Jan. 25, 1966 R. P. HEUER 3,230,682

BASIC REFRACTORY BRICK UNIT

Filed Oct. 14, 1960 4 Sheets-Sheet 1

Fig. 1.

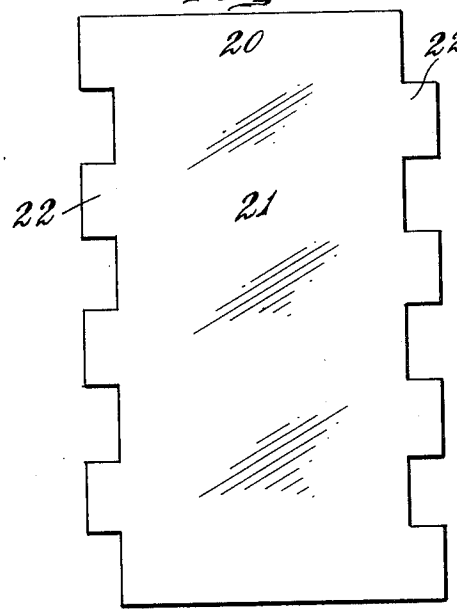


Fig. 4.

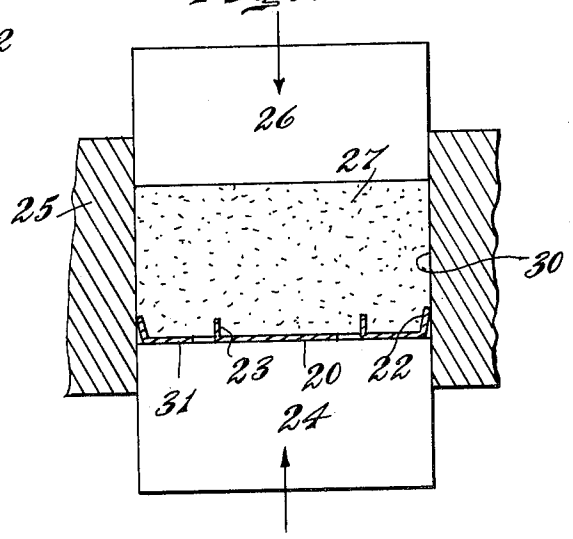


Fig. 2.

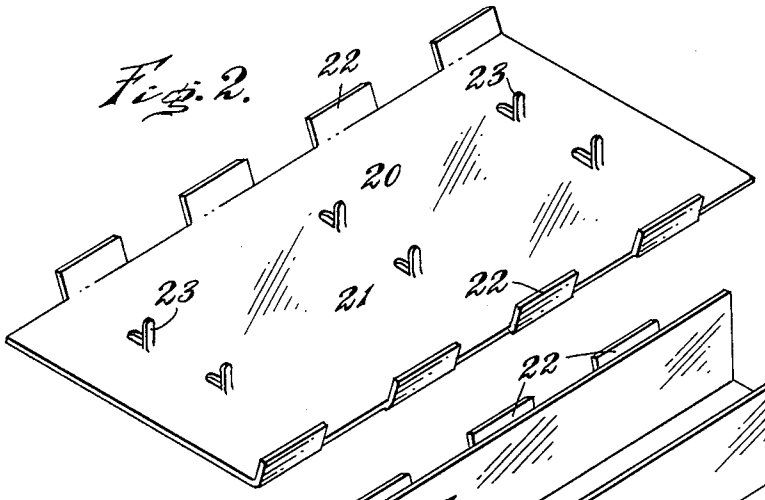
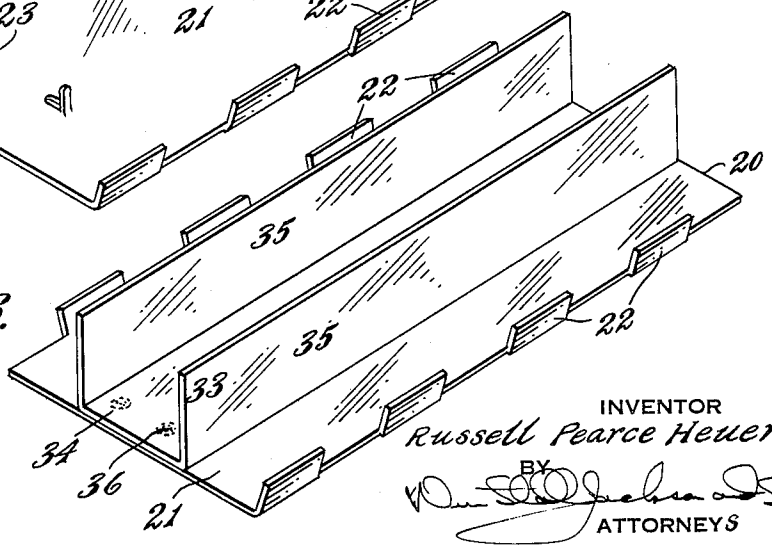


Fig. 3.



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Jan. 25, 1966 R. P. HEUER 3,230,682

BASIC REFRACTORY BRICK UNIT

Filed Oct. 14, 1960 4 Sheets-Sheet 2

Fig. 5.

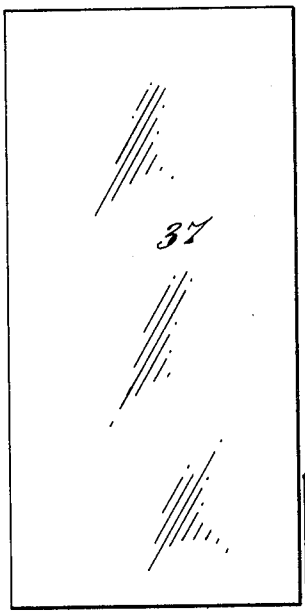


Fig. 7.

