Oct. 21, 1930. E. P. STEVENS 1,778,776

FURNACE ROOF

Filed Dec. 21, 1922 3 Sheets-Sheet 1

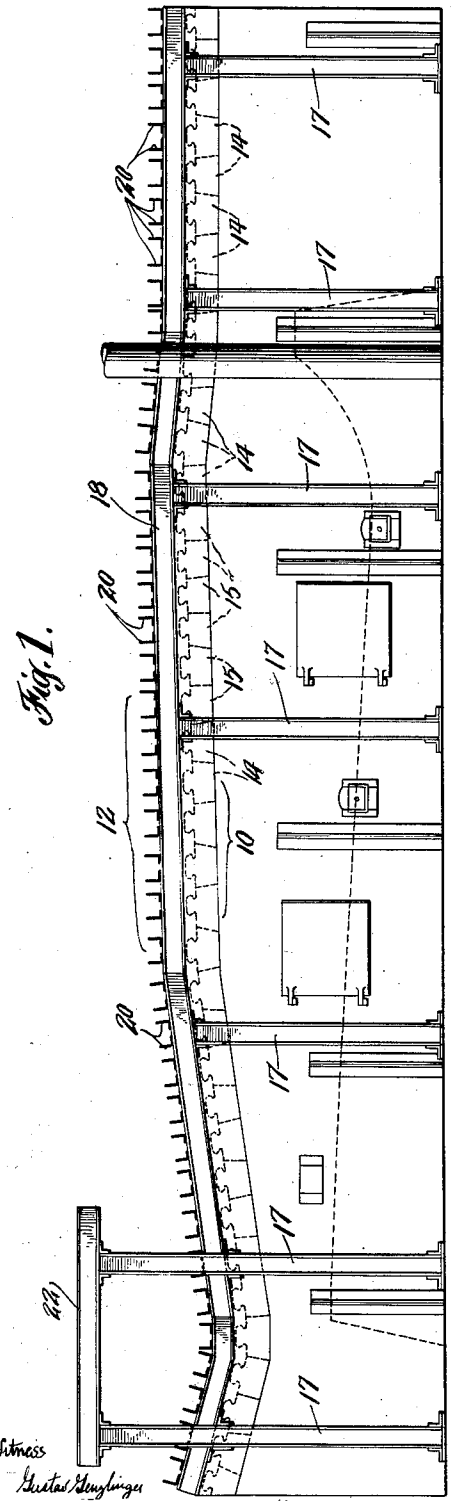


Fig. 1.

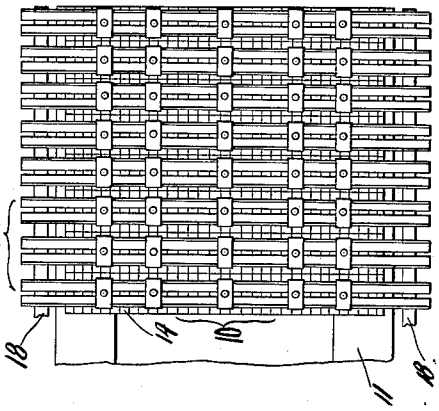


Fig. 2.

