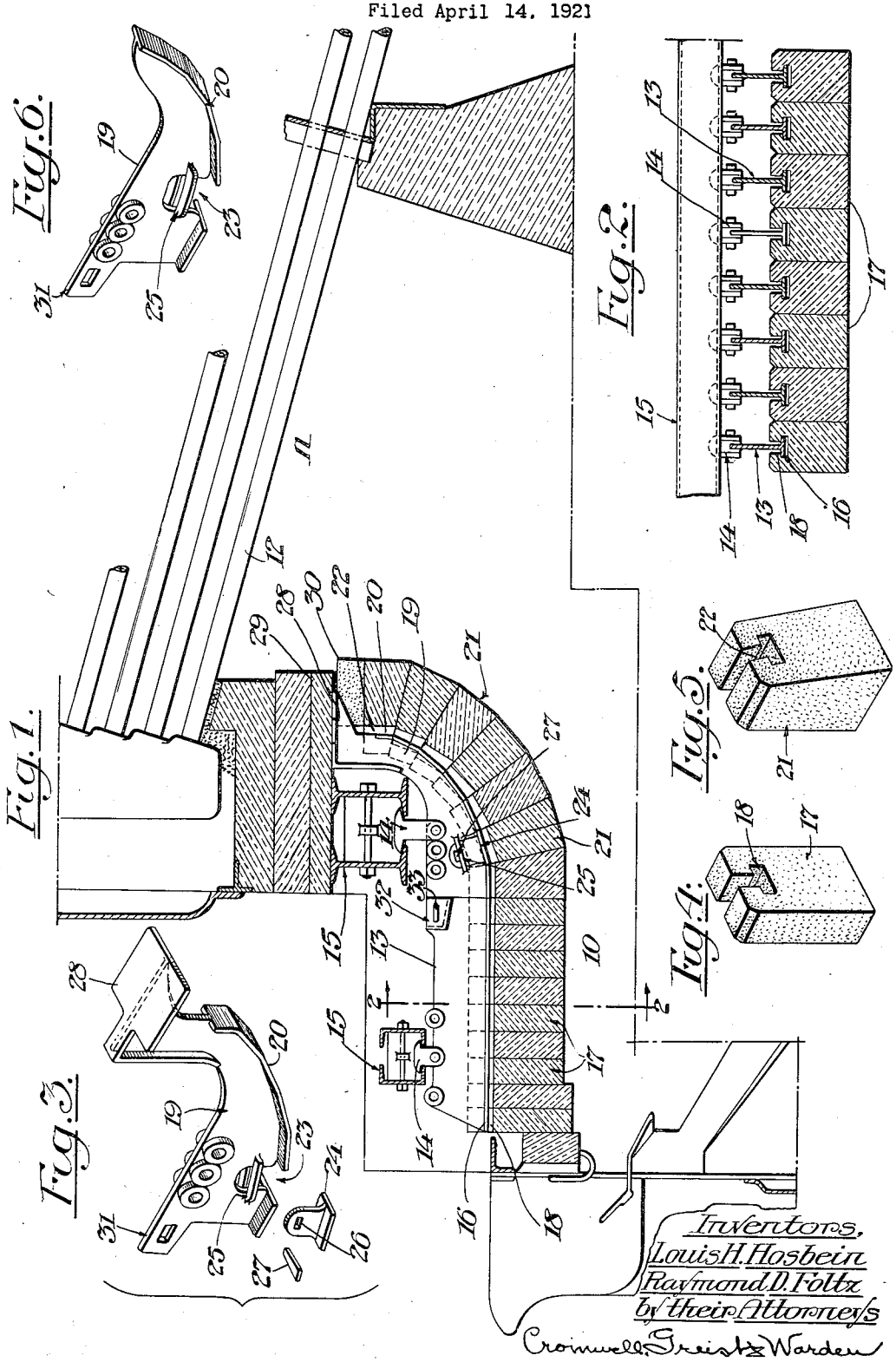
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FURNACE ARCH CONSTRUCTION

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FURNACE-ARCH CONSTRUCTION.

