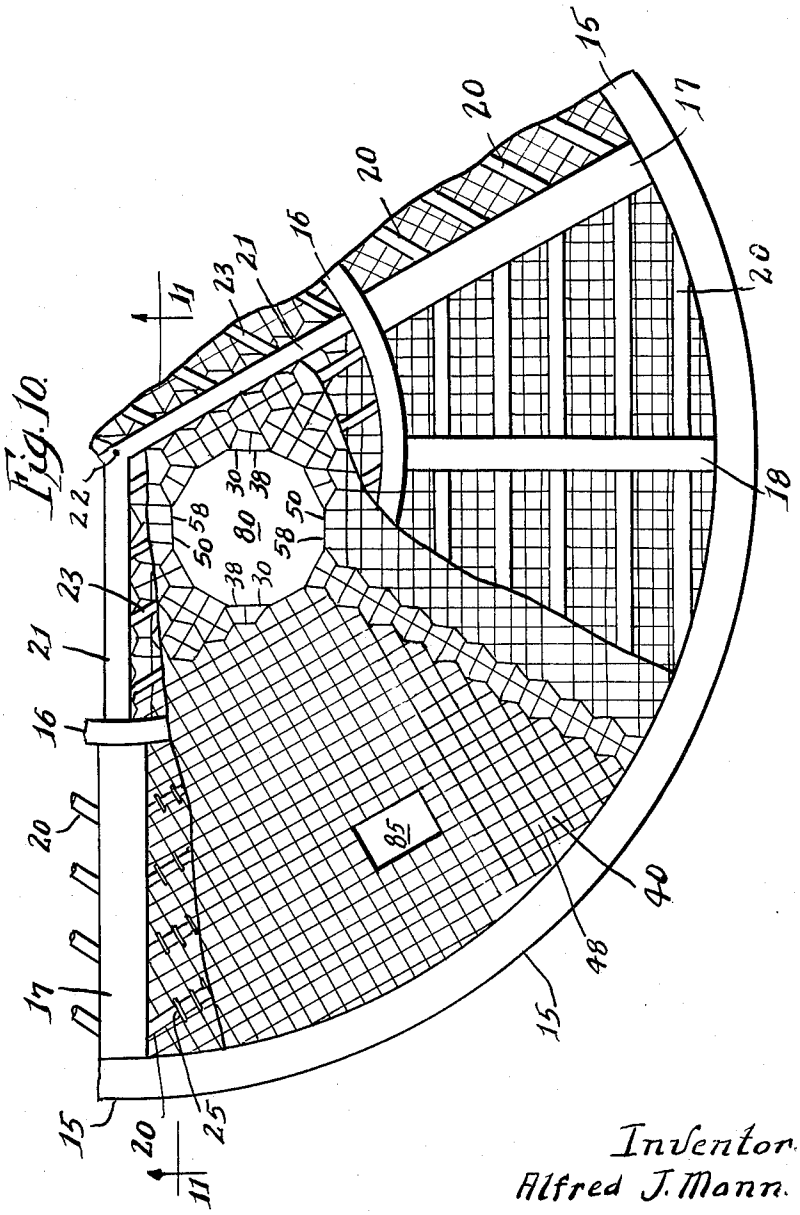

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3,230,914

CIRCULAR FURNACE ROOF AND COMPONENT REFRACTORY BRICKS

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3 Claims. (Cl. 110—99)

This invention relates to a circular furnace roof and component refractory bricks, and more particularly to a circular furnace roof using bricks of the individually suspended type.

One object of the invention is to provide a circular furnace roof wherein the framework that supports the bricks is highly efficient structually and economically, and closely correlated with the support requirements of the individual bricks.

Another object of the invention is to provide a circular furnace roof wherein the outer margin of the brick portion of the roof is substantially circular. Thus, little if any plastic refractory material is required between the brick portion and the circular frame that defines the periphery of the roof.

Another object is to provide brick shapes for use in a circular furnace roof that are of minimum variety and yet highly flexible in design capability. They permit the roof to have circular or rectangular openings, or both. The character of the roof and bricks is such that openings of desired shape and size may be located readily where necessary throughout the roof area.