Witness
Gustav Stenglinger

Inventor
Enoch P. Stevens
By his Attorneys
Symmestved & Bechner

Oct. 21, 1930. E. P. STEVENS 1,778,776

FURNACE ROOF

Filed Dec. 21, 1922 3 Sheets-Sheet 2

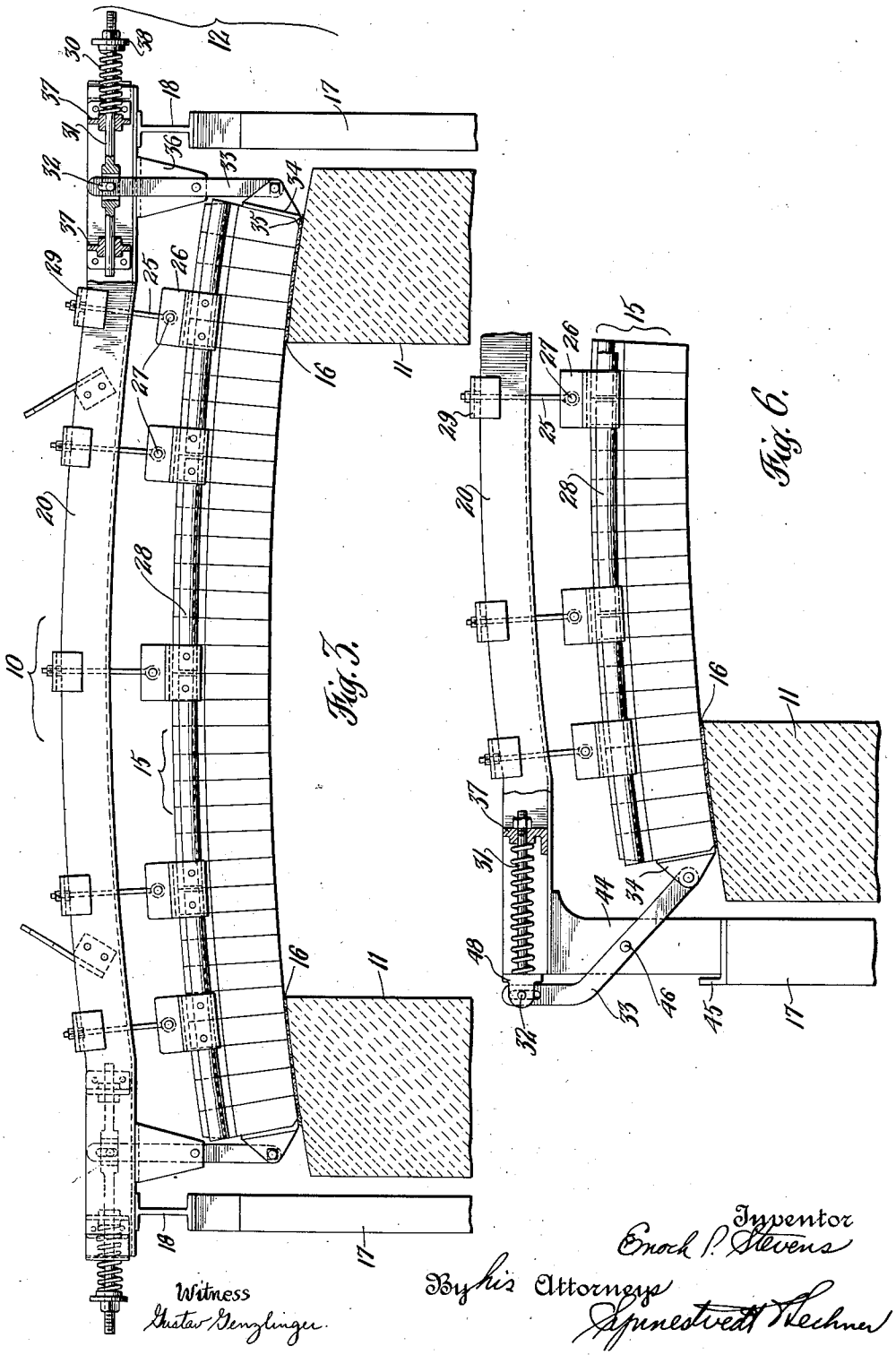


Fig. 5.

Fig. 6.

Witness
Gustav Genzlinger

Inventor
Enock P. Stevens

By his Attorneys
Spencer, Witt & Dechert

Oct. 21, 1930. E. P. STEVENS 1,778,776

FURNACE ROOF

Filed Dec. 21, 1922 3 Sheets-Sheet 3

Fig. 5.