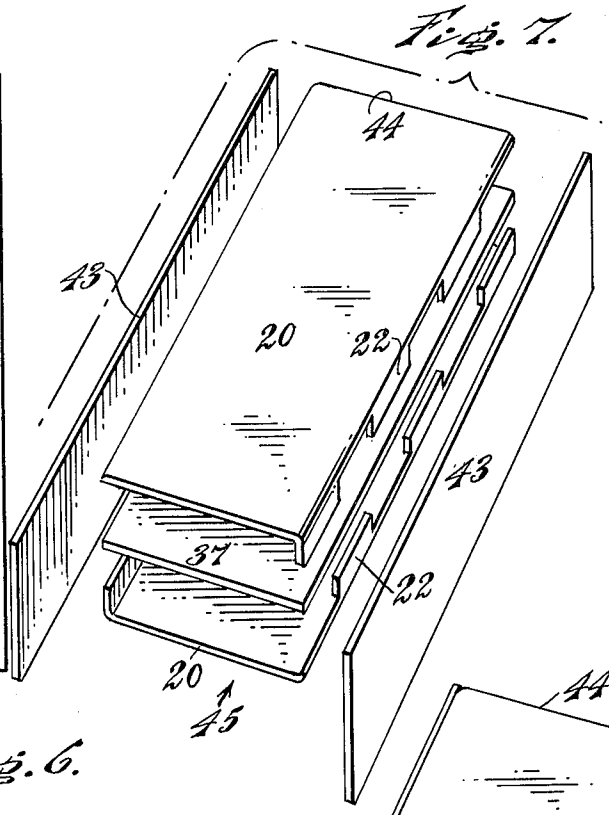


Fig. 6.

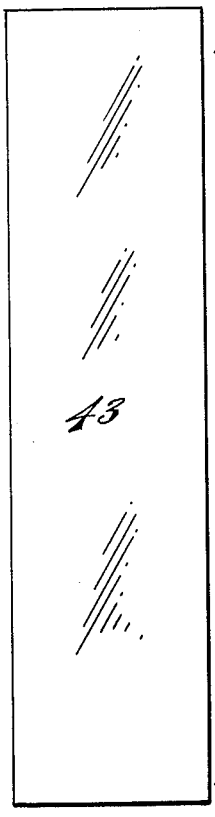


Fig. 8.

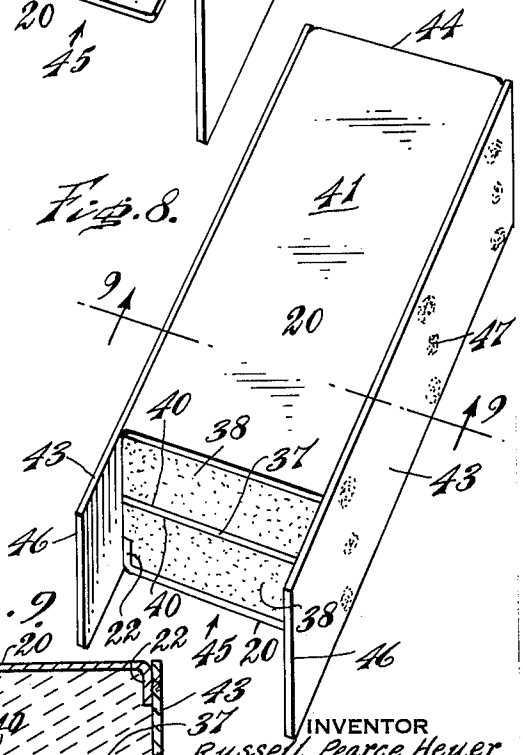
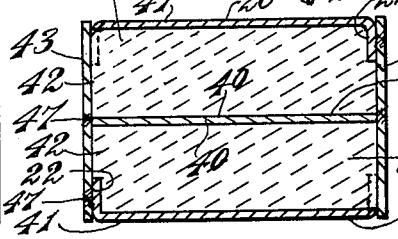


Fig. 9.



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BASIC REFRACTORY BRICK UNIT

Filed Oct. 14, 1960 4 Sheets-Sheet 3

Fig. 10.

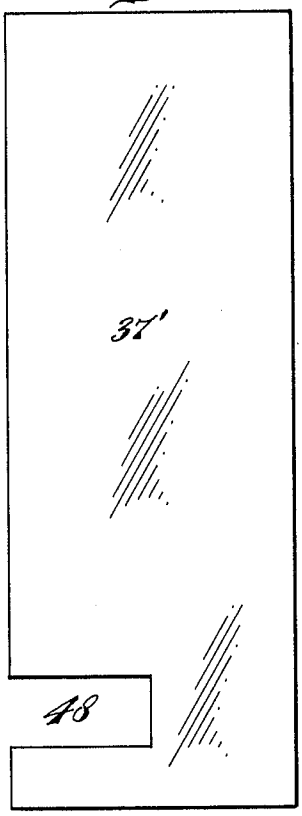


Fig. 12.

