June 9, 1925. 1,541,441

F. C. STIMMEL

FURNACE ARCH

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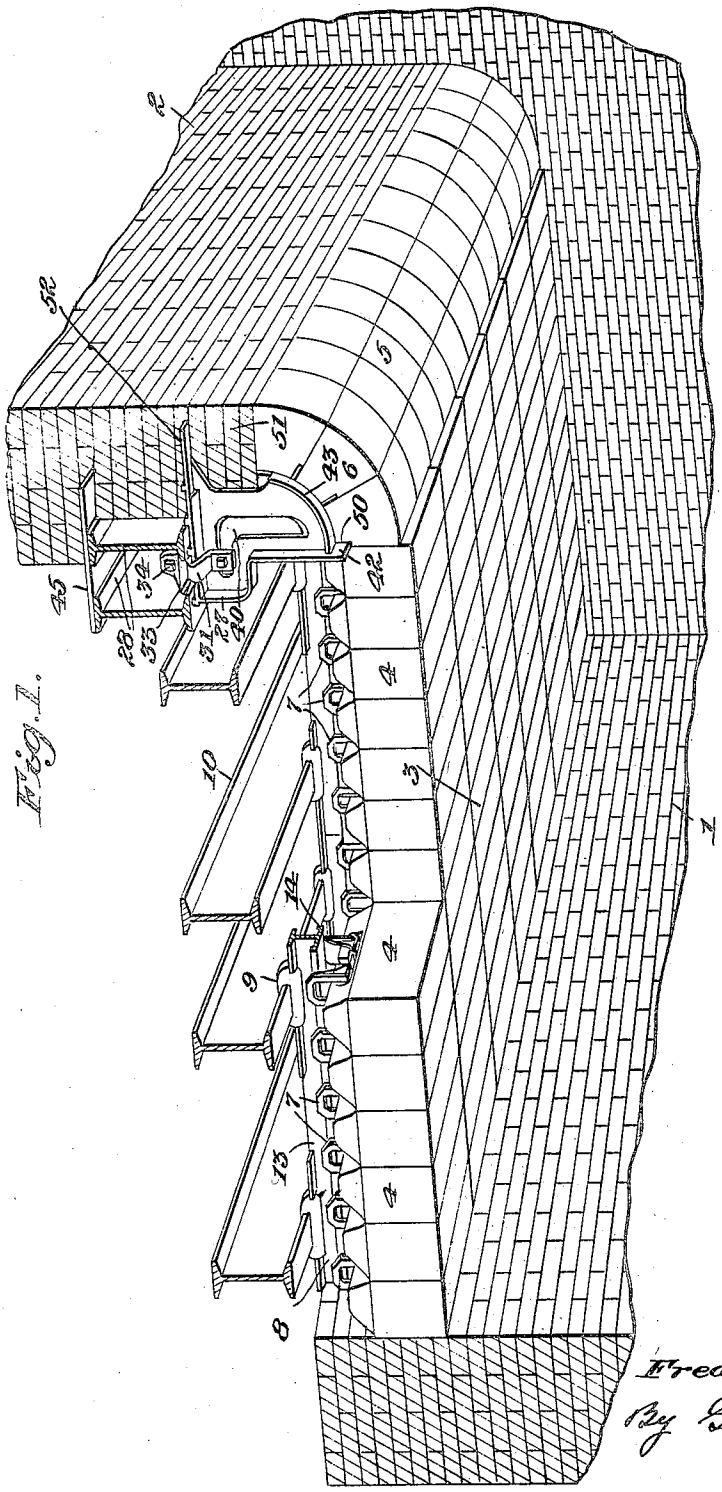


Fig. 1.

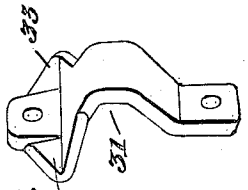


Fig. 9.

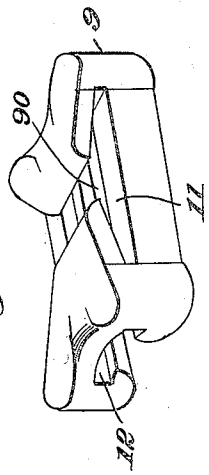


Fig. 8.

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FURNACE ARCH

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Fig. 2.

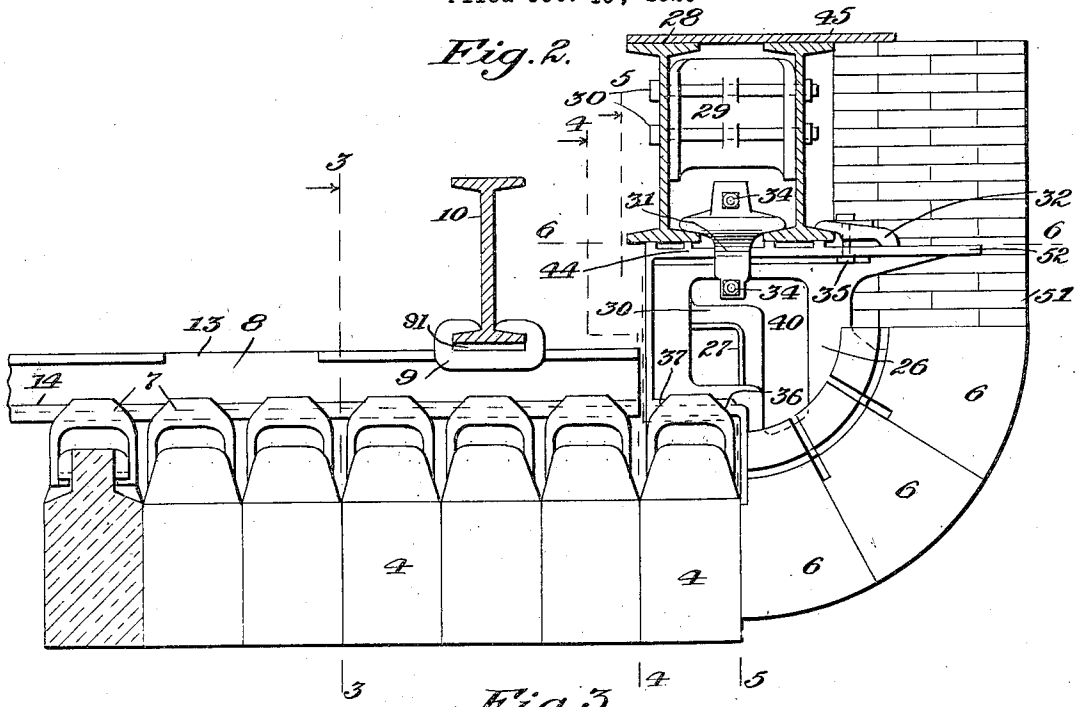
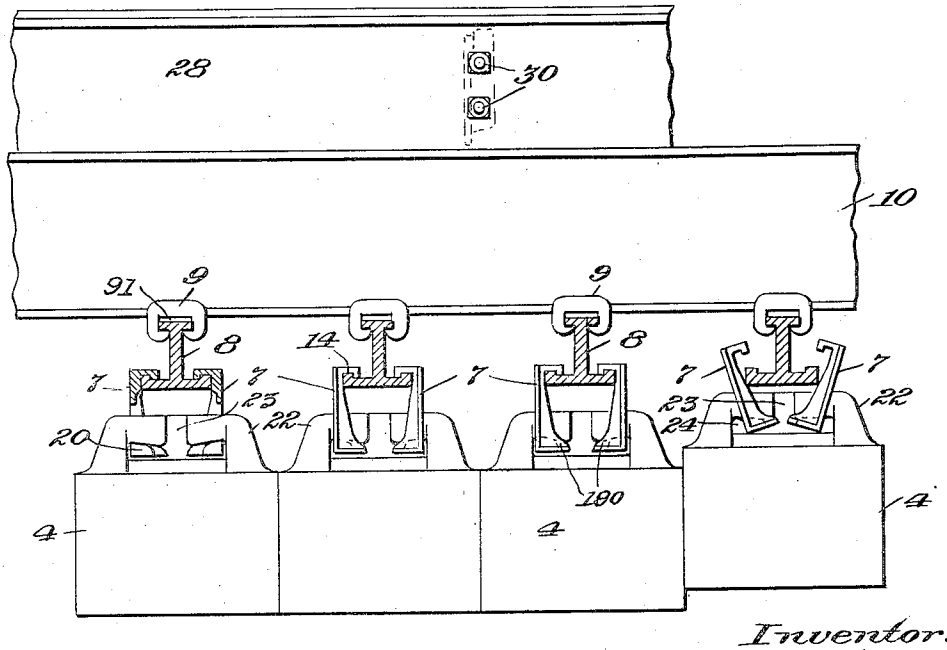


