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E. P. STEVENS

HANGING ARCH CONSTRUCTION

Original Filed Dec. 19, 1919.

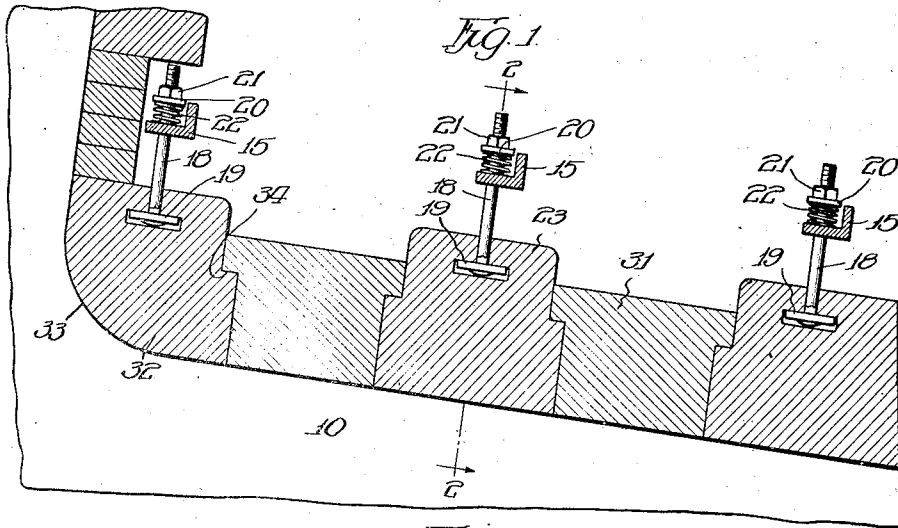


Fig. 1

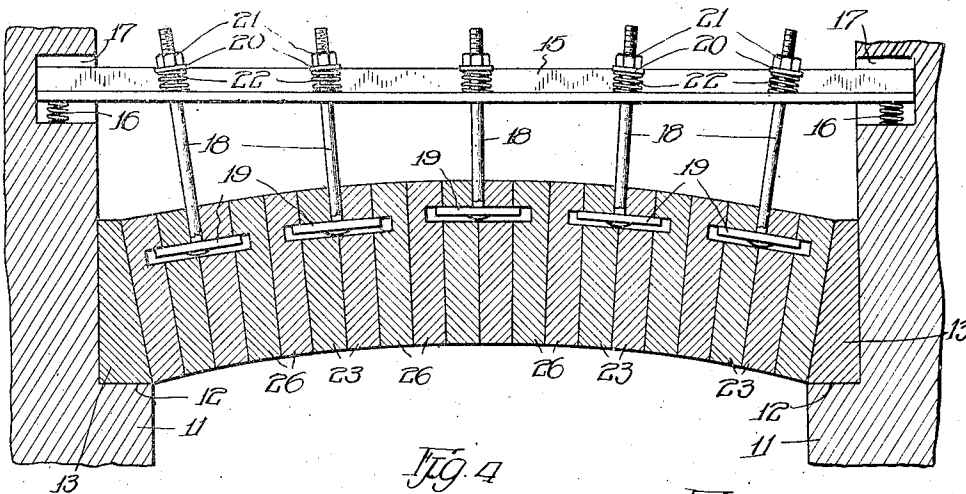
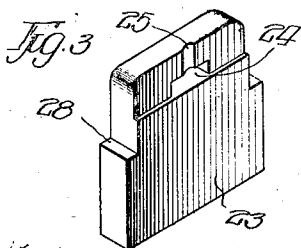
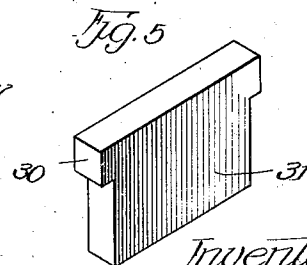
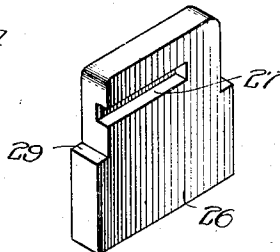


Fig. 2



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UNITED STATES PATENT OFFICE.

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HANGING-ARCH CONSTRUCTION.

Application filed December 19, 1919, Serial No. 346,155. Renewed July 6, 1923.

To all whom it may concern:

Be it known that I, ENOCH P. STEVENS, a citizen of the United States, residing at Morgan Park, Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Hanging-Arch Constructions, of which the following is a specification.

