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ELECTRIC FURNACE ROOF

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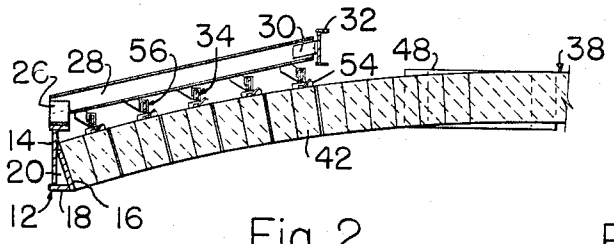


Fig. 2

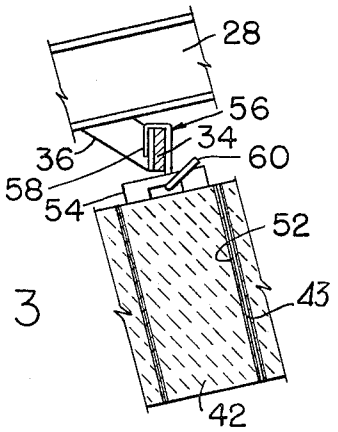


Fig. 3

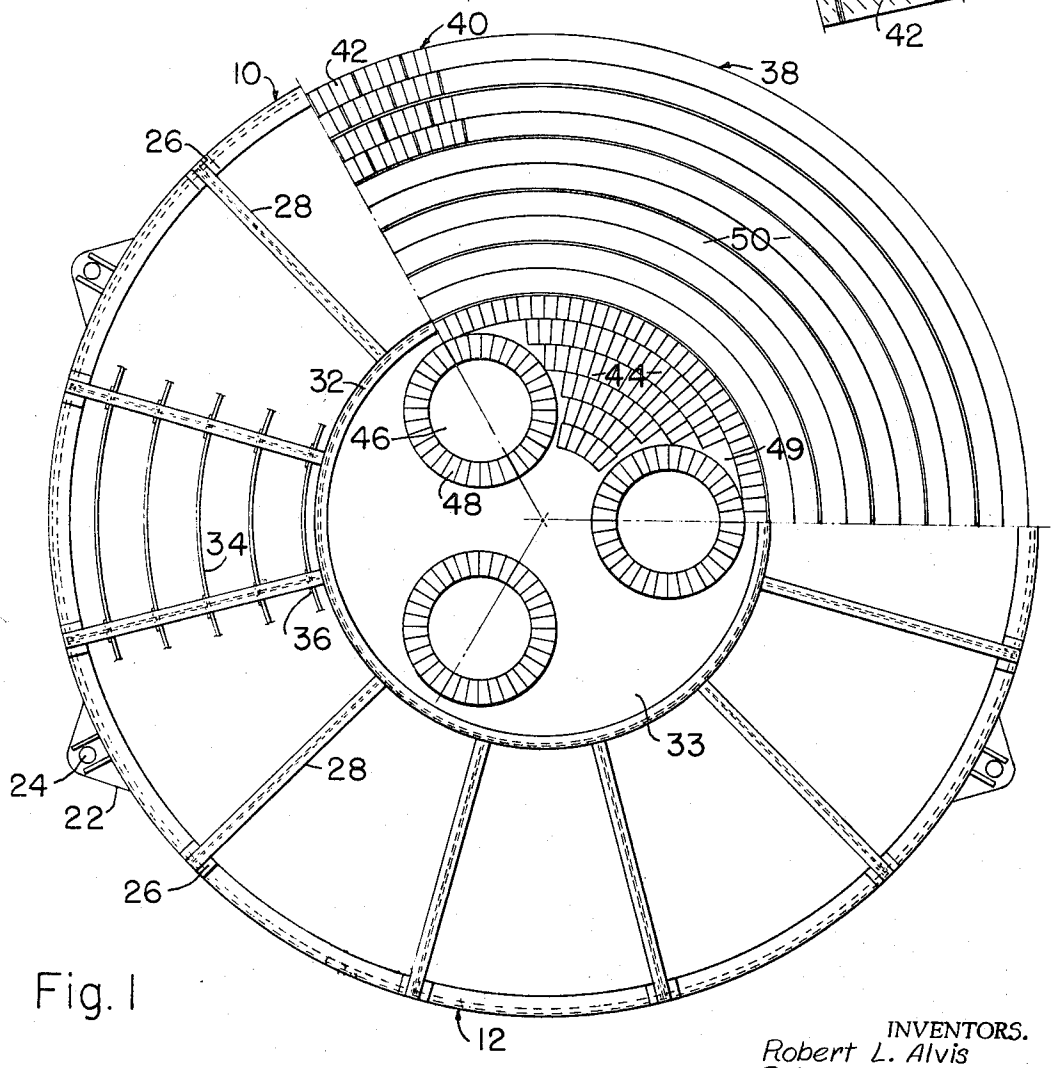


Fig. 1

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ELECTRIC FURNACE ROOF

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ABSTRACT OF THE DISCLOSURE

A roof for an electric furnace which roof is normally horizontal in its position of use but which is tilted with the furnace when the furnace is tapped, the roof having a peripheral element supported by the furnace and a framework extending inwardly from the peripheral element and connected to a central hub. The framework supports a brickwork arch which has a central portion within the hub and a marginal portion between the hub and the peripheral element, the marginal portion being supported by a number of spaced members rigid to the framework, certain of the bricks of the marginal portion being suspended from said members by hangers which engage the member and a loop carried by a corresponding brick, the clearance between the loop and the member being limited so that when the roof is tilted the bricks of the marginal portion are restrained against any substantial shifting movement.