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This invention relates generally to arch construction for boiler furnaces, and more particularly to that class of furnace arches wherein rows of fire bricks are supported by arch bars suitably maintained above the furnace chamber and usually extending longitudinally from the front to the rear thereof. In such constructions it has been customary to cover the rear ends of the arch bars with a curtain or apron wall or with special nose-bricks which are designed to protect the ends of the supporting members from the destructive action of the heat. The rear of the arch, on account of its angular relation to the front wall of the boiler setting, in many instances directs the products of combustion from the furnace chamber some distance rearwardly of said wall and beyond the forward boiler surfaces, thus reducing the volume and effect of the products brought into contact with such surfaces. Again, the angular corners presented by the nose bricks and the brick structure at the junction where the surface of the arch changes from a substantially horizontal to a relatively vertical direction, affording increased exposure to the direct action of the heat soon crack and spall. Furthermore, in some constructions, locking devices are required to retain the rear bricks detachably in place on the arch-bars.

An object of our invention is to provide a furnace arch construction of such character that the bricks at the terminus thereof present to the products of combustion an upwardly curved deflecting surface, free from projecting corners or angular turns, which surface directs the products of combustion upwardly and in close relation to the proximate surfaces of the boiler, so as to avail of the maximum heat effect of such products.

A further object of our invention is to provide a construction wherein counterpart bricks can be readily applied to present the characteristic curved deflecting surface for the products of combustion, which bricks when assembled are securely yet detachably maintained in place without the aid of extraneous locking devices.

Another object is the provision of an improved radial rear end construction for furnace arches, in which the radial turn of the arch is formed by a plurality of refractories associated in abutting and superimposed relationship, and which will allow for self-adjustment of the refractories and their supporting members in such fashion as to afford them relief from heavy compression stresses induced by their expansion under high heat, while maintaining the integrity of the arch closure, its proper relation to associated wall portions, and full protection for the metallic supporting members.

Yet another object of the invention is the provision of a radial or convex arch construction of the sort described, in which provision is made for the support of an apron wall in proper association with the terminus of the radial arch portion, while maintaining the refractories in the radial arch portion free from imposition of the weight of the wall, and also free for self-adjustment incident to expansion and contraction resulting from temperature changes, without opening joint between the apron wall and arch.

Other and further objects of our invention will be pointed out hereinafter, indicated in the appended claims, or obvious to one skilled in the art, from the present disclosure. For the purpose of the present application we have shown one fashion in which the invention may be embodied, but it is to be understood that the same is here presented for the purpose of illustration merely, and that it is not to be accorded the effect of limiting the invention which we purport to secure by Letters Patent, short of its true and most comprehensive scope in the art.

In the drawings forming a part of this specification—

Figure 1 is a longitudinal vertical section of a furnace arch construction embodying our invention.

Fig. 2 is a partial transverse section through the structure, as on the line 2—2 of Fig. 1.

Fig. 3 is a perspective view of the novel rear end section of the arch bar; the removable brick-supporting member and its key being separately shown.

Fig. 4 is a perspective view of one of the

bricks or tiles for the main or flat body of the arch.

Fig. 5 is a similar view of one of the tapering bricks for the rear end section of the arch.

Fig. 6 is a perspective view of a modified form of the rear end section, the removable brick-supporting member being removed.

Referring to the drawings, 10 designates a furnace chamber opening at its rear into the boiler chamber 11, and 12 designates lower boiler tubes in the latter chamber. 13 designates a series of parallel arch bars extending from the front toward the rear of the furnace chamber, said bars, in the particular construction illustrated, being suspended by hangers 14 from spaced-apart girders 15. Each of these bars, which may be made up of a series of connected sections, comprises a web having basal flanges 16 extending longitudinally thereof. The main portion of the bar supports a row of counterpart fire bricks 17 each of which has formed therein along its upper portion an undercut slot 18 of cross-section suitable to accommodate the lower portion of the arch bar, whereby the bricks may be applied successively to either end of the bar and slid therealong so as to be supported in close contact with one another throughout the length of the bar. The spaced relation of the bars to one another is such that the rows of bricks carried by adjacent bars are in lateral contact with each other throughout the width of the furnace. As heretofore constructed the bars have been straight from end to end, and hence a flat arch or roof for the furnace has been provided.