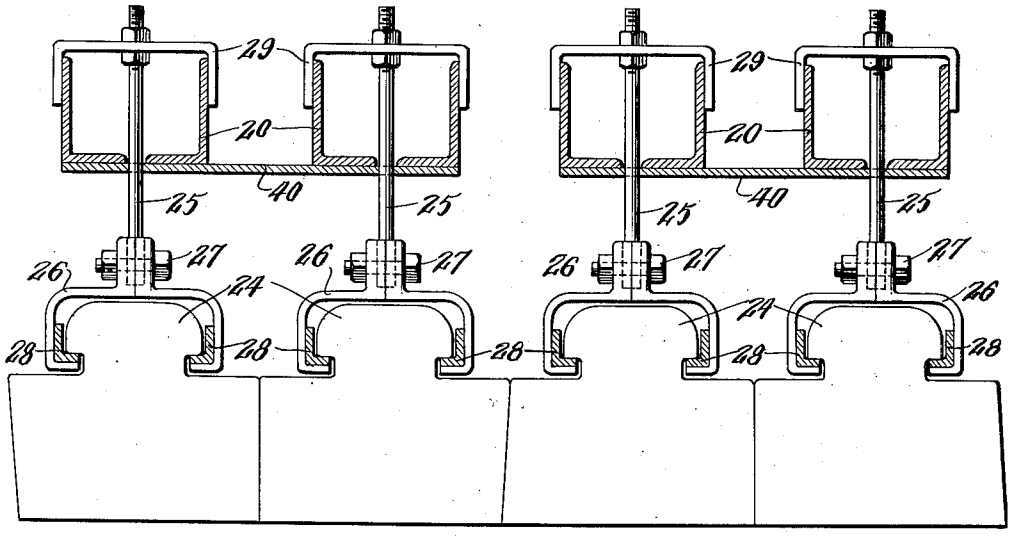
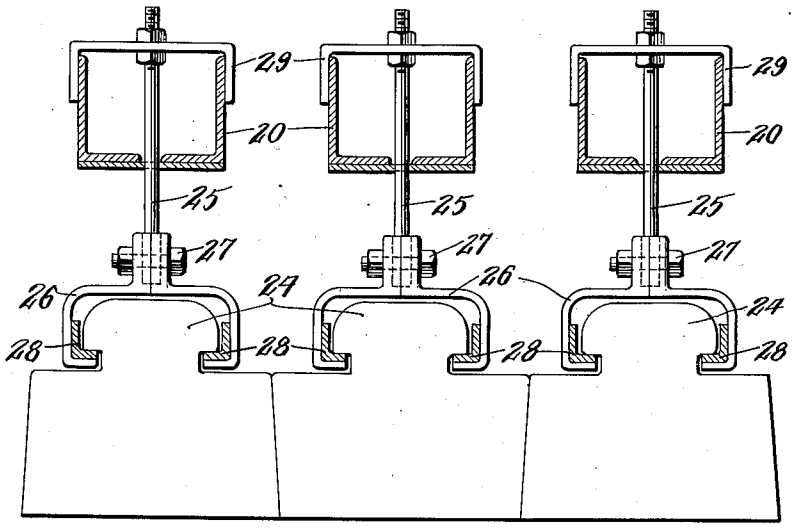


Fig. 4.



Witness.
Gustav Genzlinger.

Inventor
Enoch P. Stevens
By his Attorneys
Synnestvedt & Lechner

Patented Oct. 21, 1930

1,778,776

UNITED STATES PATENT OFFICE

ENOCH P. STEVENS, OF MORGAN PARK, CHICAGO, ILLINOIS, ASSIGNOR TO AMERICAN ARCH COMPANY, INC., A CORPORATION OF NEW YORK

FURNACE ROOF

Application filed December 21, 1922. Serial No. 608,345.

My invention relates to furnace roof construction and is especially concerned with malleable furnaces. One of my main objects is to overcome various difficulties and drawbacks of roof constructions heretofore employed for malleable iron furnaces. I aim to provide for holding the bricks forming the roof securely, and tight together, without danger of spalling or collapse, and without imposing objectionable load or thrust on the rest of the furnace structure. I also aim to facilitate removal of bungs for charging and other purposes.

How these and other objects can be realized through my invention in a novel and advantageous manner will appear from my description hereinafter of the best embodiment of the invention known to me.

In the drawings, Fig. 1 is a somewhat diagrammatic side view of a malleable furnace with a roof conveniently embodying my invention, various parts being omitted to avoid confusion.

Fig. 2 is a corresponding fragmentary plan view.

Fig. 3 shows a fragmentary transverse section through the furnace, on a larger scale than Figs. 1 and 2, with various parts partly broken away or in section.

Figs. 4 and 5 show fragmentary transverse sections through the roof structure, on a larger scale than Figs. 1, 2 and 3.

Figs. 6 is a fragmentary view similar to Fig. 3, illustrating a modification.

