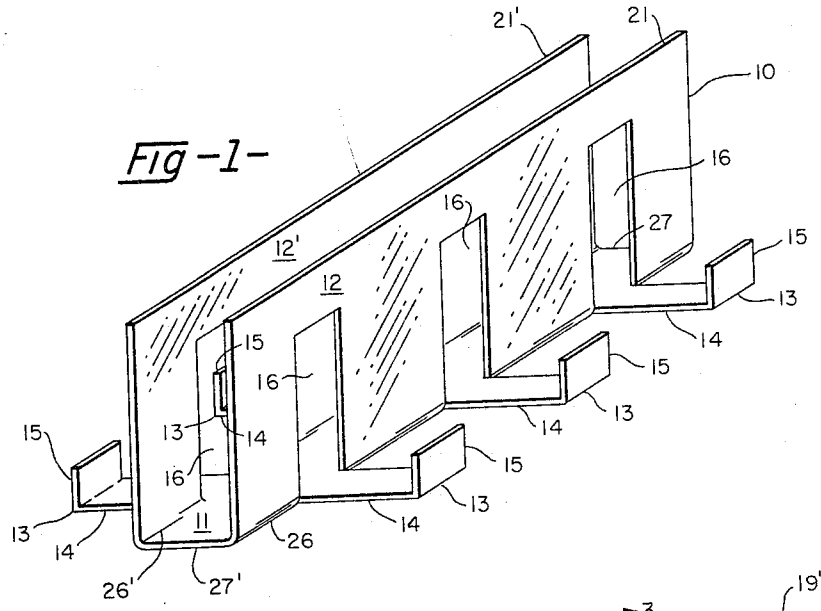
Nov. 15, 1966 R. A. EDWARDS 3,284,979

REFRACTORY SHAPE WITH EMBEDDED CHANNEL SHAPE REINFORCEMENT

Filed Nov. 6, 1963

Fig -1-



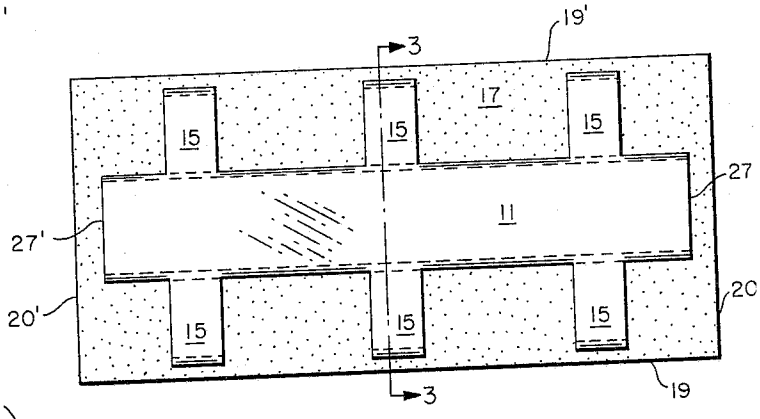


Fig-2-

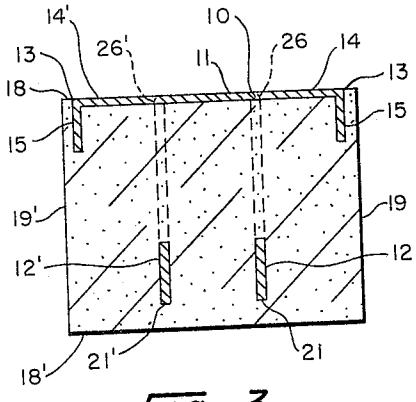


Fig-3-

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REFRACTORY SHAPE WITH EMBEDDED CHANNEL SHAPE REINFORCEMENT

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This invention relates to internally reinforced refractory brick and to metal elements for use therein.

It is well known to form refractory shapes, particularly shapes composed of nonacid refractory material including magnesite, periclase, and mixtures of these with chromite, with internal metal reinforcement. One common form which such internal reinforcement takes is the so-called U-core. These reinforcing cores are generally made from a sheet of plain carbon steel of a thickness from about 1/32 inch to 1/4 inch. The sheet is bent, generally parallel to its longest dimension, into the form of a channel having a back or web (corresponding to the base of the U) and two side flanges disposed at opposite edges of the web. It is a general practice to insert these U-cores into the refractory shape so that the web or base of the U lies in the plane of one exterior longitudinal face of the shape and the two side flanges are embedded in the refractory material. Such an assembly may be made by co-molding, i.e., inserting the metal reinforcement into the refractory material at the time such material is pressed into a brick or other shape.