Fig. 3.



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Fig. 7.

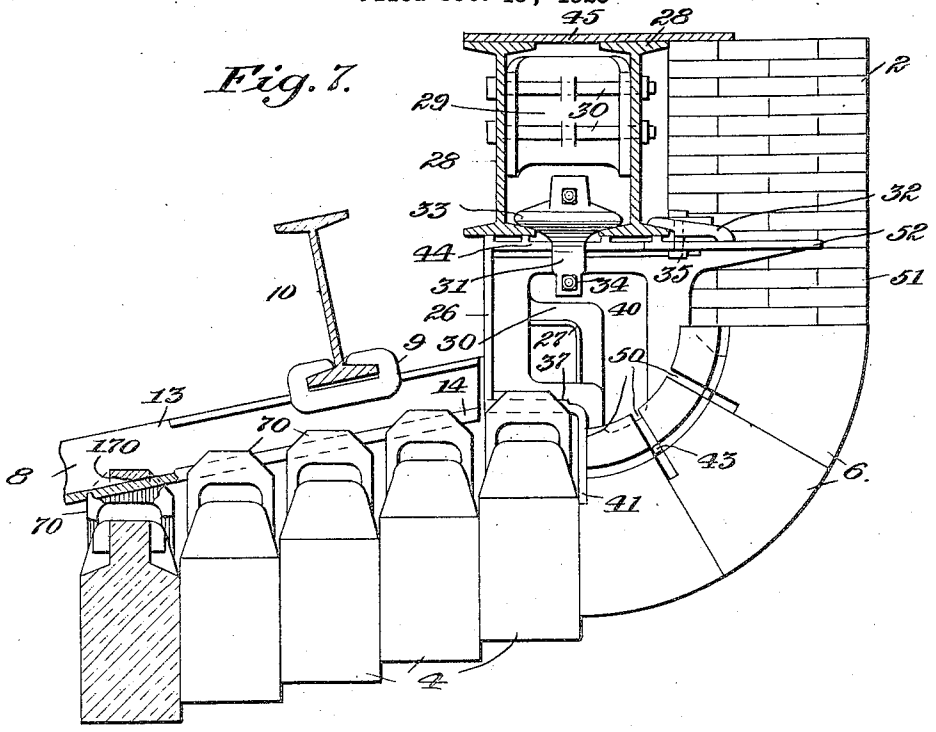
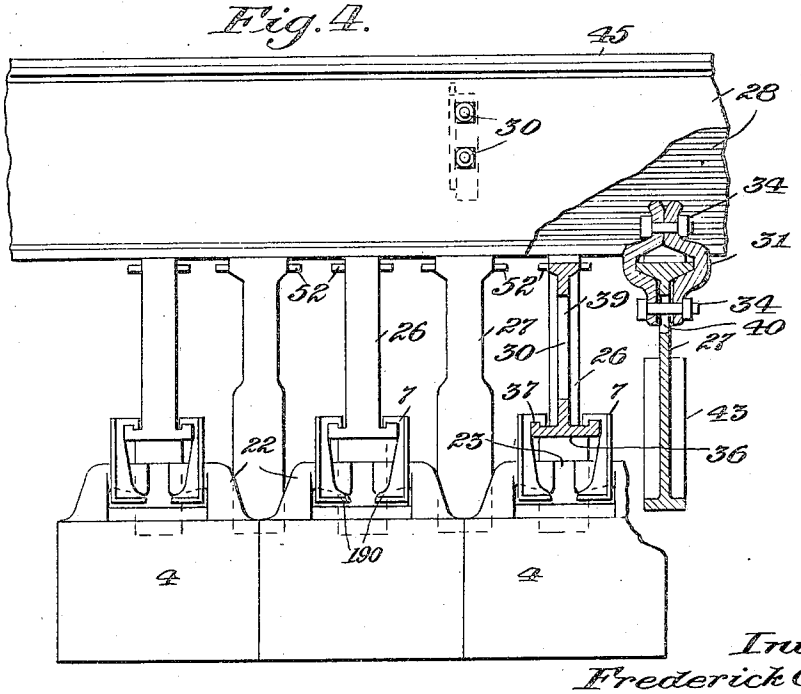


Fig. 4.



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Fig. 5.