My invention relates to arches, and more particularly, although not exclusively, to hanging arches for use in furnace roof construction for boiler furnaces, open hearth steel furnaces, annealing furnaces, malleable iron furnaces, kilns and the like. My invention is particularly useful where the roof is to be subjected to heat, but it may also be employed for arches in buildings and the like where the arches are not subjected to heat and where a particularly strong construction is desired.

In this specification the term "arch" is used as referring not only to a sprung arch, as illustrated in the drawings, but also to a flat arch, which may readily be constructed in accordance with my invention.

One of the objects of my invention is to provide an arch construction which will be particularly strong, in order to prevent collapse of the arch while at the same time attaining the necessary strength by the use of a minimum number of supporting elements.

Another object of my invention is to construct an arch in such manner that some of the bricks composing the same may be readily removed and replaced without disturbing the rest of the arch.

Another object of my invention is to construct a furnace roof having a plurality of transversely disposed rows of bricks with alternate rows of bricks supported by hangers, with intermediate rows supported on the hanger supported bricks, and with each hanger arranged to support a group of the bricks in the supported row.

A yet further object of my invention is to construct the bricks which are used for supporting purposes of thin sections, thereby giving ample opportunity for even heat distribution and avoiding the liability of cracking.

A still further object of my invention resides in a special construction and method of support of a furnace roof whereby any part of the same may be readily repaired

without necessitating the removal of the greater portion of the roof and without having to stop the operation of the furnace to which the roof may be applied.

A yet further object of my invention consists in the provision of means for counteracting the deleterious effects of expansion and contraction of the arch under varied heat conditions.

These and other objects of my invention will be more readily understood by reference to the drawings, in which—

Figure 1 is a vertical longitudinal section through a portion of an arch made in accordance with my invention;

Figure 2 is a transverse section taken on line 2—2 of Figure 1;

Figure 3 is a perspective view of one of the bricks forming the brick groups supported by a hanger;

Figure 4 is a perspective view of another of the bricks of the hanger supported group; and

Figure 5 is a perspective view of a brick such as are used in making the rows intermediate the supported rows of bricks.

The arch which is shown in the accompanying drawings is one which is adapted for use in a stationary boiler, although it will be understood that the scope of my invention is not limited to this specific construction.

The fire box portion of the boiler 10 is provided with the usual side walls 11, each of which is provided with a shoulder 12 on which rests the skewback bricks 13. Above the furnace and extending between the walls 11 are parallel beams 15, which are preferably in the form of angle bars. The ends of the beams 15 are supported in the end walls 11, preferably on coil springs 16, the object of which will presently be explained. The walls 11 have therein suitably disposed vertical slots 17 to allow vertical movement of the beams 15. Depending from the beams 15 are a plurality of hangers or carriers 18 which are longitudinally movable to the beams. In the form shown in the drawings the hangers comprise a bolt portion and a flat head portion 19. The hangers are mounted in the beams 15 in such manner that the longitudinal axes of the bolt portions are preferably radial with respect to the curvature of the arch, as shown in Fig-

ures 1 and 2, the proper radial position of the bolt being attained by provision of properly shaped washers or bearing members 20, beneath the nuts 21 which support the hangers in vertically adjusted positions. Surrounding the bolts 18 and interposed between washers 20 and beams 15, are coil springs 22.

Referring to Figure 2, it will be noted that every one of the hangers supports, in the arrangement shown, four bricks. The two inner bricks 23 have transversely extending continuous-walled apertures 24 therethrough, the size and shape of which conform to the head portion 19 of the hangers and through and beyond which said head extends. In order to permit the inner faces of the inner bricks 23 to contact when in position, recesses 25 are formed in the bricks which embrace the bolt portions of the hangers 18. The outer bricks 26 are formed with horizontally extending grooves 27 extending inward from the edge of the brick parallel to the abutting face, but transversely to the direction of support and in position to engage the ends of the heads 19 whereby these outer bricks 26 may be supported in the same position on the hanger as the inner bricks 23. The inner bricks 23 are applied to the hangers by being moved longitudinally of the head 19, that is, in a plane parallel to the beams 15, while the outer bricks 26 are applied to the hangers by being slid transversely to the direction in which the inner bricks 23 are applied. Following this construction, it will be noted that the bricks in the hanger supported row are so mounted in groups that four bricks are carried on one hanger, so that any group supported by a single hanger may be removed or renewed at any time desirable. The side edges of the bricks 23 and 26 are formed with shoulders 28 and 29, which, when the bricks are mounted on the hangers, form supporting means for the overhanging shoulders 30 formed on the bricks 31, so that intermediate rows of bricks may be formed by inserting a sufficient number of intermediate bricks 31 between the alternate rows of hanger supported bricks. This construction is readily observed in Figure 1 of the drawings.

