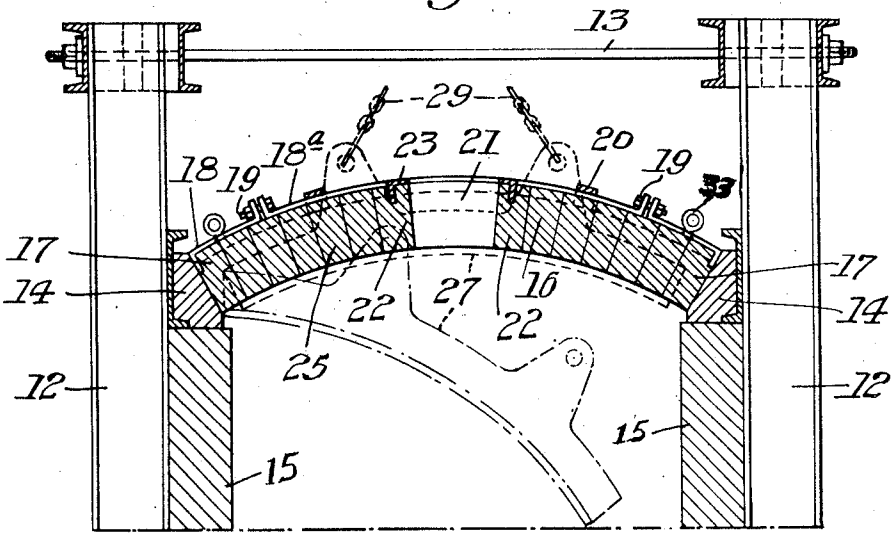
Aug. 19, 1930. G. E. HILLIARD 1,773,359

METHOD OF MAKING FURNACE ROOFS

Filed April 10, 1928 2 Sheets-Sheet 1

Fig. 1.



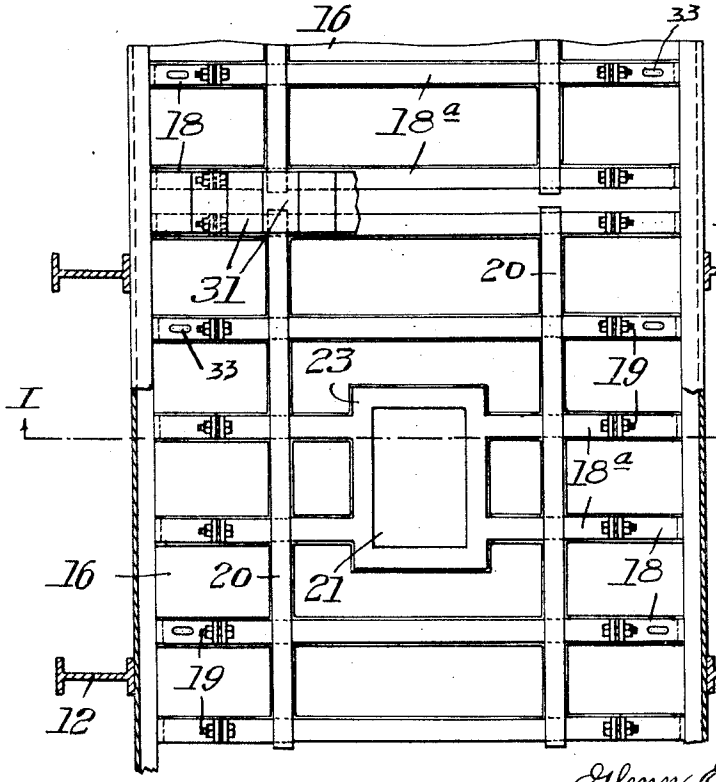


Fig. 2.

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METHOD OF MAKING FURNACE ROOFS

Filed April 10, 1928 2 Sheets-Sheet 2

Fig. 3.

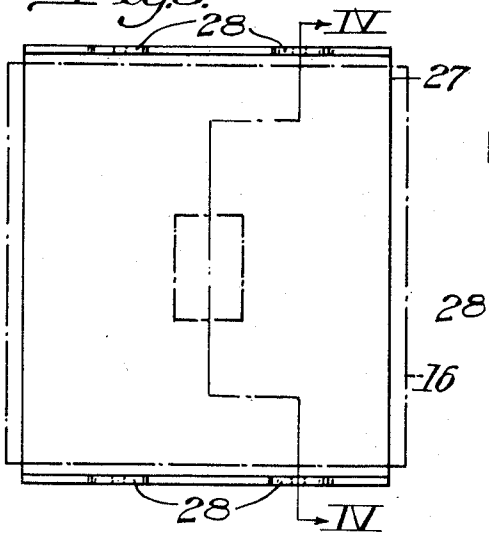


Fig. 4.

