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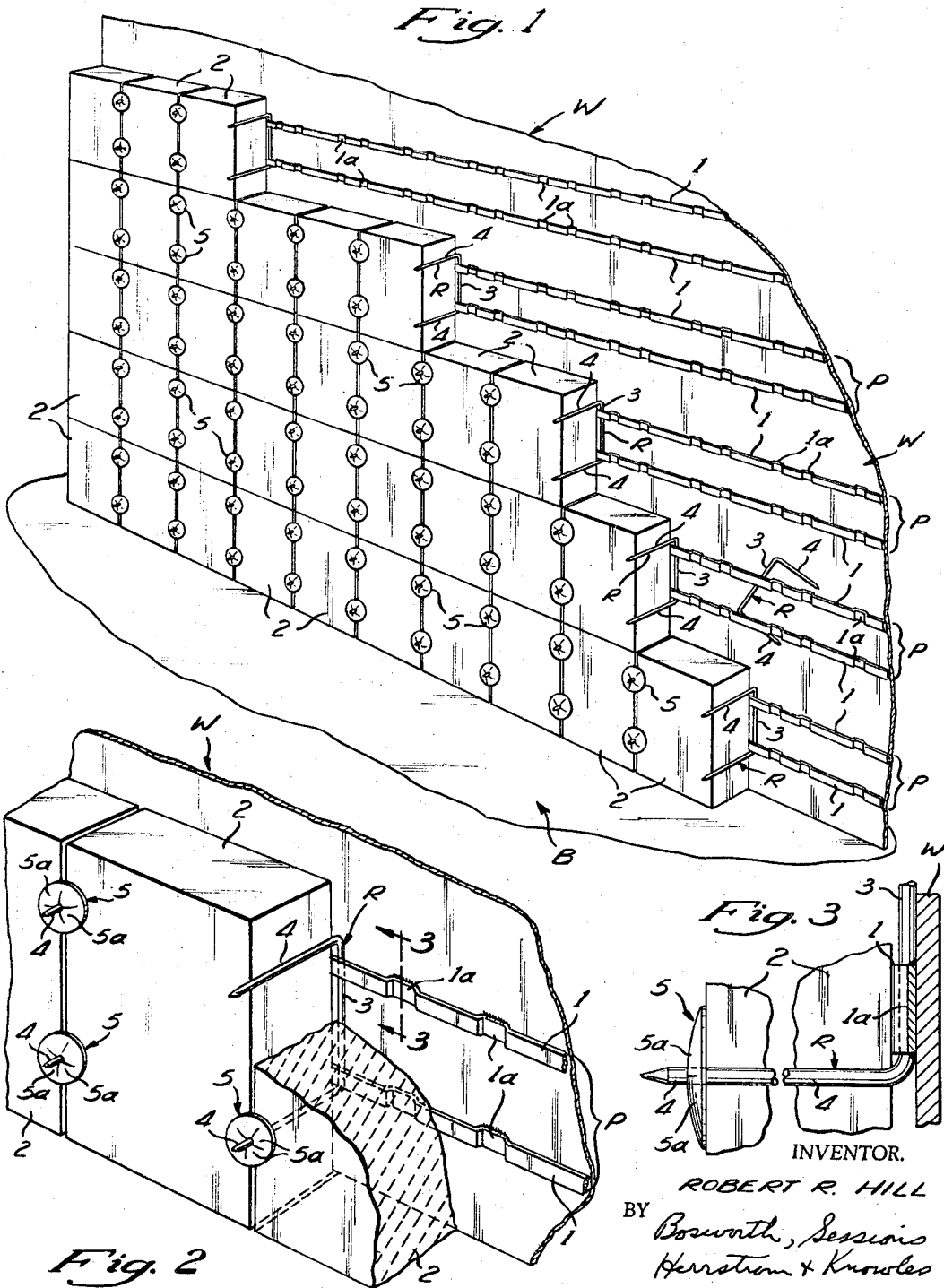


Fig. 3

Fig. 2

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WALL STRUCTURE WITH A METAL SHELL AND LINING BLOCKS SECURED BY SUPPORT BARS AND RETAINER PINS

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ABSTRACT OF THE DISCLOSURE

A wall structure, particularly adapted for furnaces that are lined with insulating or refractory blocks, in which an outer metal shell has a plurality of parallel support bars secured to its inner surface, the bars being spaced inwardly from the inner surface of the shell, and a plurality of U-shaped block retainer pins are supported with the base portions thereof between the shell and the support bars. The retainer pins have arm portions extending away from the shell between adjacent blocks and spaced apart sufficiently to permit limited movement of the pins transversely of the support bars. The base portions of the U-shaped pins are movable both longitudinally and transversely of said support bars between the bars and the outer shell. Adjustable locking means are mounted on the ends of the arm portions of the retainer pins, which extend beyond the inner faces of the lining blocks, and are movable on the arm portions to engage the faces of the adjacent blocks and hold the blocks against the support bars while permitting limited relative movement between the blocks and the support bars caused by expansion and contraction of the blocks, bars, or shell.

In many types of furnaces such as, for example, furnaces for annealing coils of strip steel, a metal outer furnace wall or shell is provided which is lined with suitable insulating or refractory material in the form of blocks or bricks. In the construction of the wall structures of such furnaces difficulty has been experienced due to the fact that, after the initial laying up of the blocks or bricks that form the lining, shrinkage of the blocks occurs during the initial operation of the furnace. Such shrinkage requires resetting of the blocks to take up the clearances formed and further requires that the blocks be resecured against the outer furnace wall or shell. This resetting operation is time consuming and expensive and it is among the objects of my present invention to provide a lined wall structure (it being understood where the term "wall" is used herein it is intended to comprehend and include ceiling and floor structures as well as side walls), particularly adapted for furnaces, whereby the individual blocks or bricks may be quickly and easily reset and resecured in position after shrinkage has occurred.