In itself, the furnace illustrated in Figs. 1, 2 and 3 may be of the usual type and design for the production of malleable iron, so that general or detailed description is unnecessary. Referring, then, at once to the roof 10, it will be seen that while it resembles those of malleable furnaces as heretofore constructed in having a slightly cambered, arching form, it is flatter than usual; and instead of resting on the side walls 11 and exerting lateral thrust on them when it expands, as well as heavy downward pressure at all times, it is externally supported, by an overlying framework or cradle structure 12. As shown, the roof 10 is of sectional construction, comprising a series of more or less unitary, independent transverse "bungs" or arch units 14, 15 each composed of a row of arch fire brick. The ends of each bung 14, 15 overlap the side walls of the furnace with slight clearance, and seals 16 of sand or the like are provided to prevent leakage of the hot gases through these overlap joints. At the ends of the furnace, similar joints and seals exist between the end bungs 14 and the end walls.

The cradle structure 12 for supporting the roof 10 is here shown as completely straddling the furnace, consisting of a series of uprights 17 along either side with their tops tied together by longitudinal stringers 18, and suitable transverse members or cross beams 20 supported by the stringers. As shown in Figs. 1 and 3, the uprights 17 with the superjacent parts are structurally quite independent of the furnace walls,—having, indeed, the character of channel or I-bar pillars or posts separated from the furnace sides, rather than that of buckstays. Hence the roof 10 not only imposes no weight load on the furnace walls, but is completely free for independent expansion and contraction without any lateral or other thrust on or reaction with the walls. Each of the transverse girder members 20 is here shown as composed of a pair of angle bars facing flange to flange, with their ends resting on top of the I-shaped stringers 18. With the exception of those for the roof bungs 15 that must regularly be removed to charge the furnace, the girders 20 may be suitably secured to the stringers 18, so as to brace and tie together the longtiudinal lateral supporting structures composed of these stringers and the uprights 17. As shown in Fig. 3, the ends of the girders 20 project a little beyond the stringers 18, so that when any of the roof bungs 14, 15 (either the charging bungs or the others) are lifted off, one by one,—as by an overhead crane or the like,—they may be deposited and "stored" (so to speak) on a sort of "rack" shown as composed of longitudinals 22 secured to the tops of extra high uprights 17 at either side of the furnace in position to receive the ends of the corresponding girders.

As shown in Figs. 4 and 5, the refractory fire brick of each bung 14, 15 have T-shaped

heads 24 at their upper ends, and are suspended from the corresponding girder 20 by hangars 25 at suitable intervals. At their lower ends, the hangers 25 are provided with clips 26 (composed of grapple-like parts secured together and to the hanger rod by bolts 27) that take under and hold together angle-bar runners 28, 28 extending lengthwise at either side of the bung, with their inturned flanges engaged under the brick heads 24. At their upper ends, the hanger rods 25 extend through inverted chanel-shaped clips 29 that straddle the upper flanges of the pair of angle bars forming each girder 20, and are secured to these clips by opposed nuts by means of which a certain measure of vertical adjustment may be made. Thus, it will be seen, the brick of each bung 14, 15 are free to expand and contract, and to shift their positions bodily lengthwise of their girder 20,—independently of one another, and without interfering reaction with other parts, or lateral thrusts on the furnace or the lateral supports 17, 18. Also, all parts of the supporting structure are protected against overheating from the refractory roof bungs by their free exposure to the air, which permits dissipation of the heat received by conduction and radiation, etc.

In order that the joints between the brick of each bung 14, 15 may be kept tightly closed under all conditions, despite expansion and contraction, provision may preferably be made for exerting a yielding pressure on the bung ends. As here shown, means for doing this are carried by each girder 20, comprising (see Fig. 3) a compression spring 30 that acts on a longitudinally movable rod member 31 having a pin and slot connection 32 with the upper arm of a lever 33 whose lower arm is pivotally connected to a shoe or backing plate 34 that bears against the outermost bung brick, and has a bottom lip 35 that takes under and protects the lower outer corner of the brick. As here shown, the lever 33 is fulcrumed and reacts on a double bracket 36 depending from the girder 20, and the rod 31 is mounted and guided in bracket pieces 37 secured between the upright flanges of the angle bars that form the member 20, and connecting them together. The spring 30 mounted on each end of each girder acts between the outer bracket 37 and an adjustable abutment 38 on the outer end of the rod 31, urging the upper arm of the lever 33 outward and pressing the lower arm inward on the bung end. Thus, it will be seen, the bung as a whole is "balanced," so to speak, (aside from friction) between the two springs 30, 30 at its ends, and kept tight. All lateral thrusts and reactions due to these springs are taken up by the girder 20, without transmission of any to the furnace, or to other parts of the cradle structure.