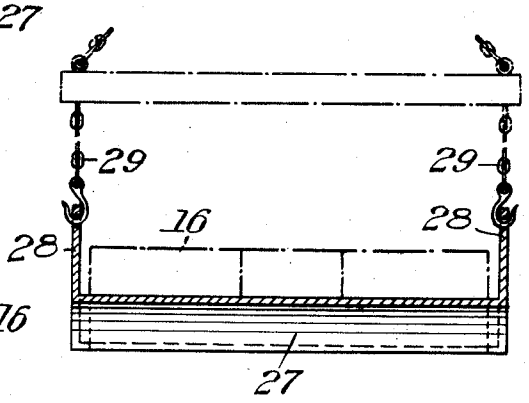


Fig. 5.

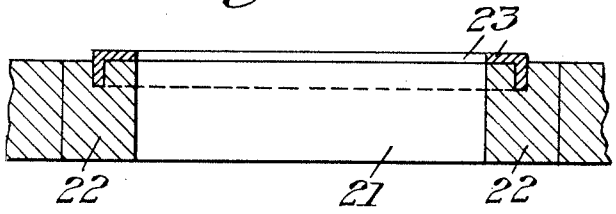


Fig. 6.

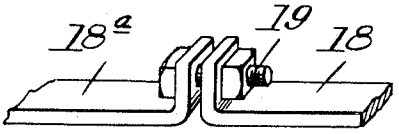


Fig. 7.

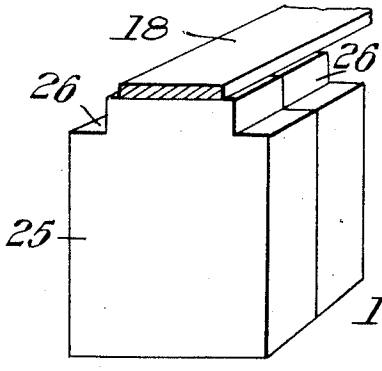


Fig. 8.

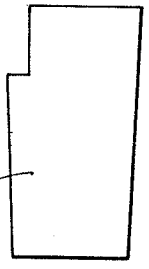


Fig. 9.

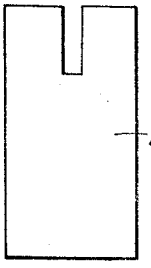
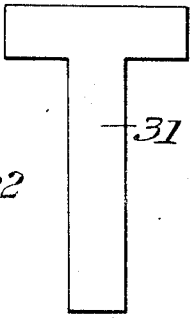


Fig. 10.



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UNITED STATES PATENT OFFICE

GLENN R. HILLIARD, OF BRACKENRIDGE, PENNSYLVANIA

METHOD OF MAKING FURNACE ROOFS

Application filed April 10, 1928. Serial No. 268,840.

My invention relates to metallurgical furnaces, such as those of the open hearth type, and more particularly to the roof structures of such furnaces.

The roof of a furnace, although usually formed of refractory brick, wears away quite rapidly, by reason of the intense heat which tends to fuse or melt the brick, with the result that the roof becomes thin and portions thereof will fall into the molten metal within the furnace. Also, certain portions of a roof will wear away more rapidly than other portions, because of the difficulty in distributing or controlling the flame in the furnace.

When the roof becomes thin, or weak spots develop therein, it is the practice to cease melting operations in the furnace, so that it can become cooled, and the old roof torn away and replaced. Such a repairing operation is quite expensive, not only by reason of the labor involved, but because the furnace is necessarily shut down while repairs are being made, for a period of perhaps three days to a week. Furthermore, after the new roof has been placed, the furnace must be brought gradually to a high temperature so that the green or new brick will not spawl off. This warming up operation may take from 60 to 72 hours. Also, even after commencing melting operations, the temperature must be kept comparatively low, so that the brick may become still more thoroughly seasoned or heat-treated, before normal melting operations are resumed.

One object of my invention is to provide a sectional roof covering which will permit of a reduction in the time and expense normally required for the replacement of a furnace roof or portions of said roof, and whereby any single portion of a furnace roof can be quickly and conveniently replaced without disturbing other portions thereof, and without the necessity of suspending melting operations.

Another object of my inveniton is to provide means for seasoning or heat-treating roof sections before placing of the same in position upon a furnace.

A further object of my invention is to provide an improved manner of assembling and handling the roof sections.

Another object of my invention is to provide an improved roof section that may suitably contain a charging opening through which metal may be introduced into the furnace.

Still another object of my invention is to simplify and improve generally the structure and method of utilizing roof structures.

One of the forms which my invention may take is shown in the accompanying drawing, wherein Figure 1 is an elevational sectional view of a furnace to which my invention is applied, taken on the line I—I of Fig. 2; Fig. 2 is a plan view of a portion of the structure of Fig. 1; Fig. 3 is a plan view showing the lifting device for placing a roof section of Fig. 2 in place upon the skew backs of a furnace; Fig. 4 is a section, on the line IV—IV of Fig. 3; Fig. 5 is a view of a portion of the structure of Fig. 1, on an enlarged scale; Fig. 6 is a perspective view, on an enlarged scale, of a portion of two clamping bars of Figs. 1 and 2; Fig. 7 is a perspective view, showing the form and arrangement of certain bricks in the roof section; Fig. 8 shows one of the end bricks of Fig. 1; Fig. 9 shows the form of the bricks surrounding the opening in the central portion of the roof section, and Fig. 10 shows a T shaped brick for closing the space between the roof sections

The framework and side walls of the furnace may be of conventional form, in that they include buck stays 12; tie rods 13 and skew backs 14 that are supported by the buck stays and the side walls 15.