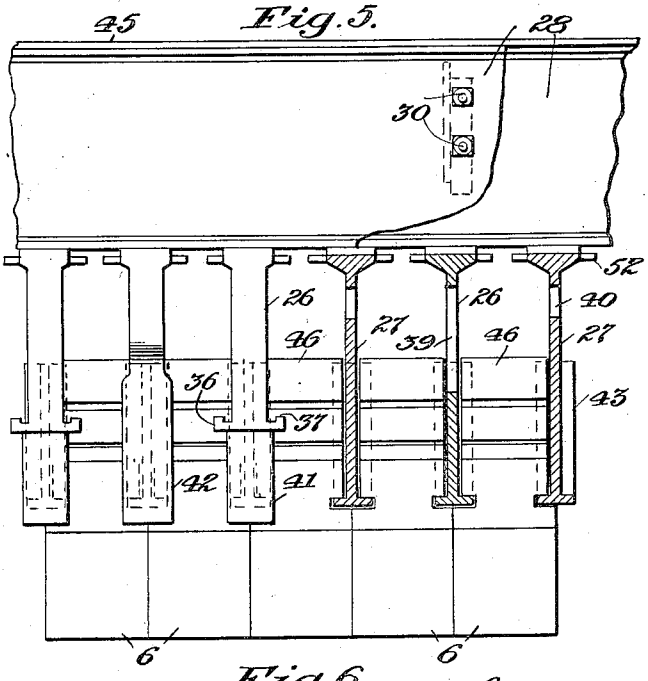
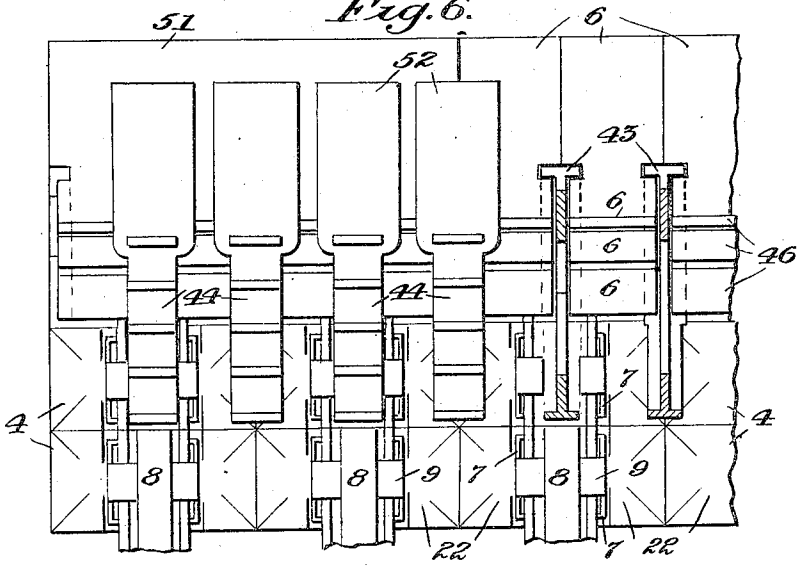


Fig. 6.



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FURNACE ARCH

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Fig. 11.

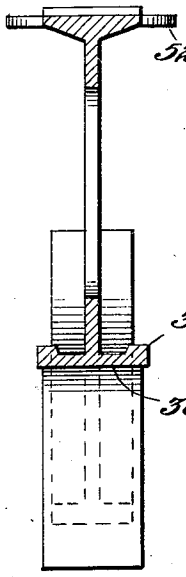


Fig. 10.

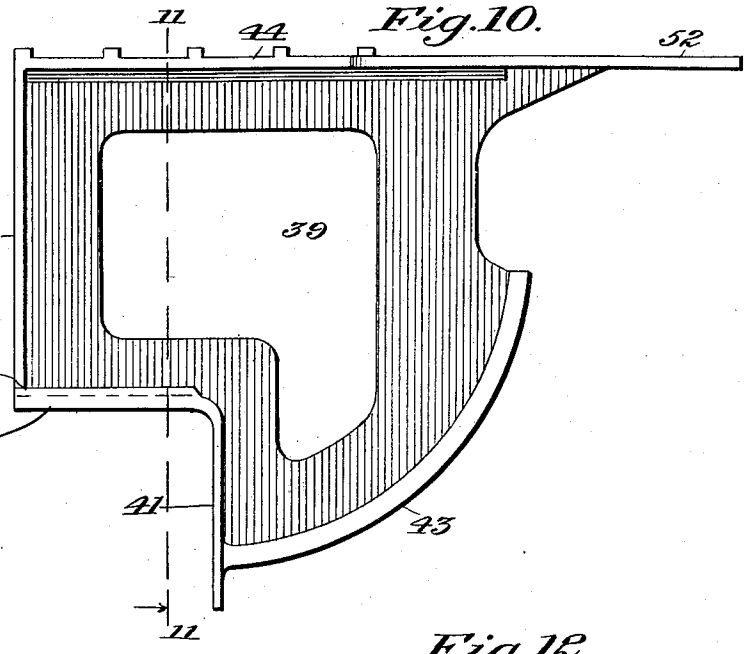


Fig. 12.

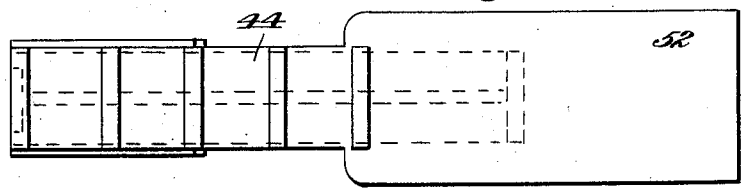


Fig. 13.

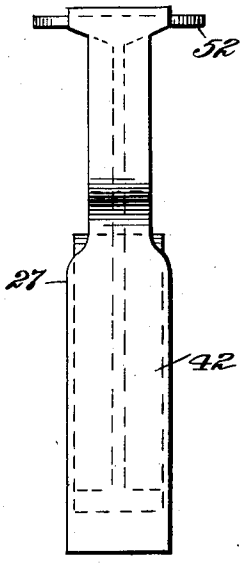
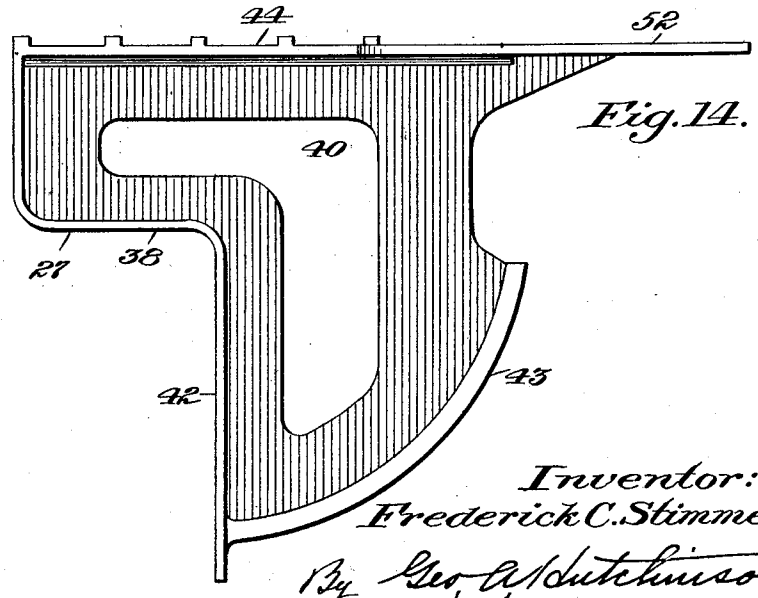


Fig. 14.



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FURNACE ARCH

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Fig.15.

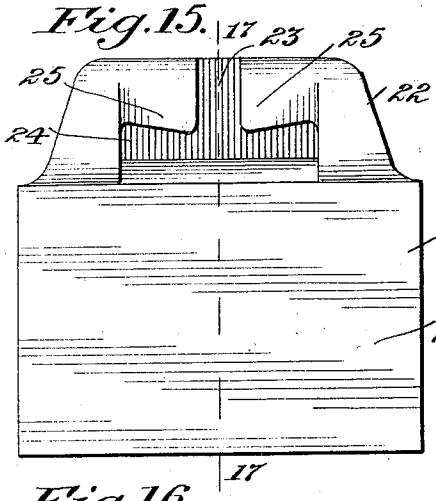


Fig.17.