Still another object is to provide a circular furnace roof of the suspended type that easily is installed, and wherein the component bricks are readily accessible for repair or replacement.

Another object is to provide a circular furnace roof wherein the bricks effectively may be held in desired position against the tendency of the bricks to raise up or buckle in response to forces generated by thermal expansion.

Other objects, advantages and details of the invention will be apparent as the description proceeds, reference being had to the accompanying drawings wherein various details of the invention are shown. It is to be understood that the description and drawings are illustrative only, and that the scope of the invention is to be measured by the appended claims.

In the drawings:

FIG. 1 is a plan view of one of the trapezoidal bricks used in the invention, the outline representing the shape of the brick in horizontal cross section.

FIG. 2 is a plan view of one of the small rectangular bricks used in the invention, the outline representing the shape of the brick in horizontal cross section.

FIG. 3 is a plan view of one of the large rectangular bricks used in the invention, the outline representing the shape of the brick in horizontal cross section.

FIG. 4 is an enlarged perspective view, partly broken away, showing four trapezoidal bricks arranged to form a hexagonal brick cluster.

FIG. 5 is a perspective view showing two small rectangular bricks arranged to form one-half of a rectangular brick cluster.

FIG. 6 is a perspective view of a hanger adapted adapted to suspend a cluster of four brick from a support member.

FIG. 7 is a plan view showing the relationship between the several brick shapes used in the invention and illustrating a random manner in which the bricks may be arranged.

FIG. 8 is a plan view of a fragmentary portion of a furnace roof illustrating the manner in which rows of small rectangular brick are arranged to extend away from a flat side of a hexagonal brick cluster.

FIG. 9 is a plan view illustrating the manner in which rows of small rectangular brick are arranged to extend away from the apex of a hexagonal brick cluster.

FIG. 10 is a plan view, partly broken away, of a segment of a circular furnace roof embodying the invention, the remaining portion of the roof, except for presence or absence of openings, being duplications of the portions shown.

FIG. 11 is a sectional view on line 11—11 of FIG. 10.

Referring first to FIGS. 10 and 11, a circular furnace roof constructed in accordance with the invention includes and outer circular frame 15 and an inner circular frame 16. Radial support members 17, such as I-beams, connect outer and inner frames 15 and 16 at intervals of sixty degrees, and in the form of the invention illustrated, optional intermediate radial support members 18 are located midway between members 17.

Referring to the region between outer and inner frames 15 and 16, spaced parallel secondary support members 20 extended between and are carried by adjacent radial support members 17, the secondary support members 20 extending below or through intermediate support members 18 when the latter are used. Secondary support members 20, when positioned between each adjacent pair of sixty-degree radial support members 17, define a plurality of concentric hexagons, as readily understood from FIG. 10.

Inner radial support members 21 radiate from a common junction 22 at the center of the roof and are attached at their outer ends to inner circular frame 16. Members 21, shown at intervals of one hundred twenty degrees, preferably are in alignment with radial support members 17. Spaced parallel inner secondary support members 23 extend between and are carried by each inner radial support member 21 and inner circular frame 16, the secondary support members 23 preferably being parallel with an adjacent radial support member 21, as shown.

In some instances it is possible to eliminate inner circular frame 16 and extend radial support members 17 to a common junction at the center of the roof. In such case secondary support members 20 are continued to the common junction which may be regarded as an inner circular frame.

The bricks next to be described are suspended by means of hangers 25 (FIG. 6) from secondary support members 20 or 20 and 23, as will be seen.

FIGS. 1–5 and 7–8 show the various refractory bricks used in the circular roof of the invention, and possible arrangements of same into brick parts and assemblies thereof.

One of the brick parts has hexagonal shape in horizontal cross section, the width of each side being "two units." For convenience, the relative dimensions or widths of the sides of each brick part will be referred to in terms of units, rather than finite dimensions. In practice, and by way of example, one unit may equal two inches.

While the hexagonal brick parts used in the invention may be unitary in character, it has been found desirable to form these brick parts by combining four component bricks that individually are trapezoidal in horizontal cross section into a brick cluster. A typical one of such component bricks is shown in FIG. 1.