The roof sections are represented by the numerals 16 and are composed of bricks arranged in arched form. The end bricks 17

of each course are of the form shown more clearly in Figs. 1 and 8, being grooved for the reception of the down-turned outer ends of clamping bars 18. The inner ends of the bars 18 are upturned as shown more clearly in Fig. 6 and are secured to upturned flanges of an intermediate tie bar 18ª, by means of bolts 19. Clamping bars 20 are provided that extend transversely of the bars 18 and serve to bind the bricks together in the opposite direction.

The roof section may have a charging opening 21 through which the metal is charged. Specially-constructed bricks 22 (Figs. 1, 5 and 9) surround this opening and have grooves in their upper ends for the reception of the downturned edges of a metal frame 23 which defines the charging opening. This metal frame may be suitably secured to or formed integrally with certain of the tie bars 18, and protects the bricks surrounding the opening 21 from damage and serves to support a suitable cover (not shown).

Bricks 25 are disposed beneath the clamping bars 18 and 18ª, as shown more clearly in Fig. 7, and have cut-out portions 26 which provide for circulation of air at the upper ends of the bricks, thus preventing them from becoming over-heated and disintegrating, which condition tends to arise by reason of the fact that the metal bars abutting against the ends of the bricks, tend to confine heat therein, to the detriment of the bricks.

In constructing a roof section, the bricks are preferably assembled in position upon a templet 27 that may be of ordinary cast iron and which has the contour of the roof arch. The clamping bars 17, 18 and 20 are then put in position to securely bind the bricks of the roof section into a unitary structure.

The templets 27 have upstanding posts or bosses 28, at each end thereof, to which a lifting chain 29 may be connected. Suitable hoisting apparatus (not shown) is then coupled to the lifting chain and the arch section transferred from its place of assembly into position in the furnace structure. When the roof section has been lowered until the end bricks 17 rest upon the skew back 14, the chains 29 are disconnected from the templet and, since the extensions 28 of the templet then lie in the spaces between adjacent roof sections (one of such spaces being shown in Fig. 2), the templet will fall into the furnace and be melted in the batch. The templets being made of cheap metal and of simple form, are inexpensive, particularly since there is no loss of metal, as the metal is melted and mingled with the main body of metal in the furnace.

The spaces between the roof sections, after the templets have been dropped into the furnace are closed by T-shaped bricks 31 (Figs. 2 and 10). These bricks may, however, be of wedge or other form.

Previous to installing the roof sections on a furnace, I prefer to subject them to a preliminary gradual heating operation, particularly in the case of silica brick, thereby avoiding the spawling which would occur if they were suddenly subjected to furnace temperatures. While it has been heretofore suggested that arch brick be heat-treated after installation, such treatment necessitates the gradual heating of the furnace from a substantially cold condition up to the point where the bricks have been fully heat-treated and metal melting operations begun. This preliminary heating may extend over a period of from forty-eight hours to seventy-two hours and represents quite considerable loss of time, since the furnace necessarily remains idle during such period.

The bricks composing the roof sections are preferably heat-treated after they have been assembled in a section. This assembly is effected by placing the bricks upon the templet or holder 27, the clamping bars 18, 18ª, 20 thereupon being placed in position. Thereafter, the templet is lifted into position over a heating chamber and the roof section deposited upon a suitable support, and the templet then removed, so that the roof section may be subjected to the gradually increasing heat necessary to properly season the bricks. Such heating chamber may be of somewhat the form of the open hearth furnace shown in section in Fig. 1.

After the seasoning operation has been completed, the templet is placed beneath the roof section and such section transferred into position on an open hearth furnace as shown in Fig. 1, and as heretofore explained.

Certain of the clamping members are provided with eye portions 33 whereby the roof sections may be lifted if desired, as when it is found necessary to remove the sections from the furnace.

I claim as my invention:—

1. The method which comprises assembling bricks to form a furnace arch section, maintaining said bricks in assembled relation by clamping means disposed within the end boundaries of the section, supporting said section upon a templet which is of less length than said section but of greater width than the section, moving said templet and the section supported thereby into position above furnace walls and bringing the ends of the said section into seating engagement with said walls, and releasing the said templet.

2. The method of assembling and placing furnace roof sections which comprises forming each section of bricks held in assembled relation by clamping means disposed within the end boundaries of the section, supporting each section upon a templet of greater width than the sections but of shorter length than

such sections, suspending the templets from above and transporting them singly into position above the seating surfaces on a furnace and bringing the ends of the sections into seating engagement with said surfaces, the roof sections being placed in relatively spaced relation upon the furnace to accommodate the suspension means for the templets, releasing the templets, and thereafter closing the spaces between the roof sections.

In testimony whereof I, the said GLENN E. HILLIARD, have hereunto set my hand.

GLENN E. HILLIARD.