Although a very large number of refractory brick have been made by the above co-molding process with internal U-core reinforcements, there are disadvantages to the prior art structure. Because of the high pressures involved in the molding process, there is strain and distortion of the U-core during its insertion or pressing into the refractory material. The release of the pressure upon removal of the formed shape from the press results in a change in shape of the internal reinforcement. This change in shape of the metal reinforcement leads to stresses in the refractory shape and may even cause cracking of the shape along the edge of the reinforcement. Even where no exterior cracks are evident, the refractory shape is greatly weakened by the internal stresses.

An even more readily apparent shortcoming of the prior art co-molded U-core shapes is that they (apparently due to the stresses in the metal reinforcement and the brick) show a taper from one face to the other, being wider on the face wherein lies the exposed back or web of the U-core reinforcement. This taper, which amounts to several thousandths of an inch, becomes very serious when a number of such refractory shapes are assembled to form a furnace wall or roof. In fact, so serious has this taper been in the past that it has frequently been necessary to lay up a furnace wall or roof with such shapes in alternating relationship in order to get a straight structure. Otherwise, a curvature or bend occurs in the wall or roof, due to the taper of the individual units.

According to the present invention, there has now been discovered a form of U-core metal reinforcement for refractory shapes which overcomes in large part the above disadvantages and results in a refractory shape with greater strength, less tendency to crack, and showing considerably less taper than prior art U-core brick.

In the annexed drawing:

FIGURE 1 is a perspective view of a U-core metal reinforcement for use in a refractory shape according to this invention;

FIGURE 2 is a plan view of a refractory brick having a reinforcement according to this invention; and

FIGURE 3 is a cross-sectional view taken along the line 3—3 of FIGURE 2.

A U-core metal reinforcement **10** according to this invention comprises an elongated metal channel having a generally rectangular web **11** with two opposed long edges **26** and **26'** and two short end edges **27** and **27'** and two generally rectangular side flanges **12** and **12'** having free outer edges **21** and **21'** and inner edges **26** and **26'** attached to the web. However, in the reinforcement of this invention there are struck from each side flange **12** of the U-core reinforcement one or more arms **13**, these arms comprising a base **14** which lies substantially in the plane of the web **11** and forms an extension thereof and a shoulder **15** which is disposed substantially perpendicularly to the base **14** and extends substantially parallel to and in the same direction as the side flanges **12** and **12'** of the U or channel.

Although the embodiment of FIGURE 1 is shown with three such arms **13** on either side of the main U-core, it will be understood that, alternatively, either a greater or lesser number of arms can be used. It will also be understood that other arrangements, such as a staggered arrangement, of the arms can be used on either side. Furthermore, the arms can vary in size or dimensions. Preferably, the side flanges **12** will be substantially perpendicular to the back **11** and the shoulders **15** of the arms **13** will be substantially perpendicular to the bases **14** of the arms, but other angles can be used.

The reinforcement **10** is inserted in a refractory shape **17**, for example by co-molding, so that the web **11** of the U-shape and the bases **14** of the arms **13** lie in the plane of one face **18** of the refractory shape, so as to be visible on the surface. The side flanges **12** of the U-shaped reinforcement and the shoulders **15** of the arms **13** struck from the sides **12** and **12'** extend down into the refractory shape **17**, anchoring the metal reinforcement to the refractory and strengthening the refractory shape itself. Also, refractory material extends through the openings **16** in side flanges **12, 12'** in the embodiment where the side flanges **13, 13'** are struck therefrom, further aiding in anchoring the channel firmly in the refractory shape. It is frequently desirable to have the metal reinforcement extend from one end face **20** of the refractory shape to the opposite end face **20'**, but the reinforcement can be terminated short of either or both end faces **20, 20'** as shown in FIGURE 2. Generally the side flanges **12** and **12'** of the metal reinforcement will not extend completely through the refractory shape **17** to the face **18'** opposite the face **18** containing the plane of the web **11** of the metal reinforcement. However, the side flanges **12** can extend through to the face **18'** of the refractory shape, if desired.

The arms **13**, are preferably of shorter length than side flanges **12, 12'**, especially when struck therefrom, whereby the openings or apertures **16**, are enclosed or surrounded on all sides by metal of side flanges **12, 12'**. However, if desired, the arms **13** can be as long or longer than side flanges **12, 12'**. In such embodiments the apertures remaining if side arms **13** are struck out are enclosed or bounded by metal on three sides only or are open to provide an interrupted edge of side flange **12**, for example, remote from web **11**. Also, it will generally be desired that the shoulders **15** of the arms **13** lie, when embedded in the refractory shape **17**, totally within the refractory and not on the side faces **19** and **19'** of the refractory shape. However, again it may be desirable in some instances to make the shape with these shoulders **15** in the plane of the sides **19** and **19'**.