Referring to FIG. 1, component trapezoidal brick 30, hereinafter sometimes referred to as a first brick, has parallel sides 31 and 32. These parallel sides have widths of two units and one unit, respectively. Third side 33, perpendicular to the parallel sides, is the square root of three units in width, whereby fourth side 34, like side 31,

is two units in width. The angle between sides **31** and **34** is sixty degrees, while the angle between sides **32** and **34** is one hundred twenty degrees.

The upper corner of brick **30** defined by the intersection of sides **31** and **33** has a quarter-circular recess **35** extending a short distance lengthwise of the brick. An enlarged quarter-circular recess **36** of limited length is formed in brick **30** immediately below recess **35**. The two recesses **35** and **36**, as will be seen, receive a portion of hanger **25** (FIG. 6) that supports a cluster of four brick from a secondary support member **20** or **23**.

Each hexagonal brick cluster, as best shown in FIGS. 4 and 7–9, includes two component trapezoidal first bricks **30** and two component trapezoidal second bricks **38**, the latter being shaped in mirror image of first bricks **30**.

The corresponding sides of second bricks **38** have the same widths as those of first bricks **30**, and the bricks have recesses **35** and **36** to receive portions of a hanger **25**.

FIG. 4 shows a hexagonal brick cluster comprising two component trapezoidal first bricks **30** and two component trapezoidal second bricks **38**, the recesses **35** and **36** thereof combining to form circular spaces in the cluster that receive and embrace the lower portion of a hanger **25** (FIG. 6). It will be noted that each flat side of the hexagonal brick cluster has a width of two units.

One of the small rectangular bricks **40** used in the invention is shown in FIG. 2. This brick sometimes is referred to herein as the third brick used in the invention. Sides **41** and **42** of third brick **40** have a width of one and one-half units, while sides **43** and **44** have a width of the square root of three units.

The upper corner defined by the intersection of sides **41** and **43** of small rectangular brick **40** has a quarter-circular recess **45** of limited length, below which there is an enlarged recess **46**, also of limited length. Recesses **45** and **46**, as in the case of recesses **35** and **36**, cooperate to receive a portion of hanger **25** to thereby suspend brick **40** from a secondary support member **20** or **23**.

Brick **40**, like brick **30**, often is used as one of a rectangular cluster of four generally similar bricks supported by a single hanger **25**. As best shown in FIGS. 5 and 7–9, each cluster of four small rectangular bricks includes two bricks **40** and two bricks **48**, the latter being shaped in mirror image of bricks **40**. For convenience, brick **48** sometimes is referred to as the fourth brick used in the invention.

The rectangular clusters of rectangular bricks **40** and **48**, as will be seen, are adapted to align in rows that lead away from either a flat side or an apex of one of the hexagonal brick clusters. The rectangular brick clusters fill in the roof area between radial rows of hexagonal brick clusters, the latter being spaced angularly at sixty degrees beneath radial support members **17**.

A fifth or large rectangular brick **50** used in the invention is shown in FIG. 3. Sides **51** and **52** of brick **50** are two units in width, while sides **53** and **54** are the square root of three units in width. The upper corner of brick **50** defined by the intersection of sides **51** and **53** has a quarter-circular recess **55** of limited length, and immediately below an enlarged quarter-circular recess **56**, also of limited length. The two recesses **55** and **56** are adapted to receive portions of a hanger **25**.

Fifth brick **50** has a companion sixth brick **58** (lower right in FIG. 7) that is shaped in mirror image of brick **50**. As will be seen, bricks **50** and **58** are used in pairs, rather than clusters of four, but the two shapes are necessary to insure proper relationship between a brick **50** or **58** and a cooperating hanger **25**.

FIG. 7 illustrates in plan view one or more of each of the mentioned bricks **30**, **38**, **40**, **48**, **50** and **58**, and shows by way of example one arrangement combining the several bricks. This example is illustrative only, and does not represent an arrangement necessarily used in the roof assembly shown in FIG. 10.

FIGS. 8 and 9 further illustrate the flexibility of design afforded by the bricks of the invention.

Referring to FIG. 8, rows of small rectangular bricks **40** and **48** are shown leading away from a flat side **34** of a hexagonal brick cluster **60** made up of two first brick **30** and two second brick **38**. It will be noted that two second bricks **38** are used in transition between hexagonal cluster **60** and the rows of rectangular bricks **40** and **48**.