In accordance with our invention the terminal portion of each of the arch bars, instead of being straight as heretofore, comprises a brick-supporting section or bracket 19 embodying preferably a web having its lower and rearward edge curved rearwardly and upwardly from the end of the straight section of the bar, and also provided with lateral flanges 20 which constitute, in effect, continuations of the basal flanges 16 of the main or straight section of the bar. The flanges 20 of each section 19 are adapted to receive and support the slotted narrow ends of a series of counterpart tapering bricks 21 which are shaped to lie in close contact with one another and collectively to present at their outer ends a practically continuous generally curved surface extending rearwardly and upwardly from the bottom surface of the arch portion formed by the bricks 17 on the straight section of the bar, as shown. The inner end of each of the bricks 21 is provided with an undercut slot 22 of cross-section suitable to accommodate the flanged portion of the section 19, so that the bricks can be readily applied successively to the upper ends of the flanges 20 and slid down thereon until the rear end of the arch has been built upward to the desired height. The bricks 21, when they are thus superimposed one upon another, are not only retained securely on the section 19 by their own weight, but they also serve to hold the bricks 17 on the straight portion of the arch bar in abutment. To remove the brick 21 from a supporting section 19 at any time, they may be slid upward thereon one by one until they clear the top of the flanges 20. In order, however, to facilitate the removal of the bricks from the lower portion of the section 19, as occasion may require, we preferably provide said section at or near its lower end with a removable member of appropriate form and size to support a single brick 21. When this member with its attached brick is removed from the section 19 an opening is provided in the latter through which the adjacent bricks 21 on the section as well as the bricks 17 on the straight section of the bar, if desired, can be individually removed. In the present instance the body of the section 19 is cut away, adjacent its lower end, as at 23, and a member 24 corresponding in form and size with the cut-out portion is provided. The sides of the web of the section 19 are formed with integral ribs 25 which span the cut-out portion of the web, and the tongue or web of the member 24 is provided with a suitably-disposed transverse slot 26, the relation of the parts being such that when the member 24 is applied to the section 19 a wedge key 27 can be readily inserted into the slot and above the ribs so as to hold the member securely yet detachably in place. The forming of the radial turn of the arch of a plurality of refractories attains many advantages, among which may be mentioned the greatly increased durability of the structure, resulting from the employment of small refractories, none of which has more than one face exposed to the furnace fire, and each of which has its outer end exposed to atmosphere outside the arch; and the internal flexibility of the convex arch portion resulting from the freedom of the wedge-shaped refractories to adjust themselves relative to one another and thereby accommodate themselves to pressures resulting from expansion of the structure under heat. The suspension of the arch bars and the bracket members 19, which carry the radial arch portion, affords a form of support whereby the arch bars and bracket members and the refractories carried on them are shiftable both transversely and longitudinally. This not only facilitates assembly of the structure, but also contributes to maintenance of close joints between the arch refractories, and constitutes an accommodating feature effective to relieve the re-

fractories and the supporting members from extremely high pressures induced in the structure as a whole incident to expansion by heat. For example, the aggregate cumulative expansion of a course of refractories longitudinally of an arch bar and its associated bracket member may be accommodated by a rearward shifting of the suspended bar and bracket, so that the course of refractories is not cramped between the stoker wall at the front and the apron wall at the rear end of the course. Likewise, transverse expansion of the arch is accommodated by the lateral shiftability of the arch bars and brackets, so that pressures resulting from expansion in the transverse direction are equalized among the several courses.

We sometimes extend the web of each section 19 a suitable distance above the upper end of the flanges 20 and provide the upstanding portion of the web with a horizontal shelf 28 which is designed to sustain the bricks 29 constituting the front or curtain wall of the setting; a course of filler bricks 30 being interposed between the uppermost brick 21 and the shelf 28. The shelf may be detachably mounted on the section 19 if desired. In Fig. 6 is shown a modified form of rear end section 19 in which the supporting shelf is omitted.

The forward end of the web of each section 19 is preferably provided with an extension 31 which is fitted between a pair of spaced lugs 32 on the rear end of the straight section of the arch bar and detachably secured thereto by means, for example, of a wedge key 33 which is driven through alining slots in the lugs and extension respectively.

The section 19 is also preferably suspended by one of the hangers from the overlying rearward girder 15.

From the foregoing it will be seen that by the employment of our invention in the rear of the arch structure the latter may be formed with an upwardly curved deflecting surface which, amongst other advantages, freely directs the flow of the products of combustion upwardly into the forward portion of the boiler chamber so as to avail of the maximum heat effect of such products on the forward boiler surfaces; that such deflecting surface is constituted by the outer faces only of a series of close-lying bricks, thus avoiding abrupt angles or corners which are liable to crack and spall; and that such bricks are so supported in relation to the rear ends of the arch bar that they not only hold themselves securely in place by their own weight, but also retain the main bricks upon the straight portions of the arch bars.

It is to be understood that we do not limit our invention to the exact details of construction herein shown and described, as the parts may be modified within the principle of our invention and the scope of the appended claims.