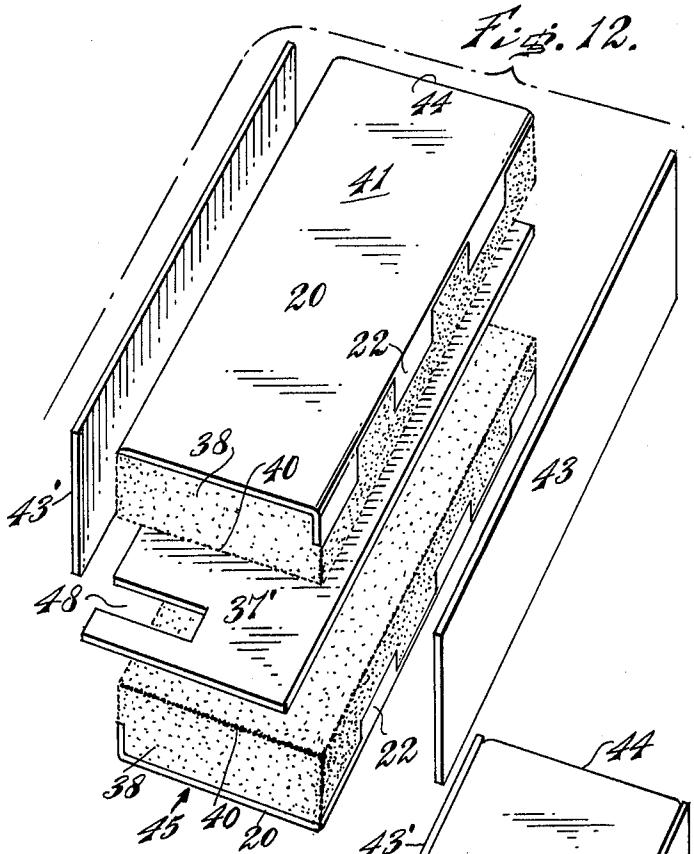


Fig. 11.

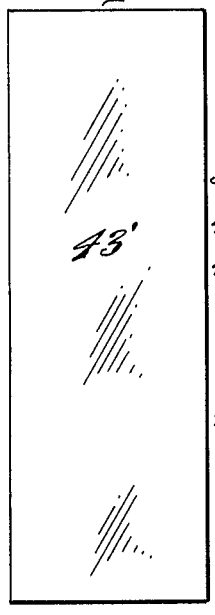


Fig. 13.

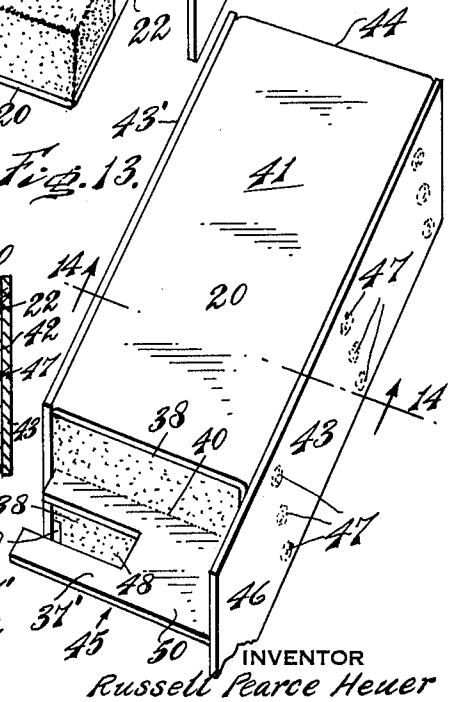


Fig. 14.

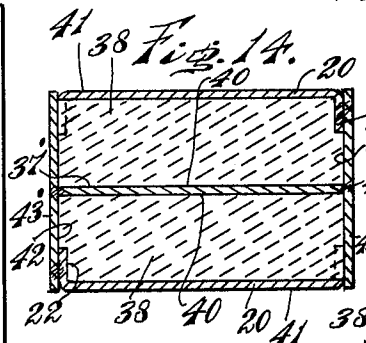
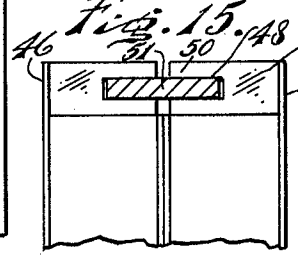


Fig. 15.



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BASIC REFRACTORY BRICK UNIT

Filed Oct. 14, 1960 4 Sheets-Sheet 4

Fig. 16.

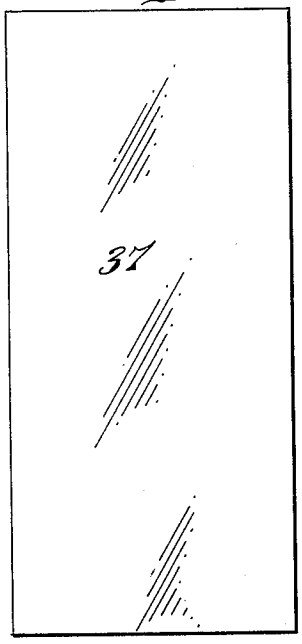


Fig. 17.