When it is said that the plane of the web **11** and of the bases **14** of the arms **13** lie in the plane of the face **18** of the refractory or that the planes of the shoulders

15 lie in the plane of the side faces 19 and 19', it will be understood that the exposed surface of the metal is flush with the surface of the refractory, the metal being embedded in the refractory to the extent of the thickness of the sheet from which the metal reinforcement is made.

As an example of the superior results obtained with the metal reinforcement of this invention, standard 9x4½x3½ refractory shapes were pressed from a standard basic refractory mix, the U-core reinforcement being co-molded or pressed into the refractory mix at the time the shapes were formed so that the web of the U-core reinforcements lay in the plane of one 9x4½ inch face. Bricks made with conventional U-cores showed a taper of 0.042 inch (measured across the 4½ inch dimension of the face), whereas bricks made with reinforcements according to this invention showed an average taper of only 0.007 inch measured in the same way.

It will be understood that the above specific description has been given for purpose of illustration only. For instance, instead of struck-out arms 13, such elements can be affixed to the web 11 of channel 10 by welding or as otherwise desired. However, this is a more expensive and troublesome procedure; and it is a further advantage of the provision of struck-out arms, such as 13, that the refractory material extends through the openings or apertures left thereby, strengthening the final product, as described hereinabove. It will also be understood that the sides of the channel need not be exactly perpendicular to web of the U-core reinforcement, nor need the shoulders of the arms be either exactly parallel to the sides of the channel or exactly perpendicular to the bases of the arms 13.

Having now described the invention, what is claimed is:

1. A nonacid refractory shape having a flat surface and a metal reinforcement comprising:
(a) a generally U-shaped channel having
(b) a flat web and
(c) two side flanges, and
(d) a plurality of arms extending outwardly from said web and struck from said flanges, each of said arms having
(e) a flat base lying in the plane of the web, and
(f) a shoulder disposed in the same direction as the flanges,
the plane of the web of the metal reinforcement lying in the plane of the flat surface of the refractory shape, and the flanges of the U-shaped channel and the shoulders of the arms being embedded in the refractory shape.

2. A nonacid refractory shape having a first flat surface, a second and flat surface substantially at right angles to the first flat surface and a metal reinforcement comprising:
(a) a generally U-shaped channel having
(b) a flat web and
(c) two side flanges, and
(d) a plurality of arms extending outwardly from said web and struck from said flanges, each of said arms having
(e) a flat base lying in the plane of the web, and
(f) a shoulder disposed in the same direction as the flanges,
the plane of the web of the metal reinforcement lying in the plane of the first flat surface of the refractory shape, the side flanges of the U-shaped channel being embedded in the refractory shape, and the shoulder of at least one arm lying in the plane of the second flat surface.

3. A nonacid refractory shape having a flat surface and a metal reinforcement comprising:
(a) a generally U-shaped channel having
(b) a flat web and
(c) two parallel side flanges substantially perpendicular thereto, and
(d) a plurality of arms extending outwardly from said web and struck from said flanges, each of said arms having
(e) a flat base lying in the plane of the web, and
(f) a shoulder disposed in the same direction as the flanges,
the plane of the web of the metal reinforcement lying in the plane of the flat surface of the refractory shape, and the side flanges of the U-shaped channel and the shoulders of the arms being embedded in the refractory shape.

4. A nonacid refractory shape having a flat surface and a metal reinforcement comprising:
(a) a generally U-shaped channel having
(b) a flat web and
(c) 2 parallel side flanges substantially perpendicular thereto, and
(d) a plurality of arms extending outwardly from said web and struck from said flanges, each of said arms having
(e) a flat base lying in the plane of the web, and
(f) a shoulder disposed substantially perpendicular to the base and extending in the same direction as the flanges,
the plane of the web of the metal reinformecent lying in the plane of the flat surface of the refractory shape, and the side flanges of the U-shaped channel and the shoulders of the arms being embedded in the refractory shape.

5. A nonacid refractory shape having a flat surface and a metal reinforcement comprising:
(a) a generally U-shaped channel having
(b) a flat web and
(c) two side flanges joined to the web at opposite sides thereof, each of said flanges having an inner edge joined to said web and an uninterrupted outer edge, and
(d) a plurality of arms extending outwardly from said web and struck from said flanges, each of said arms having
(e) a flat base lying in the plane of the web and
(f) a shoulder disposed in the same direction as the flanges,
the plane of the web of the metal reinforcement lying in the plane of the flat surface of the refractory shape, and the side flanges of the U-shaped channel and the shoulders of the arms being embedded in the refractory shape.

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