We claim—

1. In furnace arch construction, the combination of a main arch bar, a row of bricks carried thereby, a rear extension member on said bar having a rearwardly and upwardly curved brick-supporting portion, and a series of tapering bricks carried by said member and having their broader end faces associated to form a rearwardly and upwardly curved deflecting surface constituting a continuation of the bottom arch surface formed by surfaces of bricks on the main arch bar.

2. In furnace arch construction, the combination with supporting beams, of a main arch bar shiftably supported on the beams and having longitudinally extending basal flanges, a row of slotted bricks slidably hung on said flanges, a rear end extension on the said bar having a rearwardly and upwardly curved flanged portion, and a series of slotted tapering bricks slidably mounted on said flanged portion and forming at their broader ends a rearwardly and upwardly curved deflecting surface constituting a continuation of the arch surface from the bottom surface of the bricks on the main arch bar.

3. In a furnace arch construction, the combination of a main arch bar having longitudinally extending basal flanges, a row of slotted bricks slidably hung on said flanges, a rear end extension on the said bar having a rearwardly and upwardly curved flanged portion interrupted adjacent its lower forward end with an opening extending into the body of the extension, a flanged member, means for detachably securing said member in the opening, and a series of slotted tapering bricks slidably mounted on the flanges of the said extension and member and presenting at their outer faces a rearwardly and upwardly curved deflecting surface constituting a continuation of the bottom surface of the bricks on the main arch bar.

4. In furnace arch construction, a shiftably suspended brick supporting arch bar having at its rear end a rearwardly and upwardly curved portion provided with brick-supporting flanges upon which end slotted bricks can be slid one upon another.

5. In an arch nose construction, in combination, a rear end bracket having a rearwardly and upwardly curved flanged portion, center slotted wedge shaped refractories engaged with said flanged portion, and means whereby the lower end of the bracket can be secured to the rear end of an arch bar.

6. In furnace arch construction, a rear end bracket for arch bars, same having a rearwardly and upwardly curved flanged portion to engage the slotted narrow ends

of superimposed tapering bricks, said bracket having a horizontal brick-supporting shelf spaced above the upper end of said flanged portion, and means whereby the bracket can be secured to the rear end of an arch bar.

7. In furnace arch construction, a brick supporting member having a rearwardly and upwardly curved flanged portion upon which tapering end-slotted bricks can be slid one upon another, said member also having adjacent its lower portion a separable brick-supporting member, and means for detachably securing said separable member in place.

8. In furnace arch construction, an arch bar including a web portion and a laterally deflected flange portion, said flange portion for supporting refractories including a part removable to afford a gap in the flange, and means cooperating with the web for retaining said removable part in position to close the gap in the flange.

9. In a furnace arch construction, the combination of main arch bars, rows of bricks carried thereby, rear extension members on said bars, said extension members having rearwardly and upwardly curved supporting portions, and series of tapering center hung refractories carried by said members with their lateral faces in contact and with their outer end faces presenting a rearwardly and upwardly curved deflecting surface constituting a continuation of the arch surface formed by the bricks on the main arch bars.

10. In furnace construction, the combination with a roof arch, of nose brackets suspended at the rearward terminus of the roof arch, said nose brackets being shiftable transversely of the furnace, and wedge-shaped refractories suspended by their narrower end from said nose brackets in longitudinal courses, the broader ends of said refractories forming an upwardly deflected continuation of the fire surface of the roof arch.

11. In furnace construction the combination of substantially horizontal arch bars supported for longitudinal movement, rows of refractory tile carried thereby in longitudinal courses terminating at the front wall of the furnace chamber, extension members associated with said bars, said extension members being longitudinally shiftable with the bars and having upwardly curved supporting portions, and series of tapering refractory tile carried by said extension members with their lateral faces juxtaposed and their outer end faces presenting an upwardly deflected continuous refractory surface constituting a continuation of the arch surface formed by the tile on the horizontal arch bars.

12. In boiler furnace arch construction the combination with a substantially horizontally extending arch forming a roof portion for the fire box, of a plurality of metallic supporting members associated with said arch at the stack end, said supporting members being shiftable longitudinally of the furnace and having upwardly deflected portions, and a plurality of wedge shaped tile supported on said members with their lateral faces juxtaposed and their end faces forming a continuous convex upwardly curving wall arranged to guide combustion gases from the arch toward the boiler.