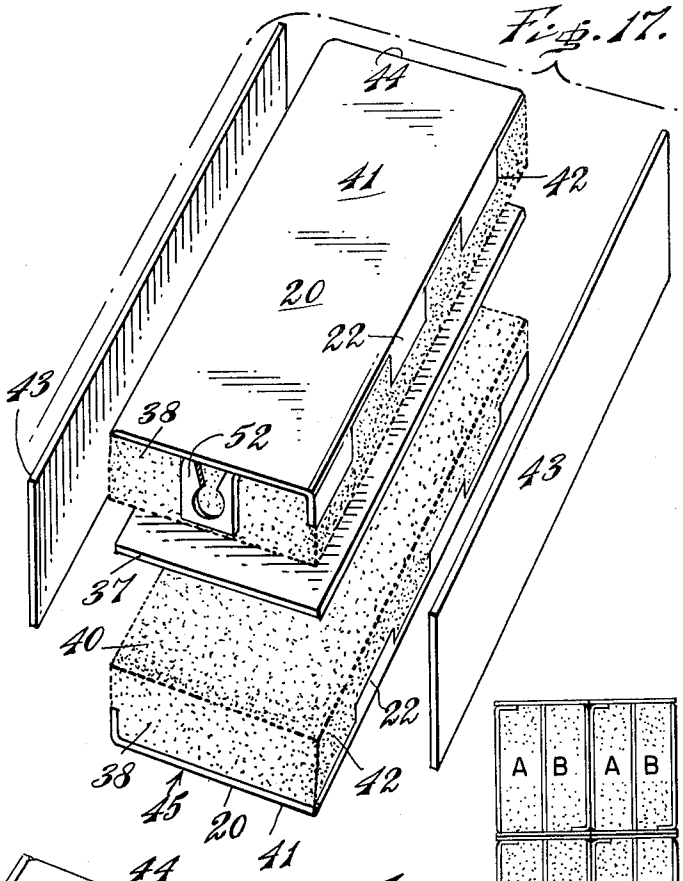


Fig. 18.

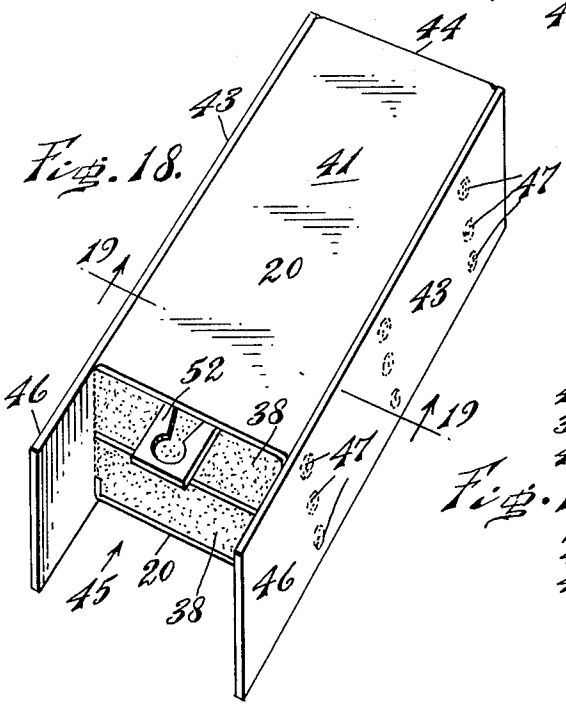


Fig. 20.

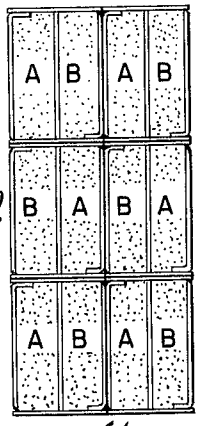
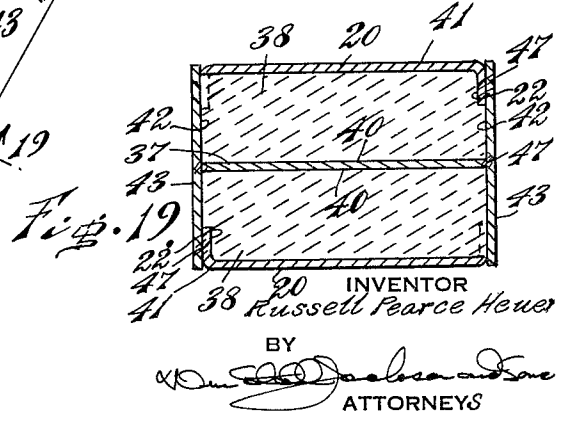


Fig. 19.



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United States Patent Office 3,230,682 Patented Jan. 25, 1966

3,230,682

BASIC REFRACTORY BRICK UNIT

Russell Pearce Heuer, Villanova, Pa., assignor to General Refractories Company, a corporation of Pennsylvania

Filed Oct. 14, 1960, Ser. No. 62,624
The portion of the term of the patent subsequent to Mar. 10, 1981, has been disclaimed
8 Claims. (Cl. 52—599)

The present invention relates to brick units for use in refractory brick construction, including furnace roofs, furnace walls, and linings of electric furnaces and rotary kilns.

A purpose of the invention is to reduce the likelihood of failure of refractory bricks by reducing the likelihood of hot spots in a refractory roof, wall or lining.

A further purpose is to minimize buckling or warpage in refractory bricks.

A further purpose is to faciliate patching of refractory structures.

A further purpose is to permit the handling of a plurality of bricks as an individual refractory brick unit.

A further purpose is to permit more effective cooling of refractory brick structure.

A further purpose is to aid in hanging, and anchoring of refractory bricks.

A further purpose is to reduce the likelihood that oxidizable metallic plates will melt out rather than oxidize when refractory bricks are placed in a furnace or kiln because of the presence of multiple thicknesses of such plates.

A further purpose is to make a basic refractory first brick which has a body made up of a plurality of basic refractory second bricks of different compositions, for example, one of chrome-magnesia and another of magnesia or magnesia-chrome, to surround the lateral faces of the first brick by an oxidizable metallic structure consisting of two or more oxidizable metallic plates connected together suitably by welding, and by said outside structure to unite said second bricks and hold them in place.