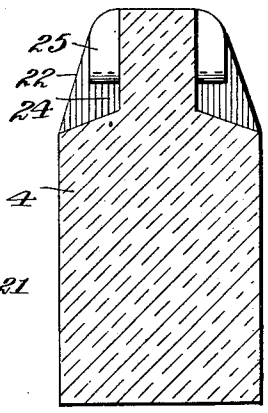


Fig.18.

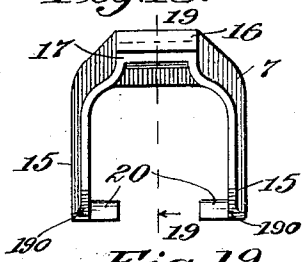


Fig.19.

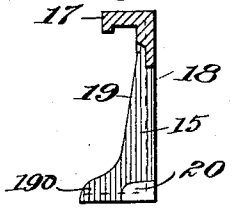


Fig.16.

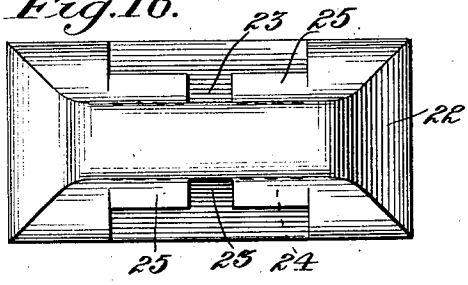


Fig.20.

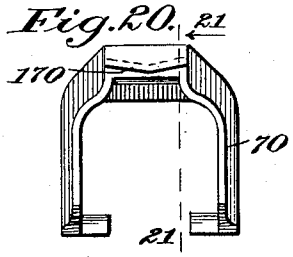


Fig.21.

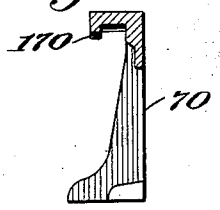


Fig.22.

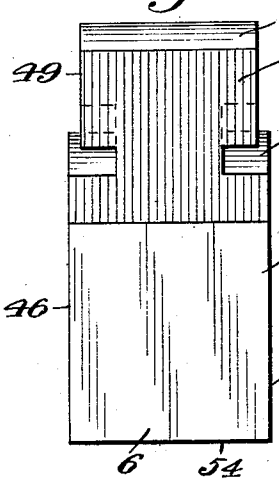
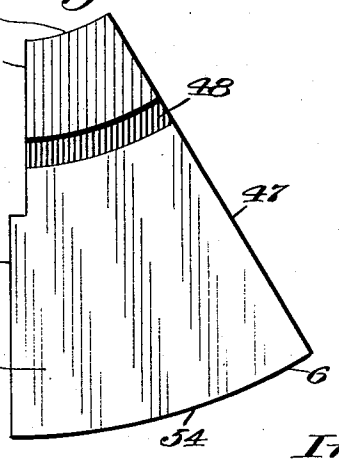


Fig.23.



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Patented June 9, 1925. 1,541,441

UNITED STATES PATENT OFFICE.

FREDERICK C. STIMMEL, OF CHATTANOOGA, TENNESSEE, ASSIGNOR TO THE CASEY-HEDGES CO., OF CHATTANOOGA, TENNESSEE, A CORPORATION OF OHIO.

FURNACE ARCH.

Application filed October 19, 1923. Serial No. 669,511.

To all whom it may concern:

Be it known that I, FREDERICK C. STIMMEL, a citizen of the United States, residing at Chattanooga, in the county of Hamilton and State of Tennessee, have invented certain new and useful Improvements in Furnace Arches, of which the following is a full, clear, and exact specification.

This invention relates to furnace arches for steam boilers and is especially designed for use in the construction of ceilings for offset fireboxes.

It is the aim of the invention to provide improved and simplified means for supporting the tiles constituting the main ceilings of such offset fireboxes, so that said tiles may be removed individually and new ones substituted therefor without necessitating the removal of other tiles. Said main ceiling tiles are suspended from supporting rails in such a manner that when one of said tiles is to be removed it may be automatically disengaged from its supporting rail by simply pushing said tile upward from below the ceiling or inside the firebox, it being unnecessary to tear up the roof of the firebox or otherwise obtain access to the supporting means above said tiles. These main ceiling tiles, which are individually suspended and may be individually removed, will hereinafter be referred to as the pendulum hanger tiles.

Another object of the invention is to provide improved means for supporting the tiles composing the curved inner end portion of the firebox ceiling where the main ceiling joins the base of the front wall of the boiler setting at the rear or inner end of the offset firebox. These tiles, because of their shape and arrangement, will be hereinafter referred to as fan tiles to distinguish them from the pendulum hanger tiles composing the main ceiling of the firebox. Said fan tiles are supported in such a manner that they may be removed for renewal by simply taking out a small section at the base of the front wall of the boiler setting arranged just above said tiles, the main portion of said wall above said removable section having independent supporting means so that when said removable section is taken out a space is provided immediately above the upper row of the fan tiles through which the several rows of said tiles may be successively removed.

The invention also contemplates the use of novel forms of pendulum hanger tiles and fan tiles, which are shaped or formed to properly co-operate with their supporting means in order to permit said tiles to be removed as explained, and also to permit each of said types of tiles to be interchangeably used with others of the same type. Other objects will appear as the description proceeds.

The invention will be first hereinafter described in connection with the accompanying drawings, which constitute part of this specification, and then more specifically defined in the claims at the end of the description.

In the accompanying drawings, wherein similar reference characters are used to designate corresponding parts throughout the several views:

Figure 1 is a broken perspective view of the ceiling of an offset firebox for steam boilers constructed substantially in accordance with this invention.

Figure 2 is a fragmentary view of a portion of said ceiling drawn to a larger scale with parts in section.

Figure 3 is a section on the line 3—3 of Figure 2.

Figure 4 is a section on the line 4—4 of Figure 2.

Figure 5 is a section on the line 5—5 of Figure 2.

Figure 6 is a section on the line 6—6 of Figure 2.

Figure 7 is a fragmentary view, similar to Figure 2, of an arch having its main portion or ceiling inclined instead of horizontal.

Figure 8 is a detailed perspective view, drawn to a larger scale, of one of the hanger clamps used for supporting the hanger beams from the main roof beams of the firebox.

Figure 9 is a detailed perspective view, also drawn to a larger scale, of one of the knee clamps used for supporting the knee brackets which, in turn, support the fan tiles and the adjacent row of pendulum hanger tiles.

Figure 10 is a detailed side elevation of one of the types of knee brackets used for

supporting the fan tiles and also for supporting the adjacent row of pendulum hanger tiles.

Figure 11 is a section on the line 11—11 of Figure 10.

Figure 12 is a plan view of the knee bracket illustrated in Figure 10.

Figures 13 and 14 are inner edge and side views, respectively, of another type of knee bracket used alternately with the type illustrated in Figures 10, 11 and 12 for supporting the fan tiles but which do not support the adjacent row of pendulum hanger tiles.

Figures 15 and 16 are side and top plan views, respectively, of one of the pendulum hanger tiles.

Figure 17 is a section on the line 17—17 of Figure 15.

Figure 18 is a detailed view of one of the tile clips used for supporting the pendulum hanger tiles composing the horizontal main portion of the ceiling of a fire box as illustrated in Figures 1 to 6, inclusive.