It is conventional in the electric furnace field to provide a removable brick roof for the furnace, the roof being connected to a superstructure of a lifting mechanism whereby the superstructure and roof are swung away from the furnace to permit top-charging of the latter, the roof then being returned to its position atop the furnace for the heating operation. The electrodes for the furnace are carried by their own lifting mechanism and are normally lifted and swung independently but are tilted with the roof and furnace.

When the furnace is ready for tapping, it is tilted as a unit with the roof, superstructure and electrodes to pour the molten metal from a spout located at the lower part of the furnace. The tilting operation normally causes unusual stresses and distortions in the roof which greatly accelerate spalling and distintegration of the brickwork. Disintegration of the bricks is particularly a problem at the center of the roof as it receives a higher proportion of heat and consequently, the center fails before the useful life of the marginal bricks has been fully realized. However, upon collapse of the central portion, the marginal portions of the self-supporting arch will also collapse, resulting in wasteful material loss.

The collapsing problem has been partially solved by constructing a sectionalized roof such as shown in U.S. Patent No. 2,742,023, issued to George P. Reintjes on Apr. 17, 1956. The sectionalized roof includes separate supports for the central and marginal portions, but such a roof is not operable in conjunction with conventional lifting and tilting equipment and, due to the expense of such equipment, industrial concerns are hesitant to discard the same. Also, the sectional roof requires modification of the furnace top and utilization of relatively expensive, non-standard bricks. Thus, the sectional roof method has not been a practical solution.

Accordingly, it is the primary object of this invention to provide a roof construction for electric furnace use wherein a conventional self-supporting arch is utilized in conjunction with suspension framework, the latter serving as an auxiliary support for the marginal portion of the arch after the center thereof collapses. Since a conventional type arch is employed, the need for modifying present roof lifting machinery is eliminated. Additionally, furnace modification will be unnecessary when using the present invention, and standard shapes of bricks may be utilized to obviate the excess cost necessitated by the unusual configurations heretofore required.

An important object of this invention is to provide a roof of the aforementioned character wherein the stresses and distortions during tapping are minimized by employing a framework assembly which rigidly supports the arch. This is to be contrasted with many previous techniques which utilized free suspension methods in an attempt to lower internal stresses within the arch.

Other objects include details of construction which will become apparent from the following specification and accompanying drawing, wherein:

FIGURE 1 is a top plan view of an electric furnace roof made pursuant to the teachings of our invention, parts thereof being broken away to reveal details of construction;

FIG. 2 is a vertical, cross-sectional view thereof; and

FIG. 3 is an enlarged view similar to FIG. 2 showing the brick suspension means in detail.

The roof of the present invention, broadly designated by the reference numeral **10**, is adapted for use with a cylindrical electric furnace, the latter having an open top to present an upper peripheral edge for receiving roof **10**. Roof **10** includes an annular, peripheral skewback or roof ring element **12** having a generally triangular sleeve configuration to present a vertical leg **14**, an inclined leg **16**, and a horizontal flange **18**. Normally, a water or air cooling passageway **20** is defined within ring **12** by legs **14** and **16** and flange **18**. A plurality of brackets **22** are secured to the outer face of vertical leg **14** and each has an aperture **24** formed therein for registering with complemental positioning pins provided at the top of the furnace.

Vertical leg **14** extends above inclined leg **16** and has a plurality of clips **26** secured thereto at equally spaced points about ring **12**. Each clip **26** is rigidly secured to one end of a spoke **28** comprising an I-beam or similar member, the other end of the spoke being rigidly secured by a strap **30** to a hub or inner ring band **32** having a transversely U-shaped configuration and defining an opening **33** therewithin. Inner ring **32** is concentric with roof ring **12** and vertically spaced therefrom by the framework of spokes **28**.

A number of annular, concentric stringer members **34** are circumscribed about inner ring **32** and are rigidly secured to the lower faces of spokes **28** by brackets **36**. Stringers **34** comprise flat bars to present a rectangular cross-sectional configuration.

Roof **10** is provided with a self-supporting brickwork sprung arch **38** having a generally dome-shaped configuration. Arch **38** comprises a plurality of annular rows **40** of bricks **42**, which rows **40** decrease in diameter as the center of the roof is approached. Bricks **42** are tapered in horizontal cross section so that the annular rows **40** can be formed without substantial gaps being presented between the bricks. There is generally asbestos or other compressible material **43** placed between the bricks to compensate for expansion and contraction of the brickwork.