It will be noted that the various types of bricks embodying my invention are flat as to the contacting faces thereof and that the various apertures and shoulders may be formed in the bricks when the same are made. The fact that in each of the two styles of bricks that comprise the group mounted upon a hanger the internal recesses which engage the supporting heads of the hangers are without unsupported projections, renders these bricks very much less liable to breakage, and the particular disposition of recesses in these two types of brick, namely a continuous-walled slot extending

through the inner pair of bricks and the groove extending but partly through the outer bricks of the single hanger group, not only insures this feature of fully supported walls to the recesses, but facilitates removal of one or more bricks of any group by a novel manipulation of the bricks which involves disturbance of a minimum number of unimpaired bricks adjacent thereto, as explained below. In Figure 1 the nose bricks 32 are shown mounted on hangers. These may be constructed to be supported by the hangers in the same manner that the bricks 23 and 26 are supported. In the form shown the bricks have curved corner portions 33 with shoulders 34 adapted to support the over-hanging shoulders 30 of the adjacent bricks forming the first row of supported bricks.

In forming a roof embodying my invention, the beams 15 are suitably mounted preferably on the springs 16 so that as the roof moves under the effect of heat, compensation for such movement may be provided by reason of the spring suspension of the beams. Furthermore, the interposition of the springs 22 in connection with the various hangers 18 serves as an additional means for compensating for the movement of the bricks under varying heat conditions. The beams 15 being in position, the various hangers are applied to the beams and adjusted at a height suitable to form the arch desired, and also at the proper angles. When the various hangers are in position the bricks 23 are slid in place and then the outer bricks 26 are applied to the various hangers, thereby forming a plurality of groups of supported bricks, the groups forming a single transverse arch. When the alternate rows of hanger supported bricks are suitably assembled, the intermediate rows of bricks may be formed by placing the intermediate bricks in position so that the projections 30 of the bricks 31 will engage shoulders 28 and 29 on the hanger supported bricks 23 and 26. It will then be apparent that any movement of the roof caused by varying conditions of heat may be compensated for in various ways. For instance, a single transverse row may be permitted to move vertically by reason of the resilient suspension of the hanger carrying beams 15. Then in addition, by reason of the resilient suspension of the hangers per se, movement of the groups of bricks may be compensated for as above described. It is of course understood that any movement of the hanger supported bricks may cause a corresponding movement of the intermediate rows of bricks 31.

All of the bricks embodied in my invention are preferably made of the same thickness for the purpose of reducing the cost of manufacturing and also for the purpose of

readily applying and removing the bricks to and from the roof. Suppose, for instance, it became necessary to remove the two inner bricks 23 of any group as shown in Figure 2. The only thing that is necessary to be done is to remove the bricks 31 immediately adjacent the bricks 26 and 23 of that particular group and then withdraw the bricks 26 of the group by sliding the same into the spaces left by removal of the bricks 31 and then move the bricks 23 on the head 19 of the hanger until such bricks become disengaged therefrom, and then sliding these laterally until removed in the same manner that the outer bricks 26 were removed. These bricks being removed, new ones may be supplied, and the group reassembled in the order inversely to that necessary for removal.

In the present embodiment of my invention I have shown the arch in the form of a sprung arch. It is well known that when such an arch is subjected to high temperatures, every brick tends to expand and the arch to rise. Since the arch is supported on the hangers 18, which in turn are carried by the beams 15, it will be evident that by reason of the resilient suspension of the beams 15 and of the individual resilient suspension of the hangers, the tension on the hangers at all times will be substantially the same, no matter how much the arch is moved by the action of the heat. Furthermore, the provision of such resilient means enables the height of the roof to be maintained in a substantially constant position, and any movement of the groups of bricks may be compensated for as above described.

While I have described more or less precisely the details of construction of my invention, I do not wish to be understood as limiting myself thereto, as I contemplate changes in form and the proportion of parts and substitution of equivalents as circumstances may suggest or render expedient, without departing from the spirit of my invention.

I claim:

1. In an arch construction, a series of hangers, a row of bricks extending in the direction of the series of hangers and in substantially balanced suspension beneath the same, said bricks having recesses and said hangers having engaging heads and the head of each hanger in engagement with a group of the bricks in the row, and an adjacent row of bricks supported on said hanger-supported bricks; a brick in a group supported by a hanger being removable in a direction transverse to its row, into a space left by removal of a brick in said adjacent row.