Figure 19 is a section on the line 19—19 of Figure 18. Figure 20 is a detailed view, similar to Figure 18, of a slightly modified form of tile clip for use in supporting the pendulum hanger tiles forming the inclined main ceiling of a firebox as illustrated in Figure 7.

Figure 21 is a section on the line 21—21 of Figure 20, and

Figures 22 and 23 are edge and side views, respectively, of one of the fan tiles.

In Figure 1 a part of an offset firebox for a steam boiler is indicated at 1, and the front wall of the boiler setting, which rises from the inner end of said firebox, is partially shown at 2. The ceiling of said firebox consists of a main horizontal portion 3 composed of pendulum hanger tiles 4, and a curved inner end portion 5 composed of fan tiles 6, said curved ceiling portion 5 extending from the inner end of the main ceiling portion 3 to the under surface of the front wall 2 of the boiler setting.

The pendulum hanger tiles 4 composing the main portion of the ceiling of the firebox are supported by tile clips 7 from I-beams 8 running longitudinally of the firebox and, in turn, suspended by hanger clamps 9 from transverse I-beams 10, the ends of which may rest on the side walls of the firebox. The hanger clamps 9, one of which is illustrated in detail in Figure 8, has transversely arranged grooves 11 and 12 to engage the base flanges of the I-beams 10 and the top flanges of the I-beams 8. Portions of the top flanges of said I-beams 8 are cut away at 13 to permit said clamps 9 to be conveniently assembled with said I-beams 8 and 10, as will be readily understood.

The base flanges of the I-beams 8 have upwardly turned edges 14 over which the tile clips 7 are adapted to hook. Two of said tile clips are used for supporting each of the pendulum hanger tiles 4, and the clips of each pair engage opposite edges of the base flange of one of the I-beams 8. Each of the clips 7 is formed in the shape of a stirrup as illustrated in detail in Figures 18 and 19 with two spaced arms or prongs 15 adapted to straddle the reduced top portion of the tiles 4, and a bridge portion 16 connecting the upper ends of said arms 15 and provided with a laterally extending hook 17 to engage over the upwardly turned edges 14 of the base flange of the I-beams 8. The outer faces 18 of the clips 7 are substantially vertical, as best shown in Figures 3, 4 and 19, but the inner faces 19 of the arms 15 of said clips are inclined inwardly and downwardly. From the lower ends of the arms 15 of each of the clips 7 horizontal lugs 20 extend toward each other. Said lugs are arranged substantially in line with the center of gravity of their clip, and they may be flush with the outer vertical face 18 thereof and spaced from the lower portions of the inclined inner faces 19 of said arms, see Figure 19.

Each of the pendulum hanger tiles 4 is formed as best illustrated in Figures 15, 16 and 17. Its body portion 21 comprises a rectangular block while its integral top portion 22 has upwardly converging side and end walls so that the top surface of the tile is considerably shorter and narrower than its body portion 21. The sides of the reduced top portion 22 of the tile are cut away, as shown, to form alined central vertical passages or grooves 23 and substantially horizontal passages 24 extending longitudinally in opposite direction from the bases of said grooves 23, leaving overhanging abutments or lugs 25 at opposite sides of each of said vertical grooves 23. The lower edges of said overhanging abutments or lugs are slightly inclined upwardly from the vertical grooves 23 to the extremities of the horizontal grooves 24. The width of the vertical grooves 23 is such as to permit the lugs 20 on the clips 7 to pass down them, and the vertical dimensions of the horizontal grooves 24 are such as to permit said lugs 20 to pass freely along the same below the overhanging abutments or lugs 25 of the tile 4. The width of the top portion of the reduced upper part 22 of the tile, between the vertical grooves 23 on opposite sides thereof, corresponds substantially to the distance between the lugs 20 on the clip 7.

Two of the clips 7 are used for supporting each of the pendulum hanger tiles 4 from the base flanges of the I-beams 8, as already explained, but said clips must be applied to the tile, one at a time. Thus, one clip is applied to the tile by having its lugs

20 passed down through the opposite vertical grooves 23 and then longitudinally along the opposite horizontal grooves 24 toward one end of the tile, after which the second clip is applied in the same manner downward through the grooves 23 and along the grooves 24 towards the other end of the tile. The lugs 20 of both clips will then be caught under the overhanging lugs or abutments 25, as best shown in Figures 3 and 4, and when suspended from the base flange of one of the I-beams 8, the inclined lower edges of said abutments 25 will tend to retain said lugs 20 in the outer end of the grooves 24 so that the clips will assume substantially vertical positions as shown. Inward projections 190 at the lower ends of the arms 15 of the clips 7 also serve to prevent the lugs 20 from coming out of the grooves 24.

When one of the tiles 4 is to be removed for renewal, it is only necessary to push upward on the same, as illustrated in the right hand portion of Figure 3, when the inclined inner faces 19 of the arms 15 of the clips 7 will engage the lateral edges of the base flange of the I-beam 8 and cause said clips to rock outwardly at their upper ends so as to release their upper hooked ends 17 from the upwardly turned edges 14 of said base flanges of the I-beam 8. When this rocking of the clips has been accomplished the tile may be lowered and removed from the ceiling of the firebox, and another tile substituted by reversing the operation just described.

Sometimes the ceilings of offset fireboxes are arranged on an incline instead of horizontal, and to effect such a change in the structure illustrated in Figures 1 and 2, the I-beams 8 and 10 may be inclined as shown in Figure 7. The tile clips 70, for supporting the pendulum hanger tiles 4 from the inclined I-beams 8, are constructed like the clip 7 already described except that their hook portions 170 are beveled in opposite directions as clearly illustrated in Figures 20 and 21 as well as Figure 7. By beveling said hooks 170 in opposite directions, the clips 70 are adapted to be used on supporting I-beams which are inclined in either direction, and said clips serve to support the tiles 4 in vertical position on said inclined beams.

The fan tiles 6 constituting the curved inner end section 5 of the firebox ceiling or arch are supported on knee brackets of which there are two types or forms 26 and 27. These knee brackets are hung from a pair of transverse I-beams 28 which are mounted in the front wall 2 of the boiler setting preferably on a slightly higher level than the I-beams 10. Said I-beams 28 are slightly spaced apart by spreader plates 29, see Figures 1, 2 and 7, and are fastened together by bolts 30 passed through said beams and plates. The knee brackets 26 and 27 are supported by knee clamps 31 and bracket washers 32. The knee clamps, one of which is illustrated in Figure 9, are arranged in pairs to embrace the upper flanges and webs of the knee brackets, as best shown in Figure 4, and have enlarged head portions 33 overlapping the adjacent lower flanges of the I-beams 28, as best shown in Figures 2 and 7. Said knee clamps are connected together at their upper and lower ends by bolts 34. The bracket washers 32 are connected to the upper flanges of the knee brackets by bolts 35, said washers resting at one end on said upper flanges of said knee brackets, while their other ends overlap the adjacent base flange of one of the I-beams 28.