A further purpose is to make up said oxidizable metallic outside structure of one or more comolded oxidizable metallic plates on one or more of said second bricks and preferably on opposed lateral faces of second bricks, as well as of one or more oxidizable metallic plates which are united to the comolded plates as by welding, and which are preferably disposed on lateral faces adjacent to those mentioned above.

A further purpose is to provide one or more extensions of the outside structure beyond the cold end.

A further purpose is to provide an oxidizable metallic intermediate plate between said second bricks and preferably to extend the said intermediate plate beyond said second bricks at the cold end.

A further purpose is to join said intermediate plate with said connector plates as by welding.

A further purpose is to provide a hanger recess in said intermediate plate.

A further purpose is to provide internal oxidizable metallic plates in said second bricks.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate a few only of the numerous embodiments in which my invention may appear, selecting the forms shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

FIGURE 1 is a plan view of a blank from which a comolded oxidizable metallic plate is formed.

FIGURE 2 is a perspective of one form of comolded oxidizable metallic plate.

FIGURE 3 is a perspective of a variant form of comolded oxidizable metallic plate.

FIGURE 4 is a diagrammatic vertical section showing the comolding of refractory and the oxidizable metallic plate.

FIGURE 5 is a plan view of an internal oxidizable metallic plate for insertion in a brick unit.

FIGURE 6 is a plan view of a connector oxidizable metallic plate for use in producing a brick unit.

FIGURE 7 is an exploded perspective of the formation of a brick unit from two of the basic refractory bricks of FIGURE 4 (omitting the refractory) along with an intermediate oxidizable metallic plate of FIGURE 5 and two connector oxidizable metallic plates of FIGURE 6.

FIGURE 8 is a perspective of the completed brick of FIGURE 7.

FIGURE 9 is a transverse section on the line **9—9** of FIGURE 8 through a brick unit formed according to FIGURE 7.

FIGURE 10 is a plan view of an intermediate oxidizable metallic plate for forming a modified brick unit according to the invention.

FIGURE 11 is a plan view showing a modified connector oxidizable metallic plate.

FIGURE 12 is an exploded perspective showing the formation of a brick unit from two of the basic refractory bricks made according to FIGURE 4 with an intermediate oxidizable metallic plate of FIGURE 10 and two connector oxidizable metallic plates of FIGURE 11.

FIGURE 13 is a fragmentary perspective showing a completed brick unit formed according to FIGURE 12.

FIGURE 14 is a transverse section through the brick of FIGURE 13 on the line **14—14**.

FIGURE 15 is a section taken longitudinally of two brick units without sectioning the brick units themselves, showing the brick units of FIGURES 12 to 14 assembled on a support.

FIGURE 16 is a plan view of a modified intermediate oxidizable metallic plate according to the invention, suitably being that of FIGURE 5.

FIGURE 17 is an exploded perspective showing the assembly of a brick unit from an intermediate oxidizable metallic plate according to FIGURE 16, two connector plates of FIGURE 6 and two of the basic refractory brick of FIGURE 4, one of which has a hanger tab.

FIGURE 18 is a perspective of the completed refractory brick unit of FIGURE 17.

FIGURE 19 is a transverse section on the line **19—19** of FIGURE 18.

FIGURE 20 is a plan view of an assembly of brick units of the invention.

Describing in illustration but not in limitation and referring to the drawings:

Extensive use is being made in refractory roofs and other refractory installations of unburned basic refractory brick provided with oxidizable metallic plates on the outside, and in some cases also on the inside of the brick.

The oxidizable metallic plates are usually of steel, preferably plain carbon steel such as AISI 1010 or 1035, or suitably low alloy steel such as AISI 8630. The plates are normally in the range of thickness between 1/64 inch and 1/4 inch and are suitably affixed to the refractory of the brick. In furnace use the plates oxidize and react with the refractory, improving the behavior of the refractory roof as a whole.

One method of making such brick includes molding the brick and then affixing to the outside of the brick two opposed U-shaped plates each of which covers one of the two parallel major lateral faces and two parallel minor lateral faces. On the minor lateral faces the arms of the U's overlap and the plates are welded together and pre-

vented from slipping off the brick by punching holes in the brick and lancing tongues of metal from the oxidizable metallic plates which fit into such holes.

This procedure is cumbersome and produces a brick in which the plates are not always tightly held to the refractory. It is also subject to the serious disadvantage that on the minor lateral surfaces of each brick there are two layers or thicknesses of metal of the oxidizable metallic plates. When the refractory first heats up to furnace temperature, where these large areas of double thickness exist there may be a tendency of the metal to melt out before it can oxidize and react with the basic refractory.

One of the purposes of the present invention, therefore, is to minimize the use of double thicknesses and thus minimize the tendency of oxidizable metallic plates to melt out without oxidizing.

Difficulty has been encountered in many refractory structures through the tendency to form localized hot spots, because of inequality in the distribution of heat which enters the lining. These hot spots are a frequent cause of failure of individual bricks and may result in warpage and buckling of the refractory lining. The present invention contemplates that bricks will be assembled in brick units which may contain two or more basic refractory bricks, and that from each brick unit there will be extensions from oxidizable metallic plates at the cold end which will assist in dissipating heat, act as spacers, reduce the danger of failure of individual bricks and decrease the incidence of warpage and buckling. The extensions at the cold end may come from an oxidizable metallic plate assembly around the lateral faces of the bricks of the brick unit which for convenience is referred to herein as a wrapper, or they may come from an oxidizable metallic plate interposed between lateral faces of the bricks of the brick unit which are not at the outside, but are positioned at the interior of the brick unit.

Not only may the extensions of the oxidizable metallic plates at the cold end be used for cooling, but they may also perform supporting functions, acting as connectors to hangers in furnace walls.

