C. E. DAVIS.

MEANS FOR SUPPORTING TOP AND SIDE TILES OF FURNACES.

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1,402,482. Patented Jan. 3, 1922.

Fig. 1.

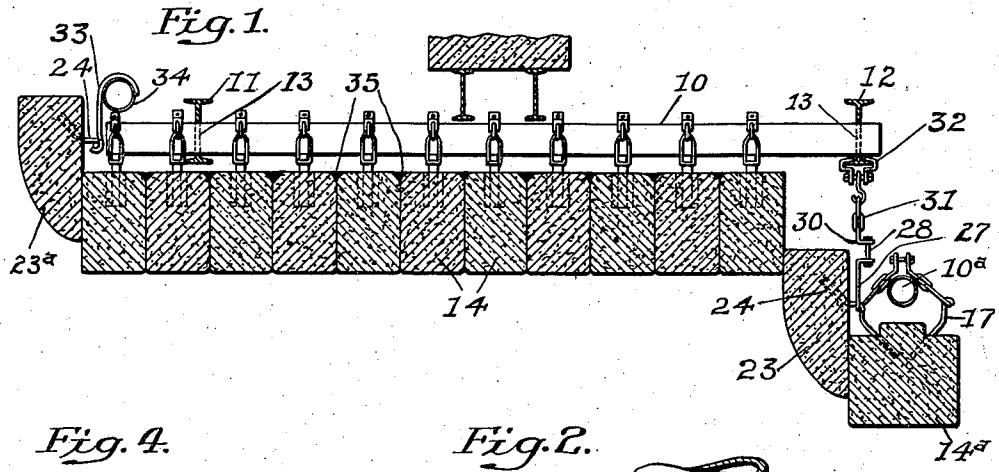


Fig. 4.

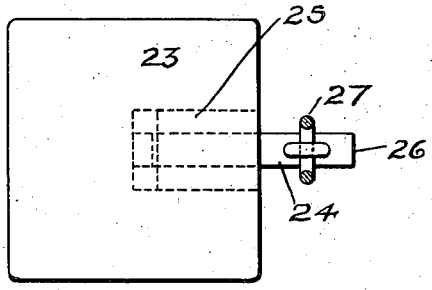


Fig. 2.

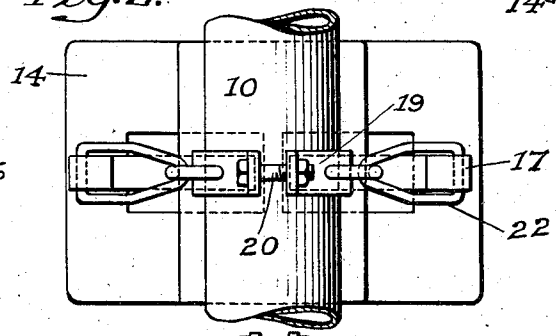


Fig. 5.

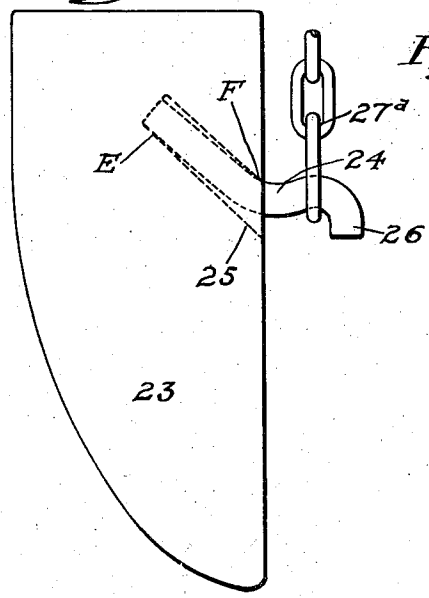
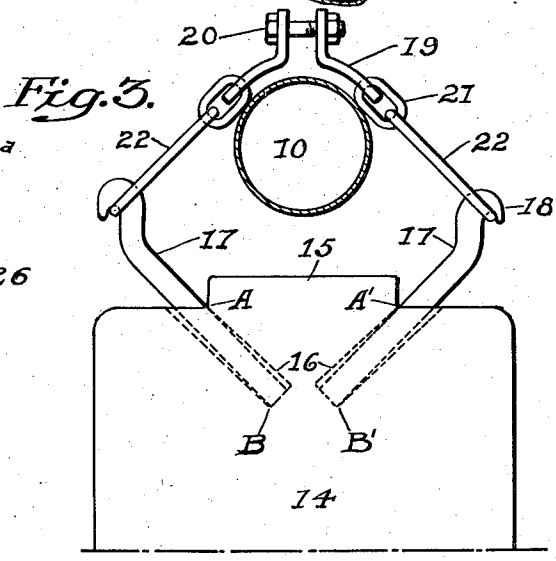