The two types of knee brackets 26 and 27 are arranged alternately along the I-beams 28, the brackets 26 being spaced apart a distance equal to the length of the pendulum hanger tiles 4, and the brackets 27 being arranged midway between adjacent brackets 26. The brackets 26 have step-flanges 36 arranged substantially on the same level with the base flanges of the I-beams 8, as clearly shown in Figure 2. Said step-flanges 36 have upwardly turned edges 37 similar to the upwardly turned edges 14 of the I-beams 8, and they serve to support the inner row of pendulum hanger tiles 4, which contact with the lower row of the fan tiles 6. The knee brackets 27 have steps 38 arranged on a higher level than the step-flanges 36 of the brackets 26, and they, being located above the meeting ends of the inner row of pendulum hanger tiles 4, are not required to aid in the support of said tiles which are hung by clips 7 from said step flanges 36 of the brackets 26, as clearly illustrated in Figure 4. The knee brackets 26 and 27 have angular slots 39 and 40, respectively, in their vertical webs, said slots being shaped differently on account of the different height of the steps in said bracket, see Figures 10 and 14. The bolts 34, which connect together the assembled pairs of knee clamps 31, pass through said slots 39 and 40 in the webs of the brackets 26 and 27.

The knee brackets 26 and 27 have vertical flanges 41 and 42, respectively, extending downwardly from their step-flanges 36 and 38. From said vertical flanges, arcuate base flanges 43 extend upwardly and rearwardly for supporting the fan tiles 6. Said arcuate base flanges 43 extend on opposite sides of the webs of the knee brackets and terminate some distance below the top flanges 44 of the knee brackets. Said top flanges 44 extend rearwardly beyond the upper ends of the arcuate base flanges 43 of the knee brackets and have their rear portions 52 broadened for supporting the

main portion of the wall 2 which is also supported on plates 45 resting on the I-beams 28.

All of the fan tiles are preferably made alike so that they may be used interchangeably. As best illustrated in Figures 22 and 23, each of said fan tiles has parallel lateral faces 46 and diverging front and rear faces 47, the top and bottom faces 53 and 54 of each tile being arcuate and constituting concentric arcs of circles having their center at the point of meeting of extensions of the diverging faces 47. The faces 46 of the fan tiles 6 have arcuate grooves 48 formed therein to engage the arcuate base flanges 43 of the knee brackets 26 and 27, it being noted that the width of the fan tiles is one-half the length of the pendulum hanger tiles 4, see Figures 1 and 6. Above said arcuate grooves 48, the fan tiles are slightly reduced in width, as best shown in Figures 22 at 49, in order to allow for the thickness of the webs of the knee brackets, see also Figures 5 and 6. The upper portion of the rear face 47 of each fan tile is cut away at 50 to allow for the vertical flanges 41 and 42 of the knee brackets 26 and 27, respectively, so that the front row of fan tiles may abut against the rear row of the pendulum hanger tiles, as clearly shown in Figures 1, 2 and 7, said cut-away portions 50 being provided on the fan tiles of the other rows in order that they may be interchangeably used in the front row.

Between the rearmost row of fan tiles, which have their upper faces substantially horizontal, and the top flanges 44 of the knee brackets 26 and 27, there are several courses of bricks 51 at the base of the wall 2. When it is desired to replace any of the fan tiles, said section 51 of the wall 2 may be removed without dislodging the main portion of said wall which is carried on the top flanges 44 of the knee brackets and on the plates 45 on top of the I-beams 28. When said section 51 of the wall 2 is removed the rows of fan tiles may be successively raised above the upper ends of the arcuate base flanges 43 of the knee brackets and removed therefrom. The fan tiles are put in place in the same manner, successive rows being first introduced through the space formed by the removal of the section 51 of the wall 2, then having their arcuate grooves 48 engaged with the arcuate base flanges 43 of the knee brackets, and finally moved along said flanges to proper position. After the uppermost row of fan tiles, which is also the rearmost row, has been placed in position in this way, the section 51 of the wall 2 is built up to fill the space between said fan tiles and the main part of the wall 2 above the top flanges 44 of the knee brackets.

Referring again to the hanger clamps 9, it will be noted that the transversely arranged grooves 11 and 12 therein communicate with each other through slots 90, illustrated in Figure 8. In other words, the top of the lower slot 12 extends above the base of the upper slot 11, so that when each of said clamps 9 is assembled with the I-beams 8 and 10, ample clearance is provided, as indicated at 91 in Figures 2 and 3, to allow for the expansion and contraction of said I-beams.

I claim:

1. In a furnace arch of the character described, hanger beams having oppositely extending base flanges, pendulum hanger tiles, and tile clips for supporting said tiles from said beams, a pair of said clips having rocking engagement with each of said tiles and each pair of clips having hooked upper ends extending toward one another for engaging over the oppositely extending base flanges of the same hanger beam, the facing portions of each pair of clips being inclined downwardly and toward each other, whereby said pair of clips may have their hooked upper ends swung away from each other for disengaging them from the hanger beam under the action of said inclined portions engaging the base flanges of said hanger beam when a tile is pushed upward substantially as described.

2. In a furnace arch of the character described, hanger beams having oppositely extending base flanges with upwardly turned edges, pendulum hanger tiles, and tile clips for supporting said tiles from said beams, a pair of said clips having rocking engagement with each of said tiles and provided with hooked upper ends extending toward one another for engagement over the upwardly turned edges of the oppositely extending base flanges of the same hanger beam, the facing portions of each pair of clips being inclined downwardly and toward each other, whereby the hooked upper ends of said clips will be swung away from each other and disengaged from the upwardly turned edges of the base flanges of the hanger beam under the action of said inclined faces of the clips engaging said base flanges of the beam when a tile is pushed upward substantially as described.

3. In a furnace arch of the character described, hanger beams having base flanges, pendulum hanger tiles having reduced upper portions with recesses in their opposite faces, and tile clips for supporting said tiles from said beams, each clip having a hooked upper end portion for engaging over one of the base flanges of said beams, and each clip also having spaced downwardly extending arms to embrace the reduced upper portion of a tile, there being

inwardly extending lugs on said arms to engage the recesses in the opposite faces of said reduced upper portion of the tile.

4. In a furnace arch of the character described, hanger beams having oppositely extending base flanges, pendulum hanger tiles having reduced upper portions, and tile clips for supporting said tiles from said beams, a pair of said clips being employed for supporting each tile from the oppositely extending base flanges of the same hanger beam, the clips of each pair having hooked upper portions extending toward each other for engaging over said flanges, and each clip also having spaced downwardly extending arms embracing and connected to the reduced upper portion of a tile.

5. In a furnace arch of the character described, hanger beams having oppositely extending base flanges, pendulum hanger tiles having reduced upper portions, and tile clips for supporting said tiles from said beams, a pair of said clips being employed for supporting each tile from the oppositely extending base flanges of the same hanger beam, the clips of each pair having hooked upper end portions to engage over said oppositely extending flanges, and each clip also having spaced downwardly extending arms embracing and having rocking engagement with the reduced upper portion of a tile, the facing portions of the arms of each pair of clips being inclined downwardly and toward each other whereby the upper hooked ends of said clips may be swung away from each other and disengaged from the base flanges of the hanger tile under the action of said inclined portions of the arms of the clips engaging said flanges when the tile is pushed upward substantially as described.