FIG. 9 shows rows of small rectangular brick **40** and **48** leading away from apex **65** of a hexagonal brick cluster **70**. It will be noted that one trapezoidal brick **30** and one trapezoidal brick **38** are used in transition between hexagonal brick cluster **70** and the rows of rectangular bricks **40** and **48**.

FIGS. 8 and 9 also illustrate the uniformity of spacing that exists between the circular recesses that receive hangers **25**. This space is uniform, regardless of whether the rows of rectangular brick extend away from the flat side or an apex of a hexagonal cluster. This characteristic cooperates to enable the use of the geometrically regular secondary supporting members **20** and **23** shown in FIG. 10.

Referring further to FIG. 10, it will be understood that the various brick shapes of the invention afford flexibility in utilizing the bricks in a circular roof. This flexibility permits latitude in the location, size and shape of roof openings.

Circular roofs often are used with electric furnaces, and one or more openings of predetermined location, size and shape normally are provided in such roofs to accommodate electrodes.

Referring to the central portion of the roof shown in FIG. 10, it will be noted that this region, as illustrated, consists mainly of hexagonal clusters. The omission of one such cluster provides a substantially circular opening of comparatively small size, and such opening may be positioned, within reasonable limits, at any desired location.

Still referring to FIG. 10, the illustrated central portion of the roof is provided with a substantially circular opening **80** of comparatively large size. Opening **80** is formed by omitting a number of hexagonal clusters and employing some of the large rectangular bricks **50** and **58**. As will be noted, bricks **50** and **58** are used in spaced pairs in association with intermediate pairs of trapezoidal bricks **30** and **38** to define a twelve-sided or dodecagonal opening which is sufficiently circular to accommodate a circular electrode properly. If a closer fit is required, an annular seal (not shown) may be provided between the circular electrode and the margin of the dodecagonal opening.

Rectangular openings, such as opening **85** in FIG. 10, of suitable size, shape and location also may be provided readily in portions of the roof formed of rectangular brick **40** and **48**. It merely is necessary to omit brick where an opening is desired.

It will be understood that the entire roof may be formed of hexagonal brick cluster, if desired, in which case comparatively large, substantially circular openings may be positioned in any desired location.

Any tendency of the bricks to raise up or buckle from forces due to thermal expansion may be resisted by members **90** (FIG. 11) disposed between radial support members **17** and **18** and the tops of the bricks. Wedges **91** or the like may be used to apply "down" pressure on the tops of the bricks.

From the above description it is thought that the construction and advantages of this invention will be readily apparent to those skilled in the art. Various changes in detail may be made without departing from the spirit or losing the advantages of the invention.

Having thus described the invention, what is claimed as new and desired to secure by Letters Patent is:

1. A circular furnace roof comprising:
an outer circular frame;
an inner circular fame;
radial support members connecting said outer and inner frames at intervals of sixty degrees;
secondary support members carried by said radial support members and arrange to define a plurality of concentric hexagons; and
refractory bricks suspended from said secondary support members, said refractory bricks including a radial row of hexagonal brick parts beneath each radial support member and rows of rectangular brick filling the space between said radial rows.

2. A circular furnace roof comprising:
an outer circular frame;
an inner circular frame;
radial support members connecting said outer and inner frames at intervals of sixty degrees;
secondary support members carried by said radial support members and arranged to define a plurality of concentric hexagons; and
refractory bricks suspended from said secondary support members, said refractory bricks including a radial row of hexagonal brick parts beneath each radial support member;
each hexagonal brick part a cluster of four bricks trapezoidal in horizontal cross section;

the parallel sides of each trapezoidal brick respectively one unit and two units in width, a third side the square root of three units in width and perpendicular to said parallel sides, whereby the fourth side has a width of two units;
two of said four trapezoidal bricks having the same shape, the other two shaped in mirror image of said first two; and
rows of rectangular brick filling the space between said radial rows.

3. The combination of claim 2 wherein the unequal sides of said rectangular bricks have widths of one and one-half units and the square root of three units.

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