Fig. 3.



Inventor:
Carleton E. Davis
by Watson & Coleman
Attorney.

UNITED STATES PATENT OFFICE.

CARLETON E. DAVIS, OF PHILADELPHIA, PENNSYLVANIA.

MEANS FOR SUPPORTING TOP AND SIDE TILES OF FURNACES.

1,402,482. Specification of Letters Patent. Patented Jan. 3, 1922.

Application filed March 3, 1920. Serial No. 363,046.

To all whom it may concern:

Be it known that I, CARLETON E. DAVIS, a citizen of the United States, residing at Overbrook, Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Means for Supporting Top and Side Tiles of Furnaces, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to means for supporting slabs or blocks of brick, and particularly to means designed for the purpose of supporting slabs of fire brick or other refractory material over or around furnaces, though this system of construction is not limited to any such use.

One of the objects of the invention is to provide improved means for supporting slabs, tiles or blocks of the character described whereby to form a flat arch or form a wall, the supporting construction being such that each tile or slab is supported by metal hangers or supporting members so inserted in the tile as to set up or cause a turning couple in the tile which would cause a turning movement of the tile were it not resisted by opposed forces.

A further object is to so construct a wall of tiles or slabs as to cause a turning couple in the tile or slab which is opposed by other portions of the arch or wall.

A further object is to so support each tile or slab that any tile or slab may be removed or replaced without removing or affecting any other tile or slab except to remove adhering parts of the replaced tile from adjacent tiles.

Another object is to provide means for supporting the tile or slab which includes hangers disposed entirely within the vertical planes bounding the tile or entirely within the projection of said vertical planes so as to permit all parts of the supporting device in engagement with the tile to be kept within said vertical planes bounding the tile and thus permit the tile to be removed or adjusted without affecting any other tile.

A further object is to provide a support for a tile or slab of such character as to cause the tile or slab to maintain a simultaneous contact with the end tiles of two arches at different levels or with an arch in a wall, or where the horizontal distance between the arches or two sections of an arch or between an arch in a wall is either decreased or increased by a movement of either or both arches, sections, or the arch and wall.

A further object is to use for the support of a tile or slab a hanger which is inclined to a vertical plane and which extends into an opening in the tile, which hanger by its engagement with two spaced points on the tile causes a turning couple to be set up within the tile.

A further object is to provide a support for tiles or slabs of furnaces comprising hangers inserted in openings in the tiles or slabs in an upwardly divergent relation, these hangers being operatively connected to a centrally disposed, external support whereby the turning couple caused by one hanger is resisted by the opposed turning couple caused by the other hanger.

And a further object is to provide means whereby the hangers of each tile may be supported by means of a central, external support, and the individual tiles raised or lowered without affecting adjacent tiles or slabs.

Another object is to provide a construction wherein the tiles or slabs are supported by means of a hollow, air-cooled supporting beam.

And another object is to provide means for running grouting along the outside joints of the tiles or slabs to thus prevent heat from passing between the contacting faces of the slabs or blocks.

Other objects will appear in the course of the following description.

My invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a vertical sectional view through the top portion of a furnace in which the slabs or blocks forming the arch or top of the furnace are supported in accordance with my invention;

Figure 2 is a top plan view of a portion of the supporting beam and one block or slab supported therefrom;

Figure 3 is a side elevation partially in section of the structure shown in Figure 2;

Figure 4 is a top plan view of another block used in the furnace and its hanger;

Figure 5 is a side elevation of the block shown in Figure 4 and its hanger;

Referring particularly to Figure 1, 10 designates a horizontally disposed supporting beam or arch bar, which, as illustrated,

is annular in cross section and is supported upon the I-beams 11 and 12, as by passing through openings 13 in these I-beams, though it is to be understood that these supporting beams 10 might be supported in any other suitable manner. These beams 10 are hollow and open at each end, and may be conveniently made of boiler tubes. These beams, because of their being hollow, are air cooled. The air may be caused to circulate therein either naturally or by forced or induced draft.

Each arch bar 10 supports a series of blocks 14, each block being made of refractory material and having any suitable dimensions. The upper face of each block is illustrated as having an upwardly extending portion 15 at its middle. Extending into the block on each side of its upwardly extending portion 15 and extending convergently downward are holes 16, these holes having any desired cross sectional shape and any desired area, but preferably being relatively narrow vertically and relatively wide horizontally. Disposed within these holes are the hangers 17, the shanks of which extend into the holes and the outer ends of these hangers are hook-shaped, as at 18. It will be seen from Figures 3, 4 and 5 that the shanks of these hangers have a diameter preferably less than the vertical height of the openings or holes 16, and that the diameter of the shank of each hanger is considerably smaller than the width of each opening 16. Thus when the upper ends of these hanges are drawn towards each other by the downward strain on the block, each hanger 17 bears at its lower end against the bottom of the hole, and intermediate its ends against the corner formed by the intersection of the hole with the upper surface of the block. In Figure 3 one of the hangers 17 is brought in contact with the block at the points A and B, and the other hanger at the points A′ and B′. The forces thus created by each hanger form a couple, which couple transmits a turning force to the block, but as there are two of these hangers, they cause opposing couples and, therefore, equilibrium is established in the block.

For the support of the series of blocks 14 on the beam 10, I provide a saddle extending over the beam or arch bar 10 for each block or slab, and this saddle comprises two angular irons 19 connected at their upper ends by a transverse bolt 20, these irons being formed at their lower ends with eyes connected by a link 21 to a relatively long stirrup 22, enlarged at its lower end to engage over the hook-shaped ends 18 of the hangers 17. The links 21 rest upon the end of the beam or arch bar 10, and the weight of the slab 14 will cause the upper ends of the hangers 17 to be drawn towards each other and the hanger held in binding engagement with the slab or block so that the greater the downward strain on the block, the greater will be the holding power of the hanger.

These tiles or slabs 14 are disposed in contact with each other, and yet it is obvious that they may be shifted longitudinally along the beam 10 and that they may be raised or lowered within a short range by tightening up or relaxing the bolt 20, and that one tile or slab may be readily removed or adjusted without affecting any other tile or slab. The hangers 17 are so arranged as to not intersect any vertical planes projected from the vertical planes of the tile. In other words, these hangers and the entire supporting mechanism are entirely within the facial planes of the tile. This permits the tiles or slabs to be removed or adjusted without affecting any other title of the series. In replacing a cracked, burned, or defective tile 14 without interfering with adjacent tiles, the tile 14 is removed from the bottom of the arch through the furnace itself and replaced in a similar manner. The object in making the openings 16 wider than the hangers 17 is to allow circulation of air for cooling the shanks of the hangers.