6. In a furnace arch of the character described, hanger beams having oppositely extending base flanges, pendulum hanger tiles having reduced upper portions with alined vertical grooves disposed centrally of their opposite faces, there being horizontal grooves in the opposite faces of said reduced upper portions of said tiles, said horizontal grooves communicating with and extending in opposite directions from the lower ends of said vertical grooves, and tile clips for supporting said tiles from said beams, a pair of said clips being employed for supporting each tile from the oppositely extending base flanges of the same beam, the clips of each pair having hooked upper end portions extending toward each other to engage over said base flanges of a beam, and each clip also having spaced downwardly extending arms to embrace the reduced upper portion of a tile, there being lugs on the lower end portions of the arms of each clip to engage in the horizontal grooves in the opposite faces of said reduced upper portion of a tile, each pair of clips being attached to the tile they are to support by having the lugs on the arms of each clip successively passed down through the vertical grooves in the reduced upper portion of the tile and then along the horizontal grooves towards opposite ends of the tile.

7. In a furnace arch of the character described, hanger tiles having oppositely extending base flanges, pendulum hanger tiles having reduced upper portions with alined vertical grooves disposed centrally of their opposite faces, there being horizontal grooves in the opposite faces of said reduced upper portions of said tiles, said horizontal grooves communicating with and extending in opposite directions from the lower ends of said vertical grooves, and tile clips for supporting said tiles from said beams, a pair of said clips being employed for supporting each tile from the oppositely extending base flanges of the same beam, the clips of each pair having hooked upper end portions extending toward each other to engage over said base flanges of a beam, and each clip also having spaced downwardly extending arms to embrace the reduced upper portion of a tile, there being lugs on the lower end portions of the arms of each clip to engage in the horizontal grooves in the opposite faces of said reduced upper portion of a tile, each pair of clips being attached to the tile they are to support by having the lugs on the arms of each clip successively passed down through the vertical grooves in the reduced upper portion of the tile and then along the horizontal grooves towards opposite ends of the tile, the lower end portions of the arms of each pair of clips also having inward projections for retaining said lugs in said horizontal grooves when both clips of a pair are engaged therewith.

8. In a furnace arch of the character described, hanger tiles having oppositely extending base flanges, pendulum hanger tiles having reduced upper portions with alined vertical grooves disposed centrally of their opposite faces, there being horizontal grooves in the opposite faces of said reduced upper portions of said tiles, said horizontal grooves communicating with and extending in opposite directions from the lower ends of said vertical grooves, and tile clips for supporting said tiles from said beams, a pair of said clips being employed for supporting each tile from the oppositely extending base flanges of the same beam, the clips of each pair having hooked upper end portions extending toward each other to engage over said base flanges of a beam, and each clip also having spaced downwardly extending arms to embrace the reduced upper portion of a tile, there being lugs on the lower end portions of the arms of each clip to engage in the

horizontal grooves in the opposite faces of said reduced upper portion of a tile, each pair of clips being attached to the tile they are to support by having the lugs on the arms of each clip successively passed down through the vertical grooves in the reduced upper portion of the tile and then along the horizontal grooves towards opposite ends of the tile, the upper walls of the end portions of said horizontal grooves being inclined upwardly for the purpose specified.

9. In a furnace arch of the character described, hanger tiles having oppositely extending base flanges, pendulum hanger tiles having reduced upper portions with alined vertical grooves disposed centrally of their opposite faces, there being horizontal grooves in the opposite faces of said reduced upper portions of said tiles, said horizontal grooves communicating with and extending in opposite directions from the lower ends of said vertical grooves, and tile clips for supporting said tiles from said beams, a pair of said clips being employed for supporting each tile from the oppositely extending base flanges of the same beam, the clips of each pair having hooked upper end portions extending toward each other to engage over said base flanges of a beam, and each clip also having spaced downwardly extending arms to embrace the reduced upper portion of a tile, there being lugs on the lower end portions of the arms of each clip to engage in the horizontal grooves in the opposite faces of said reduced upper portion of a tile, each pair of clips being attached to the tile they are to support by having the lugs on the arms of each clip successively passed down through the vertical grooves in the reduced upper portion of the tile and then along the horizontal grooves towards opposite ends of the tile, the facing portions of each pair of clips being tapered downwardly and toward each other for the purpose specified.

10. In a furnace arch of the character described, hanger beams having inclined base flanges, pendulum hanger tiles, and tile clips for supporting said tiles from said beams, said clips having hooked upper end portions with beveled underfaces to engage over the inclined base flanges of said hanger beams for supporting said tiles in vertical position.

11. In a furnace arch of the character described, hanger beams having inclined base flanges, pendulum hanger tiles, and tile clips for supporting said tiles from said beams, said clips having hooked upper end portions with oppositely beveled underfaces to engage over the inclined base flanges of said hanger beams for interchangeably supporting said tiles in vertical position.

12. In a furnace arch of the character described, a main arch portion composed of pendulum hanger tiles, a curved arch portion arranged at the inner end of said main arch portion and composed of fan tiles having arcuate grooves in their lateral faces, said fan tiles being half the length of said pendulum hanger tiles, knee brackets having arcuate flanges to be engaged by the arcuate grooves in certain of said fan tiles, other knee brackets alternating with the first mentioned knee brackets and also having arcuate flanges to be engaged by the arcuate grooves in certain of the fan tiles, said latter knee brackets also having horizontal flanges for supporting a row of the pendulum hanger tiles adjacent said fan tiles.

13. In a furnace arch of the character described, a curved arch section composed of fan tiles having arcuate grooves in their lateral faces, knee brackets having arcuate flanges to be engaged by said arcuate grooves of the fan tiles for supporting the latter in place, a pair of spaced I-beams extending transversely of said knee brackets, and knee clamps fastened at their lower ends to the knee brackets and having heads on their upper end portion to overlap the adjacent base flanges of said pair of I-beams for supporting the knee brackets therefrom, said knee clamps being arranged in pairs and having bent intermediate portions to embrace the upper faces of the knee brackets, and bolts for connecting together the upper ends and the lower ends of each pair of knee clamps.

14. In a furnace arch of the character described, a curved arch section, brackets for supporting the same, a pair of I-beams extending transversely above said brackets, clamps connected at their lower ends to said brackets and having heads on their upper end portions to overlap adjacent base flanges of said beams for supporting said brackets from said beams, said brackets projecting laterally beyond the beams for supporting a wall thereon, and bracket washers secured to said laterally projecting portions of the brackets and overlying the adjacent base flange of one of the I-beams.

15. A pair of clamps for supporting a member, having oppositely extending top flanges, from a pair of spaced ledges, said clamps having heads on their upper end portions to overlap said ledges, said clamps also having oppositely bent intermediate portions to embrace the top flanges of the member to be supported, means for fastening the upper end portions of said clamps together, and means for fastening the lower end portions of said clamps to said member.

16. A bracket having an arcuate base flange for supporting a curved arch section, said bracket also having a stepped portion with a vertical flange against which the lower end of said arcuate flange abuts, and a

horizontal flange on said stepped portion on the other side of said vertical flange from the arcuate flange for supporting a horizontal arch section adjacent and substantially on the same level as the lower edge of said curved arch section.