It will of course be evident that the extensions at the cold end of the brick unit, when used for cooling, may be rendered more effective by circulating a cooling medium such as cooling air, and such air may flow immediately above the refractory of the roof in the case of a furnace roof, or immediately behind the wall in the case of a furnace wall, or may flow in the space between a rotary kiln lining and the shelf. In this case the extensions at the cool ends may also perform the function of spacers to hold the refractory bricks away from the shell or to maintain a passage through which a cooling medium is circulated adjoining the shell.

As in previous practice, the oxidizable metallic plates may be of plain carbon steel or of low alloy steel as previously described, but where the plates are to perform hanger or supporting functions particularly, and in other cases also where desired, a steel which is corrosion resisting at low temperature but which will oxidize at furnace temperature in an open hearth furnace or the like may be employed for the plates. Such a steel may be stainless steel of the chromium nickel type, for example that containing 18 percent of chromium and 8 percent of nickel, balance iron, or it may be a stainless steel of the straight chromium type, for example of the type containing 16 percent of chromium, balance iron.

One of the great advantages of the brick units of the invention is that they can be conveniently handled as a unit for installation in the first place and provide facility in patching without separately handling individual bricks.

In the illustrations I have shown the bricks as having straight parallel sides simply for convenience and economy in illustration, but it will be evident that the bricks may be wedge or key bricks as desired.

I illustrate in FIGURES 1 and 2 an oxidizable metallic first plate **20** which in FIGURE 1 is in the form of a

blank having a body portion **21** which is intended to extend along the major portion and suitably the entire extent of one first lateral face of the brick and having projecting portions or tabs **22** which are adapted to be bent up suitably to an angle somewhat greater than a right angle as shown in FIGURE 2.

There are also projections **23** lanced out from the body portion **21** of the U of the oxidizable metallic plate and capable of being imbedded into the refractory by comolding.

The plate **20** is placed in a mold as shown in FIGURE 4 resting on the bottom die **24** with the tabs or arms **22** of the U extending upward and the projections **23** extending upward. The base of the U is narrower than the mold and the upper ends of the tabs **22** spring-engage the side walls **25** of the mold. The mold has an upper die **26** which in molding moves relatively toward the lower die. A mass of basic refractory mixture **27** is placed in the mold of FIGURE 4.

The basic refractory mixture may be any suitable basic refractory such as chrome-magnesia or magnesia-chrome in the broadest aspects of the invention, many such refractory mixtures having been described in my prior patents.

In one aspect of the invention, however, the two bricks which are used in the brick uits being made will be of different compositions, one, for example, of chrome-magnesia and the other of magnesia-chrome, or magnesia free from chrome. In making brick units of this character, therefore, two different brick presses will be operated to produce bricks of the appearance of those shown in FIGURE 4 but of different composition, or the same brick press will be used at different times to produce the bricks having the different compositions. It has been found that a brick unit of bricks of different compositions gives a superior result and where chrome-magnesia brick and magnesia-chorme or magnesia brick are interspersed, there is particularly better resistance to spalling.

The upper and lower dies **26** and **24** move relatively together, applying a molding pressure which should exceed 3000 p.s.i. and preferably should exceed 10,000 p.s.i. or 15,000 p.s.i. The effect is to produce a brick of the character shown in the later drawings, which has a refractory body **27** and a comolded oxidizable metallic plate **20** extending over with the tabs **22** substantially flush on the outside a short distance only on second or minor lateral faces **30**, suitably along not more than ¼ of the minor lateral faces. The body **21** of the U covers the major portion and in the actual bricks substantially all of the major lateral face **31** of the brick. It will also be noted that the tabs **22** are separated in the preferred embodiment by refractory areas where no tabs are present at each one of the minor faces **30**.

While the angle of the tabs to the base of the U exceeds 90° in FIGURE 4 prior to molding, and the width of the base of the U is smaller than the intended corresponding side of the formed brick, after molding, the tabs **22** are formed at right angles to the body **21** of the U in the formed brick, as a result of the molding pressure. The projections **23** of course are firmly anchored in the interior of the brick by comolding.

In some cases it is desirable to use an internal plate comolded with the brick in accordance with my U.S. Patent 2,791,116. In FIGURE 3 I illustrate an internal oxidizable metallic plate **33** of U-shaped form having a base **34** which is united to the body **21** of the plate **20** and having arms **35** of the U which are imbedded in the interior by comolding of the brick. In the plate of FIGURE 3, the base **34** of the U of the internal plate is desirably united to the base **21** of the U of the external plate as by spot welding, as shown at **36**. Any desired number of internal plates may be comolded in this fashion.

In producing a brick unit of the character shown in FIGURES 5 to 9 inclusive, I utilize an oxidizable me-

tallic intermediate plate **37** as shown in FIGURE 5 which is placed as a partition between two basic refractory bricks **38** having their non-plated major or first lateral faces **40** adjoining the side faces of the oxidizable metallic intermediate plate **37**, which desirably extends over the entire or substantially the entire major or first lateral faces **40**. The comolded oxidizable metallic plates **20** are then positioned on the major or first lateral faces **41** of the bricks opposite to said major or first lateral faces **40** and the arms **22** of the U are disposed on portions of the minor or second lateral faces **42** of the bricks which adjoin the major or first lateral faces **41**. Plates **40** have opposed longitudinal end edges substantially at the hot and cold ends of the related bricks.