In Figure 1 I have illustrated at the right hand end of the figure the beginning of a second arch or of a side wall, consisting of a series of tiles 14^a, these tiles being likewise supported upon hangers such as have been described, but supported upon an arch bar 10^a extending transversely to the arch bars 10 and on a lower lever than the arch bars 10, it being understood that while I have illustrated only one bar 10 in the construction of the furnace, there will be a series of parallel bars 10 for each series of blocks 14. In order to form a joint between the first arch formed of the slabs 14 and the second arch or wall formed of the slabs 14^a, I dispose between the last one of the slabs 14 and the adjacent slab 14^a, the slab, block, or tile 23. This block has the usual form of blocks of this character, being rounded upon one face and supported, as illustrated in Figures 4 and 5, by a hanger 24 of the same form as the hanger 17, having its shank inserted in an upwardly inclined opening 25 having a width greater than the width of the shank and in which this shank fits loosely, the outer end of this shank being hook-shaped, as at 26, and adapted to engage with a link 27, as in Figure 1, or a chain 27^a, as in Figure 5, which link or chain in turn may be connected by a bolt 28 to an angular iron 30, in turn connected by a chain 31 to a hook supported by a hanger 32 engaging one of the beams 12, as illustrated clearly in Figure 1. By adjusting the bolt 28, it is possible to raise or lower the block 23 and it may be, of course, shifted longitudinally on the beam 12 by means of the hanger 32.

It will be noted that in the instance shown at the right hand end of Figure 1 and in

Figures 4 and 5, a turning couple is created by forces at the points of contact of the hanger with the walls of the opening 25. This turning couple is resisted by an opposing couple created from the contact of the block 23 at points E and F with the adjacent blocks, or by one of these forces E and F and the horizontal forces transmitted through the hanger, as is shown at the left hand end of Figure 1, wherein the block 23ª has a hanger 24 extending from it and supported by means of the hook-shaped member 33, whose upper end is hooked over the transversely extending, hollow, arch bars 34, and whose lower hooked end engages with the extremity of the hanger.

Thus, it will be seen that when the tile or slab 23 is disposed as illustrated at the right hand end of Figure 1, the swinging tendency of the tile, caused by the turning couple, tends to force the upper inside face of the tile against an upper or adjacent slab, as the slab 14, while the lower outside face of the tile tends to swing against an outer adjacent slab, as for instance, the slab 14ª. Thus I support the tile by a metal hanger at such an angle as to cause the tile or slab to maintain simultaneous contact with the end tiles, slabs or blocks of two arches or two sections of an arch at different levels or an arch and a wall without regard to whether the horizontal distance between these arches or sections remains constant or is decreased or increased by a movement of either or both arches, sections or walls. The same principle applies to the slab, block or tile 23ª. It will be noted in Figure 1 that the upper corners of the blocks 14 are rounded or bevelled off so as to provide channels at the intersection of adjacent tiles, whereby grouting 35 of refractory or insulating material may be placed in these grooves as a sealing medium for the protection of the metal supports from gases which might escape through the irregularities in the contacting faces of the tiles.

While I have heretofore described my invention as applied particularly to a flat arch forming the top wall of a furnace, yet it will be understood that the principle of the invention might equally well be applied, as illustrated on the right hand side of Figure 1, to the formation of walls, or to a wall which will connect the rear of a suspended arch with a larger swung arch or joint, or the blocks 23 may be used to joint to a portion of a boiler or extend to baffling on the boiler tubes. I do not wish to be limited, therefore, to the use of this method or system of forming arches and walls with furnaces, as it will be obvious that this system might be used in a variety of different building constructions.

I claim:—

1. A structure of the character described including a supporting bar, a tile disposed below the supporting bar and having downwardly convergent holes therein, upwardly and outwardly diverging hangers disposed in said holes, and means engaging said hangers with said supporting bar.

2. A structure of the character described including a support, a tile or block disposed below the support and having an opening in one face thereof disposed at an inclination to the face, a hanger extending into said opening and having binding engagement therewith at spaced points with opposite walls of the opening, and an operative connection between said hanger and the support.

3. A structure of the character described including a support, a tile or block disposed below the support, a hanger inserted in an opening extending into the tile, said hanger being disposed to exert a turning force on the block or tile, means resisting the turning force, and means connecting the hanger to the support.

4. A structure of the character described including a support, a tile or block disposed below the support, the tile or block having a relatively large opening extending inward from one face of the block and at an angle to said face, a hanger having its vertical dimension less than the vertical dimension of said opening and inserted in said opening, suspending connections from the hanger to said support, said hanger engaging at spaced points with the upper and lower walls of the opening to thereby exert a turning force on the block or tile, and means opposing said turning forces.