13. In furnace arch construction the combination with a substantially horizontal arch of tile supporting members having an upwardly curved portion, a plurality of wedge shaped tile suspended on said supporting members with their lateral faces juxtaposed and their outer end faces associated to form a convex upwardly curving refractory arch portion, and means associated with said supporting members whereby they are suspended to maintain said refractory surface in position to form a continuation of the furnace arch surface.

14. In furnace arch construction, the combination of collaterally arranged brackets, courses of wedge-shaped refractories suspended by their narrower ends from said brackets and having their broader ends associated to form a convex arch portion, shelf portions projecting over the topmost of said refractories, and an apron wall supported on said shelf portions independently of the wedge-shaped refractories and in conjoining association with the convex arch portion.

15. Furnace arch construction, comprising, in combination, collaterally arranged brackets, courses of wedge-shaped refractories suspended on said brackets to form a radial arch portion, shelf portions supported on the brackets above said wedge-shaped refractories, and an apron wall supported on said shelf portions independently of the wedge-shaped refractories.

16. In furnace arch construction, in combination, collaterally arranged arch bars having upwardly deflected rear terminal portions, refractories suspended on said arch bars in longitudinal courses, the refractories on said terminal portions being wedge-shaped and forming an upwardly deflected convex arch portion, an apron wall conjoining the upper terminus of said convex arch portion, and means supporting said apron wall independently of the refractories on the arch bars.

17. In a fire arch, the combination with flanged arch bars having curved inner ends, of arch forming refractories mounted on said arch bars, the refractories at the curved ends of said bars being wedge-shaped and forming a radial structure at the inner end of the arch, and an apron wall built above

the upturned radial extremity of said arch and supported independently of the arch refractories.

18. In a furnace arch, the combination with flanged arch bars having detachable tips with upwardly curved inner ends, of arch refractories interlocked to said arch bars and tips, the refractories at the curved end of said tips being wedge-shaped and forming a radial structure at the inner end of the arch, and an apron wall built above the upturned radial extremity of said arch and supported independently of the arch refractories.

19. In a furnace arch, the combination with a supporting member having an upwardly deflected flanged portion and a shelf portion, of wedge-shaped refractories suspended on said flanged portion and forming a convex fire surface, and refractories supported on the shelf portion to form parts of an apron wall above the convex fire surface.

20. In a furnace arch, the combination with a shiftably supported arch bar having an upwardly deflected tip at its inner end, of refractories suspended on said arch bar in a course running longitudinally thereof, the refractories at the inner end of the arch bar being wedge-shaped and forming a convex arch nose, a shelf extending over the wedge-shaped refractories, and an apron wall supported on said shelf.

21. In furnace arch construction, the combination of wedge-shaped refractories supported to form a convex arch portion, a demountable shelf-carrying member, a shelf carried on said member and extending over the wedge-shaped refractories, and an apron wall portion supported on said shelf.

22. In furnace arch construction, the combination with a beam extending across the furnace chamber, of an arch bar suspended from the beam and passing below the same, said arch bar having a rear end portion curving upwardly to the rear of the beam, and wedge-shaped refractories suspended on said upwardly curving portion of the arch bar to form a radial arch portion of uniform thickness between the beam and the furnace chamber.

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DISCLAIMER

1,628,318.—*Louis H. Hosbein*, Chicago, Ill., and *Raymond D. Foltz*, East Orange, N. J. FURNACE-ARCH CONSTRUCTION. Patent dated May 10, 1927. Disclaimer filed November 1, 1935, by the assignee, *M. H. Detrick Company*.

Hereby enters this disclaimer to that part of the claim in said specification which is in the following words to wit:

"14. In furnace arch construction, the combination of collaterally arranged brackets, courses of wedge-shaped refractories suspended by their narrower ends from said brackets and having their broader ends associated to form a convex arch portion, shelf portions projecting over the topmost of said refractories, and an apron wall supported on said shelf portions independently of the wedge-shaped refractories and in conjoining association with the convex arch portion.

"15. Furnace arch construction, comprising, in combination, collaterally arranged brackets, courses of wedge-shaped refractories suspended on said brackets to form a radial arch portion, shelf portions supported on the brackets above said wedge-shaped refractories, and an apron wall supported on said shelf portions independently of the wedge-shaped refractories."

"21. In furnace arch construction, the combination of wedge-shaped refractories supported to form a convex arch portion, a demountable shelf-carrying member, a shelf carried on said member and extending over the wedge-shaped refractories, and an apron wall portion supported on said shelf."

[*Official Gazette November 26, 1935.*]