17. A bracket having an arcuate base flange for supporting a curved arch section, said bracket also having a stepped portion with a vertical flange against which the lower end of said arcuate flange abuts, and a horizontal flange on said stepped portion on the other side of said vertical flange from the arcuate flange for supporting a horizontal arch section adjacent and substantially on the same level as the lower edge of said curved arch section, said horizontal flange having an upwardly turned edge for the purpose specified.

18. A bracket having a vertical web portion and oppositely extending arcuate flanges at the base of a part of said web for supporting a curved arch section, said bracket also having oppositely extending horizontal flanges at the base of another part of the web for supporting a horizontal arch section adjacent said curved arch section, said horizontal flanges being arranged above said arcuate flanges, and there being oppositely extending vertical flanges extending from said horizontal flanges to said arcuate flanges for the purpose specified.

19. A pendulum hanger tile for furnace arches, having a rectangular body portion and a reduced top portion, there being alined vertical grooves and communicating horizontal grooves in the opposite faces of said reduced upper portion of the tile for the purpose specified, said horizontal grooves extending in opposite directions from the bases of said vertical grooves.

20. A pendulum hanger tile for furnace arches, having a rectangular body portion and a reduced top portion, there being alined vertical grooves and communicating horizontal grooves in the opposite faces of said reduced upper portion of the tile for the purpose specified, the upper walls of said horizontal grooves being inclined upwardly from the bases of said vertical grooves.

21. A pendulum hanger tile for furnace arches, having a rectangular body portion and a reduced top portion, there being alined vertical grooves and communicating horizontal grooves in the opposite faces of said reduced upper portion of the tile for the purpose specified, said horizontal grooves extending in opposite directions from the bases of said vertical grooves, and the upper faces of the opposite end portions of said horizontal grooves being inclined upwardly from said vertical grooves.

22. In a furnace arch of the character described, pendulum hanger tiles having reduced upper portions with alined vertical grooves in their opposite faces, there being horizontal grooves communicating with said vertical grooves in said opposite faces of the reduced upper portions of the tiles, and tile clips for supporting said tiles, said clips having spaced downwardly extending arms to embrace the reduced upper portions of the tiles, there being lugs on the lower end portions of said arms to engage in the horizontal grooves in the opposite faces of the reduced upper portions of the tiles, said lugs being introduced into said horizontal grooves through said vertical grooves.

23. In a furnace arch of the character described, pendulum hanger tiles having reduced upper portions with alined vertical grooves in their opposite faces, there being horizontal grooves communicating with said vertical grooves in said opposite faces of the reduced upper portions of the tiles, and tile clips for supporting said tiles, said clips having spaced downwardly extending arms to embrace the reduced upper portions of the tiles, there being lugs on the lower end portions of said arms to engage in the horizontal grooves in the opposite faces of the reduced upper portions of the tiles, said lugs being introduced into said horizontal grooves through said vertical grooves, the upper walls of said horizontal grooves being inclined upwardly from the vertical grooves for the purpose specified.

24. In a furnace arch of the character described, pendulum hanger tiles having reduced upper portions with alined vertical grooves in their opposite faces, there being horizontal grooves in said opposite faces of the reduced upper portions of said tiles, said horizontal grooves communicating with and extending in opposite directions from the lower ends of said vertical grooves, and tile clips for supporting said tiles, a pair of said clips being employed for supporting each tile, said clips having spaced downwardly extending arms to embrace the reduced upper portions of the tiles, there being lugs on the lower end portions of said arms to engage in the end portions of said horizontal grooves in the opposite faces of said reduced upper portions of the tiles, said lugs being introduced into said horizontal grooves through said vertical grooves.

25. In a furnace arch of the character described, pendulum hanger tiles having reduced upper portions with alined vertical grooves in their opposite faces, there being horizontal grooves in said opposite faces of the reduced upper portions of said tiles, said horizontal grooves communicating with and extending in opposite directions from the lower ends of said vertical grooves, and tile clips for supporting said tiles, a pair of said clips being employed for supporting each tile, said clips having spaced down-

wardly extending arms to embrace the reduced upper portions of the tiles, there being lugs on the lower end portions of said arms to engage in the end portions of said horizontal grooves in the opposite faces of said reduced upper portions of the tiles, said lugs being introduced into said horizontal grooves through said vertical grooves, the upper walls of the end portions of said horizontal grooves being inclined upwardly from the vertical grooves for the purpose specified.

26. In a furnace arch of the character described, pendulum hanger tiles having reduced upper portions with alined vertical grooves in their opposite faces, there being horizontal grooves in said opposite faces of the reduced upper portions of said tiles, said horizontal grooves communicating with and extending in opposite directions from the lower ends of said vertical grooves, and tile clips for supporting said tiles, a pair of said clips being employed for supporting each tile, said clips having spaced downwardly extending arms to embrace the reduced upper portions of the tiles, there being lugs on the lower end portions of said arms to engage in the end portions of said horizontal grooves in the opposite faces of said reduced upper portions of the tiles, said lugs being introduced into said horizontal grooves through said vertical grooves, the lower end portions of said arms also having projections to extend along the horizontal grooves toward the vertical grooves for retaining said lugs in said horizontal grooves when both clips of a pair are engaged therewith.

27. A stirrup-shaped tile clip for supporting a pendulum tile in a furnace arch, said clip having spaced downwardly extending substantially vertical arms to embrace the upper portion of a tile, said arms having lugs extending toward one another to interlock with said tile, said clip also having an integral cross-bar joining the upper ends of said arms and provided with a laterally extending hook to engage a supporting member.

28. A stirrup-shaped tile clip for supporting a pendulum tile in a furnace arch, said clip having spaced downwardly extending substantially vertical arms to embrace the upper portion of a tile, said arms having lugs extending toward one another to interlock with said tile, said clip also having an integral cross-bar joining the upper ends of said arms and provided with a laterally extending hook to engage a supporting member, the inner faces of said arms being inclined for the purpose specified.

29. A stirrup-shaped tile clip for supporting a pendulum tile in a furnace arch, said clip having spaced downwardly extending substantially vertical arms to embrace the upper portion of a tile, said arms having lugs extending toward one another to interlock with said tile said clip also having an integral cross-bar joining the upper ends of said arms and provided with a laterally extending hook to engage a supporting member, there being projections on the lower ends of said arms extending in the same directions as the hooks on the upper ends of the clips for the purpose specified.

30. A stirrup-shaped tile clip for supporting a pendulum tile in a furnace arch, said clip having spaced downwardly extending substantially vertical arms to embrace the upper portion of a tile, said arms having lugs extending toward one another to interlock with said tile, said clip also having an integral cross-bar joining the upper ends of said arms and provided with a laterally extending hook to engage a supporting member, said hook being beveled longitudinally of the clip for the purpose specified.

31. A stirrup-shaped tile clip for supporting a pendulum tile in a furnace arch, said clip having spaced downwardly extending substantially vertical arms to embrace the upper portion of a tile, said arms having lugs extending toward one another to interlock with said tile, said clip also having an integral cross-bar joining the upper ends of said arms and provided with a laterally extending hook to engage a supporting member, said hook being beveled in opposite directions longitudinally of the clip for the purpose specified.

In testimony whereof I have signed my name to this specification.

FREDERICK C. STIMMEL.