5. A structure of the character described including a support, a tile or block disposed below the support and having openings extending downward and convergently from its upper face, downwardly convergent hangers disposed in said openings, the engagement of each hanger with the walls of said opening creating a turning couple, and one turning couple opposing the other turning couple, whereby the block is supported in equilibrium, and flexible suspending connections extending from the ends of the hangers to the support.

6. A structure of the character described including a support, a block disposed below the support and having upon one face an upwardly extending opening, a hanger having its shank disposed in said opening and extending downward and outward, and flexible connections from said hanger to the support, the hangers creating a turning couple in the block tending to rotate the block to bring the face having the opening toward a horizontal plane, a member bearing against that face of the block opposite to said opening and disposed above the point of engagement of the hanger with the flexible connec-

tion, and a member disposed against the opposite face of the block and below said point of connection, whereby said members create a couple opposing the turning couple created by said hanger.

7. A structure of the character described including a supporting member, a plurality of tiles disposed to one side of the supporting member and having their faces in contact with each other, and flexible supporting means attached to each tile and extending around the supporting member and permitting each tile to swing parallel to the supporting member and at right angles to the supporting member.

8. A structure of the character described including parallel, longitudinally extending supporting beams, a transversely extending, hollow, fluid cooled supporting bar, a series of tiles disposed below said supporting bar, each tile upon its upper face having downwardly converging openings, upwardly divergent hangers engaged in said openings in each tile, a saddle for each tile supported upon the bar, connections between said saddle and the hangers, a transverse, hollow, air cooled bar disposed at one end of the series of tiles, a series of tiles supported by said last named bar and disposed on a level below the first named tiles and spaced therefrom, and a tile disposed between said first named series of tiles and the second named tiles and having upon its outer face an upwardly and inwardly extending opening, a downwardly and outwardly extending hanger disposed in said opening, and flexible suspending connections for said tile, the upper inside face of said last named tile bearing against the outside face of the adjacent tile of the first named series, and the lower outside face bearing against a tile of the second named series, said adjacent tiles of the first and second named series resisting a turning movement of the second named tile.

9. A structure of the character described including an arch bar, a tile disposed below the arch bar and having downwardly converging holes therein, upwardly and outwardly converging hangers disposed in said holes, the holes being greater in size than the hangers, a saddle disposed over the arch bar, links operatively connecting the saddle to the hangers, the saddle being composed of two sections, and a bolt connecting said sections whereby they may be adjusted toward or from each other.

10. A structure of the character described including an arch bar, a tile disposed below the arch bar and having downwardly converging holes therein, upwardly and outwardly converging hangers disposed in said holes, the holes being greater in size than the hangers, a saddle disposed over the arch bar, links operatively connecting the saddle to the hangers, the saddle being composed of two sections, and a bolt connecting said sections whereby they may be adjusted toward or from each other, the hangers, the links, and said saddle being all disposed entirely within the vertical planes of the tiles suspended thereby.

11. A structure of the character described having an arch portion of one height and an adjacent portion of another height and spaced from the first arch portion, and a tile disposed intermediate said portions and contacting with the adjacent ends of these portions and supported independently thereof, said tile being so supported that the upper end of the tile tends to swing toward one portion and the lower end of the tile tends to swing toward the other portion.

12. A construction of the character described having an arch portion of one height and an adjacent portion of another height and spaced from the first named arch portion, a tile disposed intermediate said portions and contacting with the adjacent end faces of said portions, and a depending supporting member engaged with one face of the tile whereby the tile is swingingly supported independently of the adjacent tiles so that the upper end of one face tends to swing toward one portion and the lower end of the tile tends to swing toward the other portion.

13. A structure of the character described having an arch portion of one height and an adjacent portion of another height and spaced from the first named arch portion, a tile disposed intermediate said portions and contacting with the end faces of these portions, said tile having an opening extending downwardly toward the top of the lower arch portion, a hanger disposed in said hole and extending to the outer face of the tile, and a depending suspending member connected to said hanger, said tile being supported by the hanger entirely independently of adjacent tiles.

In testimony whereof I hereunto affix my signature.

CARLETON E. DAVIS.