2. In an arch construction, a series of hangers, a row of bricks extending in the direction of the series of hangers and in sub-

stantially balanced suspension beneath the same, said bricks having recesses and said hangers having engaging heads and the head of each hanger in engagement with a group of the bricks in the row, and an adjacent row of bricks supported on said hanger-supported bricks; a brick in a group supported by a hanger being removable in a direction transverse to its row, into a space left by removal of a brick in said adjacent row; other bricks in a group of hanger-supported bricks being movable upon its hanger in the direction of its row to disengage it from the hanger, and being then removable from the row into said space.

3. In a brick arch, a hanger having a head and a group of bricks supported on said head, comprising an apertured intermediate brick through and beyond the side of which said head extends and an outer brick having a groove extending transversely to the direction of the hanger support, receiving the protruding end of said head.

4. In a brick arch, a hanger having a head, and a group of bricks supported on said head, comprising a plurality of inner bricks having slots through and beyond which said head extends and a pair of outer bricks having grooves in their faces which receive the protruding ends of said head, said grooves permitting removal of said outer bricks in a direction transverse of the head.

5. In a brick arch, a hanger having a head, and a group of bricks supported on said head, comprising a plurality of inner bricks having slots through and beyond which said head extends and a pair of outer bricks having grooves in their faces which receive the protruding ends of said head; the grooves of said outer bricks extending parallel to the face of the brick but transversely to the direction of hanger support and to the edge of the brick, whereby said bricks are releasable from the hanger by movement in a transverse direction.

6. In a brick arch, a hanger having a head, and a group of bricks supported on said head, comprising a plurality of inner bricks having slots through and beyond which said head extends and a pair of outer bricks having grooves in their faces which receive the protruding ends of said head, said grooves permitting removal of said outer bricks in a direction transverse of the head, said hanger embodying in its construction a suspending rod in the plane of the abutting faces of two inner bricks of the group.

7. In a brick arch, a hanger comprising a suspending rod and a transversely extending head thereon, and a group of bricks supported on said hanger comprising a pair of inner bricks recessed to receive the rod between their abutting faces and having continuous-walled slots extending through

them perpendicularly to said recessed faces, through and beyond which slots said head extends, and outer bricks abutting faces of said inner bricks and having slots in their abutting faces extending transversely to the direction of hanger support and receiving the protruding ends of said head.

8. In an arch construction, spaced rows of hanger supported bricks, and an intermediate row of bricks interposed between said hanger supported bricks; each row of hanger supported bricks comprising a series of groups of bricks with each group supported upon a hanger; each hanger comprising a suspending rod and a head; and the bricks in each group comprising a pair of inner bricks in between which the suspending rod projects, having transverse slots through and beyond which said head extends in opposite directions from said rod, and a pair of outer bricks abutting said inner bricks and having in their abutting faces grooves extending transversely to the direction of hanger support, which receive the protruding ends of said head and which extend to the edges of the bricks remote from the intermediate row of bricks.

9. In a furnace roof construction, a plurality of transversely disposed rows of bricks, hangers supporting alternate rows thereof, means for carrying said hangers, said hangers being mounted in said carrying means in such manner as to permit bodily movement thereof relatively to the carrying means without affecting sustaining engagement therebetween, and resilient means for supporting said carrying means whereby compensation in the height of the carrying means is made for variations in the

position of said rows of bricks under varying heat conditions.

10. In a furnace roof construction, a plurality of transversely disposed rows of bricks, hangers supporting alternate rows thereof, means for carrying said hangers, and resilient means for supporting said hangers relatively to said carrying means whereby compensation in the positions of said hangers is made for variations in the position of said rows of bricks under varying heat conditions.

11. In an arch construction, a rigid supporting beam, resilient means for sustaining said beam but permitting it to yield bodily to changes in load imposed upon it, a series of hangers on said beam with individual resiliency relatively thereto in the directions of the loads which they sustain, and a row of arch-forming bricks sustained by said hangers.

12. In an arch construction, in combination, a plurality of rows of bricks, hangers supporting said rows of bricks, means for carrying said hangers, and means for resiliently supporting said hangers relatively to said carrying means.

13. In an arch construction, in combination, a plurality of rows of bricks, hangers supporting said rows of bricks, means for carrying said hangers, resilient means for supporting said hangers in said carrying means, and means for resiliently supporting said carrying means in carrying position.

Signed at Biloxi, Mississippi, this 11th day of December, 1919.

ENOCH P. STEVENS.