Referring, now, to Figs. 1, 4 and 5, it will be seen that the refractory transverse bungs 14, 15 are of wedge-like cross section (i. e., the outside faces or edges of the bung brick are inclined relatively to one another), and expand upward and downward in alternation throughout the length of the furnace. This conformation allows the bungs 14, 15 to be perfectly close-fitting and tight with one another when in place, yet affords clearance and guidance to facilitate setting in place or removal. As shown, the bungs 14 that form the more permanent portion of the furnace roof have both outer faces inclined relatively to the vertical, so that alternate downward-converging bungs can be at once lifted out without difficulty. The charging bungs 15, however, have vertical faces at the alternate joints between them: i. e., the juxtaposed faces of pairs of contiguous bungs 15 are vertical. This, it will be seen, permits such bungs 15 to be lifted off concurrently in convenient agroupments: i. e. continuous sections of the roof 10 composed of these bungs 15 can be lifted off in their entirety. As shown in Fig. 5, the girders 20 belonging to pairs of the bungs 15 with vertical juxtaposed faces are secured together by underlying plates 40, to facilitate their removal as unitary sections.

In the modified bung unit construction illustrated in Fig. 6, the ends of the girders 20 are provided with feet 44 to rest on the lateral supporting structures, which have angle bars 45 with upstanding flanges along their tops to hold the feet in place. Only one guide and connecting bracket 37 is provided at each end of the girder 20. The lever 33 is fulcrumed and reacts on the foot 44 at 46, and its upper arm is bent to allow the rod 31 to be made shorter. The member 48 against which the spring 30 abuts at the outer end of the rod 31 also serves for the pin and slot connection 32 between rod 31 and lever 33.

As a means of dispensing with merely repetitive description, various parts and features of Fig. 6 corresponding to those of Figs. 1 to 5 are marked with the same reference characters as in Figs. 1 to 5.

What I claim is:

1. A furnace roof bung unit comprising a girder adapted to be spanned between supports at the furnace side walls; a bung of refractory bricks with the bricks freely suspended from the girder; and yielding means carried by said girder for exerting pressure on the bung ends to compensate for expansion and contraction of the bricks and maintain tight joints between them.

2. A furnace roof bung unit comprising a girder for spanning the furnace; a bung of refractory bricks with longitudinal supporting runners sustainingly engaging their upper portions and freely suspended from said girder at intervals; and means carried by said girder for exerting pressure on the bung

ends to close the joints between the bung brick.

3. A furnace roof bung unit comprising a transverse girder adapted to be spanned between supports outside of the furnace side walls; a bung of refractory bricks with longitudinal supporting runners sustainingly engaging their upper portions, and hangers at intervals for suspending said runners from said girder, so that the brick may shift and adjust themselves freely for expansion and contraction; and means for closing the joints between the bung brick comprising springs mounted on the ends of said girder and levers with their upper arms urged outward by said springs and their lower arms pressing inward on the bung ends.

4. A furnace roof bung unit comprising a girder with feet at its ends for supporting it; a bung of refractory brick suspended from and below said girder between its said feet with freedom for vertical adjustment; and resilient means for closing the joints between the bung brick reacting at least in part between said feet and the bung ends.

5. A furnace roof bung unit comprising a girder with feet at its ends for supporting it; a bung of refractory bricks suspended from and below said girder between its said feet with freedom for adjustment longitudinally and vertically with reference to the girder; and means carried by said girder for closing the joints between said brick, comprising springs mounted on the girder, and levers with their upper arms urged outward by said springs and their lower arms pressing inward on the bung ends.

In testimony whereof, I have hereunto signed my name.

ENOCH P. STEVENS.