The central portion **44** of arch **38** has three openings **46** formed therein and defined by annular brick sleeves **48**, there being refractory ramming material **49** between sleeves **48** and bricks **42**. Openings **46** are designed to receive the electrodes of the furnace therethrough. The particular location of inner ring **32** is determined by the location of openings **46** and the electrode characteristics of the furnace as there should be no metal framework interfering with the arching operation of the electrodes. It

is common practice to space all metal framework at a distance of at least 18 to 24 inches from the electrodes.

Arch 38 is normally constructed over a dome-shaped form with all of the bricks 42 being encased, with the casings 52 (shown in enlarged cross section in FIG. 3) on the alternate rows 40 of the marginal portion 50 of arch 38 being of the extended type having a loop 54 extending upwardly therefrom. Arch 38 is self-supporting and is positioned in roof 10 by resting the outer edge thereof on inclined leg 16 of roof ring 12, with spokes 28 and inner ring 32 then overlying arch 38. Stringers 34 are spaced to overlie the alternate encased rows of the marginal portion 50 of arch 38 and are connected by hangers 56 to loops 54 of casings 52. Each hanger 56 includes a U-shaped hook 58 embracing the sides and top edge of a corresponding stringer 34, there being an integral re-bent hook 60 provided on one of the legs of hook 58, hook 60 being inserted through the opening presented in loop 54.

In operation, roof 10 is placed on the electrical furnace with flange 18 of ring 12 lying on the upper peripheral edge of the furnace. Roof 10 is connected to the superstructure of a conventional lifting and tilting mechanism located adjacent the furnace. Each opening 46 has an electrode journalled therethrough, which is carried by its own lifting mechanism, the electrodes and their mechanisms being arranged to tilt with the furnace.

When it is desired to charge the furnace, the lifting mechanism is operated to raise the superstructure, roof and electrodes as a unit, and swing the same away from the top of the furnace whereby the latter may be charged. After charging, the roof is swung into overlying relationship with the furnace and lowered until apertures 24 of flanges 22 register with the positioning pins provided adjacent the top edge of the furnace.

When the furnace is ready to tap, it is tilted as a unit with the superstructure, roof 10 and electrodes, and the molten material within the furnace is poured from a spout located near the bottom of the furnace. The tilting operation imparts stresses and distortions to arch 38 but the novel rigid framework suspension structure minimizes unusual pressures within the arch.

Particularly, the close proximity of stringers 34 to the loops 54 of the bricks carried thereby, as shown in FIG. 3, permits engagement of the stringers 34 with the loops 54 when the furnace is tilted thereby restraining bricks 42 against any substantial shifting movement about hook 60 as the furnace is tilted. This restraining or hold down action exerted by the stringers 34 upon the bricks 42 of the marginal portions 50 minimizes the stresses and distortions which would otherwise result from frequent tilting of the roof and, therefore, prolongs the life of bricks 42.

During prolonged use of roof 10, the central portion 44 of arch 38 directly underlying the opening 33 defined by ring 32, will disintegrate at a higher rate than the marginal portion 50 which is suspended from spokes 28. Thus, when central portion 44 has sufficiently disintegrated, it will collapse along with sleeves 48 and ramming material 49, but marginal portion 50 will remain intact as it will then be carried by spokes 28 which thus serve as an auxiliary support to supplement the primary support provided by the natural self-supporting structure of the arch. To refabricate the roof, it is only necessary to place the same over a concrete form and replace the central portion 44 with new bricks whereby roof 10 may again be placed into service utilizing the older bricks of marginal portion 50.

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

1. A furnace roof comprising:
a support having a peripheral element, a hub, and a framework interconnecting the element and the hub;
a self-supporting brickwork arch within said element and carried thereby in spaced, underlying relationship to the hub and said framework, said arch having a central portion and a marginal portion disposed between the central portion and said element; and
structure connecting the framework with at least certain of the bricks of said marginal portion for suspending the latter from the support upon collapse of said central portion and for restraining the bricks of said marginal portion upon tilting of the furnace roof, said structure including a number of spaced members rigid to the framework over said marginal portion and means for connecting said members with said certain bricks of the marginal portion comprising one part carried by said certain bricks, said members and said one part being in sufficiently close proximity when the roof is in a horizontal position of use to restrain said certain bricks against any substantial shifting movement when the roof is tilted.

2. The invention of claim 1, said connecting means including a plurality of hangers for each member respectively, each hanger having a hook engaging its corresponding member.

3. The invention of claim 2, each hanger having a second hook suspending a corresponding brick therefrom.

4. The invention of claim 3, the one part being a loop carried by each corresponding brick, said second hook of each hanger being received by said loop.

5. The invention of claim 4, there being a limited clearance between the normally uppermost portion of said loop and the normally lowermost portion of said member whereby when said roof is tilted said portions will engage to restrain said certain bricks against any substantial shifting movement.

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FREDERICK KETTERER, *Primary Examiner.*