When the bricks are assembled and in engagement with the intermediate oxidizable metallic plate **37**, connector oxidizable metallic plates **43**, best seen in FIGURE 6, are applied on each minor or second lateral face **42**, the connector plates being longer than the bricks so that while they terminate at a longitudinal end edge suitably flush with the bricks at the hot end **44**, they extend out at the cold end **45**, suitably a distance of several inches to provide fins **46**. The intermediate plate **37** has opposed longitudinal end edges respectively substantially at the hot and cold ends of the bricks.

It will be evident that in the assembled brick one first lateral face of one brick body is in close proximity to one first lateral face of the other brick body, and opposed first lateral faces of the brick bodies are remote from one another. It will also be evident that in the assembled brick a second lateral face of one brick body extends in prolongation of a second lateral face of the other brick body at each side of the brick.

The connector plates **43** are united to the tab portions **22** of the comolded plates **20** and also to the edges of the intermediate plate **37** by welds **47**, suitably spot welds, serving as connection means.

Accordingly, it will be evident that a unit of two or more bricks is provided with the lateral faces covered by an oxidizable metallic plate sheath or wrapper which consists of the two connector plates and the comolded plates as shown, with an intermediate plate between the bricks, the latter plate and the sheath being components securely in a plate unit or frame work.

All of the oxidizable metallic plates will have a composition and thickness as described.

The construction of FIGURES 5 to 9 can be conveniently used where cooling is required, since the fins or extensions **46** can very satisfactorily cool the refractory structure, or cool the patch or other localized area.

As already explained, the basic refractory of the brick, is in unfired condition when inserted in the furnace.

The refractory compositions of the bricks of a given unit may be the same or they may be different as explained above.

In the form illustrated in FIGURES 10 to 14 inclusive, the brick unit is somewhat modified. The bricks are the same as previously described, but in this case the intermediate oxidizable metallic plate **37'** is extended out as a fin at the cold end **45** beyond the bricks, and provided with a hook having a support recess **48**. The extension **37'** thus includes a fastener having an outermost portion forming a bearing surface in the support opening adapting the fastener to be interlocked with a support. At one side opposite to the recess **48** connector plate **43** is used, but at the other side a connector plate **43'** is employed which terminates at the cold end of the brick. Since, however, the connector plate **43** at one side adjoins the intermediate plate **37'**, heat is readily transmitted to the intermediate plate, and conveyed out to the extension portion **50** of the intermediate plate. The spot welds to the intermediate plate help in this regard.

The support recess **48** can be used to support two brick units by fitting the support recess over a support bar **51** in FIGURE 15 running along the cold end. In the case of the roof, this may be a hanger bar; in the case of a wall it may be a vertical support; and in the case of the patch such as roof patch it may be a short patch supporting bar. Thus in this instance the extension **50** performs the function both of a cooling fin and also of a support.

Here again the two bricks of the unit may be of the same composition or of different compositions as already explained.

In some instances it is desirable to have the brick supported by a usual hanger tab.

In the form of FIGURES 16 to 19, the intermediate oxidizable metallic plate **37** does not extend out beyond the bricks at the cool end **45**, while the connector plates **43** extend out at the cool end **45** also as in the form of FIGURES 5 to 9 inclusive. A hanger tab **52** lies against the end of one of the bricks secured to the plate **20** in molding, but is bent out longitudinally as in FIGURE 18 during use. The hanger tab is preferably of corrosion resisting steel as mentioned above.

In the form of FIGURES 16 to 19, different compositions may be used in the different bricks if desired.

FIGURE 20 shows the assemblage of the brick units, containing bricks of compositions A and B, with each unit 180° reversed with respect to the next so that the brick compositions alternate in any direction, A, B, A, B, A, B, etc.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I therefore claim all such insofar as they fall within the reasonable spirit and scope of my claim.

Having thus described by invention what I claim as new and desire to secure by Letters Patent is:

1. A basic refractory brick unit comprising two basic refractory brick bodies each of rectangular cross section and each having two parallel first lateral faces, two parallel second lateral faces generally at right angles to said first lateral faces, and two opposed ends, said first lateral faces of said first and second brick bodies being generally parallel, one first lateral face of said first brick body being in close proximity to one first lateral face of said second brick body, and the other first lateral face of said first brick body being remote from the other first lateral face of said second brick body, each of the second lateral faces of the first brick body extending in prolongation of a corresponding one of the second lateral faces of the second brick body, and the opposed ends of the first brick body being adjacent to ends of the brick unit with a corresponding adjacent one of the opposed ends of the second brick body, first oxidizable metallic plates respectively securely on said first and second brick bodies and extending in contact with those first lateral faces of said first and second brick bodies which are remote from one another, and also having arms extending over and in contact with only portions of said first and second brick bodies disposed at locations adjoining said first lateral faces which are remote from one another, said arms having outermost surfaces substantially flush with said second lateral faces of said first and second brick bodies at locations adjoining said first lateral faces which are remote from one another, an oxidizable metallic intermediate spacer plate extending between said opposed ends of the brick bodies and having opposed faces contacting those first lateral faces of said brick bodies which are in close proximity to one another, said intermediate spacer plate further having opposed edges adjacent to the second lateral faces of said brick bodies, oxidizable metallic connector plates extending on the opposite sides of said first and second brick bodies generally parallel to said second lateral faces of said brick bodies, in contact with corresponding said second lateral faces of the brick bodies, and connection means securing said connector plates to said arms of the first oxidizable metallic plates and secur-

ing said edges of said intermediate spacer plate to said connector plates for said first plates and said connector plates to form a sheath having said brick bodies and said intermediate spacer plate securely united therewith and at least one of collectively said intermediate spacer plate and said connector plates being a plate having an extension portion thereof directed generally longitudinally of the brick unit away from the refractory at the end of the brick unit corresponding to said longitudinal ends of the brick bodies and said extension portion forming a heat exchange fin for the brick unit to be cooled.

2. A basic refractory brick unit comprising two basic refractory individually integrally molded brick bodies each of rectangular cross section and each having two parallel first lateral faces, two parallel second lateral faces generally at right angles to said first lateral faces, and opposed first and second longitudinal ends, said first lateral faces of said first and second brick bodies being generally parallel, one first lateral face of said first brick body being in close proximity to one first lateral face of said second brick body, and the other first lateral face of said first brick body being remote from the other first lateral face of said second brick body, each of the second lateral faces of the first brick body extending in prolongation of a corresponding one of the second lateral faces of the second brick body, and the opposed ends of the first brick body being adjacent to ends of the brick unit with a corresponding adjacent one of the opposed ends of the second brick body, first oxidizable metallic plates comolded with the refractory and respectively securely on said first and second brick bodies and extending in contact with those first lateral faces of said brick bodies which are remote from one another, said first oxidizable metallic plates having longitudinal end edges substantially at said opposed ends of the brick bodies and having arms extending over and in contact with only portions of said brick bodies disposed at locations adjoining said first lateral faces which are remote from one another, and said arms having outermost surfaces substantially flush with said second lateral faces of said brick bodies at locations adjoining said first lateral faces which are remote from one another, two oxidizable metallic connector plates extending on the opposite sides of said first and second brick bodies and generally parallel to said second lateral faces of said brick bodies, in contact with corresponding said second lateral faces of the brick bodies, and said connector plates having longitudinal end edges substantially at said first longitudinal ends of said brick bodies, connection means securing said connector plates to said arms of the first oxidizable metallic plates for said first plates and said connector plates to form a sheath around said brick bodies, and an oxidizable intermediate spacer plate securely within said sheath and forming a partition between said brick bodies, said intermediate spacer plate having opposed generally parallel faces contacting those first lateral faces of said brick bodies which are in close proximity to one another and having a longitudinal end edge substantially at said first longitudinal ends of said brick bodies, and at least one of collectively said intermediate spacer plate and said connector plates being a plate having an extension portion thereof directed generally longitudinally of the brick unit away from the refractory at the end of the brick unit corresponding to said second longitudinal ends of the brick bodies and said extension portion forming a heat exchange fin for the brick unit to be cooled.

3. A brick unit of claim 2, in which at least one of said connector plates has a plate extension portion thereof forming a heat exchange fin for the brick unit to be cooled.

4. A brick unit of claim 2, in which said intermediate spacer plate has a plate extension portion thereof forming a heat exchange fin for the brick unit to be cooled.

5. A brick unit of claim 2, in which both of said connector plates have extension portions thereof forming heat exchange fins for the brick unit to be cooled.

6. A brick unit of claim 2, in which said intermediate spacer plate and one of said connector plates have plate extensions thereof forming heat exchange fins for the brick unit to be cooled, the other of said connector plates extending substantially entirely between said opposed ends of said brick bodies, and said intermediate spacer plate further is in the form of a hook having a recess opening outwardly away from said one of said connector plates and having a bearing surface in said recess adapting said intermediate spacer plate to be engaged with a support.

7. A brick unit of claim 2, in which both of said connector plates have extension portions thereof forming heat exchange fins for the brick unit to be cooled, and one of said first plates carrying a bendable hanger tab intermediate said fins of said connector plates for the brick unit to be engaged with a support.

8. A basic refractory brick unit comprising two basic refractory individually integrally molded brick bodies each of rectangular cross section and each having two parallel first lateral faces, two parallel second lateral faces generally at right angles to said first lateral faces, and opposed first and second longitudinal ends, said first lateral faces of said first and second brick bodies being generally parallel, one first lateral face of said first brick body being in close proximity to one first lateral face of said second brick body, and the other first lateral face of said first brick body being remote from the other first lateral face of said second brick body, each of the second lateral faces of the first brick body extending in prolongation of a corresponding one of the second lateral faces of the second brick body, and the opposed ends of the first brick body being adjacent to ends of the brick unit with a corresponding adjacent one of the opposed ends of the second brick body, first oxidizable metallic plates comolded with the refractory and respectively securely on said first and second brick bodies and extending in contact with those first lateral faces of said brick bodies which are remote from one another, said first oxidizable metallic plates having longitudinal and edges substantially at said opposed ends of the brick bodies and having arms extending over and in contact with only portions of said brick bodies disposed at locations adjoining said first lateral faces which are remote from one another, and said arms having outermost surfaces substantially flush with said second lateral faces of said brick bodies at locations adjoining said first lateral faces which are remote from one another, two oxidizable metallic connector plates extending on the opposite sides of said first and second brick bodies and generally parallel to said second lateral faces of said brick bodies, in contact with corresponding said second lateral faces of the brick bodies, and said connector plates having longitudinal end edges substantially at said first longitudinal ends of said brick bodies and adjacent to said second longitudinal ends of said brick bodies, connection means securing said connector plates to said arms of the first oxidizable metallic plates for said first plates and said connector plates to form a sheath around said brick bodies, and an oxidizable intermediate spacer plate securely within said sheath and forming a partition between said brick bodies, said intermediate spacer plate having opposed generally parallel faces contacting those first lateral faces of said brick bodies which are in close proximity to one another and having longitudinal end edges substantially at said first longitudinal ends of said brick bodies and adjacent to said second longitudinal ends of said brick bodies.

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9

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10

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