Among the other objects of my invention is the provision of means for firmly securing the individual lining blocks of a furnace wall structure firmly in position against the outer furnace wall or shell which means are relatively inexpensive to manufacture and install and are particularly adapted to facilitate removal and/or replacement of blocks that have become worn or damaged.

The above and other objects of my invention will appear from the following description of one embodiment thereof, reference being had to the accompanying drawing in which:

FIGURE 1 is a fragmentary perspective view of a portion of a refractory block lined furnace wall structure in which my block retaining means are employed to se-

cure the blocks in position and to facilitate resetting thereof after initial shrinkage.

FIGURE 2 is an enlarged fragmentary view of a portion of the wall shown in FIGURE 1 illustrating the block support bars and block retainer members in greater detail.

FIGURE 3 is a vertical cross-sectional view taken substantially on line 3—3 of FIGURE 2 and drawn to a somewhat enlarged scale.

As illustrated, the furnace floor or base is indicated at B and the furnace outer wall or shell member, which is commonly formed of steel plate, is seen at W. Secured to the inner face of the outer shell member W and, in the vertical wall illustrated extending horizontally, are a plurality of parallel narrow support bars 1. These bars are formed with longitudinally spaced offset pads 1a which, as clearly seen in FIGURE 2, are secured as by welding to the wall W. The offset of the pads 1a is sufficient to space the bars 1 from the wall W a distance substantially equal to the diameter of the block retainer members R as will more fully appear later.

The furnace lining is made up of a plurality of individual rectangular liner blocks 2, the bottom row of which is supported on the furnace floor or base B and succeeding rows are laid up one upon the other with the vertical edges of the blocks of the several rows in alignment. In building the wall the bottom row of the blocks 2 is first positioned and as the individual blocks of successive rows are put in place a block retainer member or pin R is placed between the adjacent vertical edges of each pair of adjacent blocks.

The retainer members R are in the form of U-shaped clips or pins each of which has a base portion 3 and a pair of arm portions 4, of greater length than the thickness of the blocks 2, extending substantially at right angles to the base portion. As the wall is laid up these retainer pins are slipped down between the wall W and a pair P of adjacent support bars 1. This is accomplished by laying a retainer R with its arm portions 4 parallel to and against the wall W and then pushing the unit down behind the pair of adjacent parallel support bars 1 in the manner illustrated in the lower right hand portion of FIGURE 1. After the retainer pin has been positioned behind the pair P of support bars it is rotated through 90° so that the arms 4 thereof extend at right angles to the wall W. The retainer member R then slid longitudinally of the bars 1 until it engages the vertical edge of the adjacent block 2. When the next block of the row is positioned it is pushed up against the retainer member R and locking means are secured on the outwardly projecting ends of the arms 4. These locking means, as illustrated, are pierced and slit dished self-locking washers 5 which are pushed inwardly onto the pointed projecting ends of the arms 4 until they overlie and engage the inner faces of the blocks 2 and force the inner faces thereof firmly against the support bars 1. The form of these dished locking washers is such that, while they may be moved easily inwardly on the pins or arms 4, they lock against outward movement at any position of adjustment due to the locking action of the inclined slotted tang portions 5a of the washers.

As has been previously referred to, and as is clearly seen in FIGURE 1, the support bars 1 are arranged in parallel pairs P. The spacing apart of the bars making up a pair, and the spacing apart of the adjacent pairs of bars, is coordinated with the vertical dimensions of the blocks being installed. As seen in FIGURE 1 a pair P of bars 1 is arranged symmetrically to the horizontal center line of each horizontal row of blocks 2. The longitudinal spacing of the attaching pads 1a on the bars 1 is also coordinated with the width of the individual blocks 2 which make up the wall, this spacing being such that

each U-shaped retainer pin R may have a limited amount of unrestricted horizontal movement relative to its pair of supporting bars P. Furthermore, as the base portions 3 of the retainers R are greater in length than the vertical spacing between the bars 1 of each pair P, limited unimpeded vertical movement of the retained units R may also occur.

As previously noted, the space between the bars 1 and the furnace shell W which is provided by the pads 1a is substantially equal to the diameter of the rod or wire stock making up the retainer members R and preferably is such that bars 1 will hold the retainers R in vertical position by frictional engagement therewith so that the retainers, when they are first positioned between adjacent blocks 2 during lay-up of the wall, will have their top arm member 4 supported above the adjacent bar 1. This is clearly seen in FIGURE 2 and the reason for this frictional support of the retainers R will appear later.

After the wall structure is initially laid up with a U-shaped retainer pin R between the vertical edges of each pair of adjacent blocks 2 of each row, each block of each row being closely positioned next to the adjacent block with a pin R therebetween and the several blocks being firmly held back against the retainer bars 1 by the locking washers 5, there is no substantial spacing between the blocks and a substantially solid wall lining is provided. However, after the furnace is fired and has been in use for a time the initial shrinkage of the individual blocks will cause looseness and clearance between the vertical edges of the blocks and the several rows will settle to leave clearance between the tops of the walls and the ceiling or roof of the furnace chamber.

Furthermore, as the blocks 2 will also shrink in thickness, they will not be tightly held against the bars 1 and the wall W by the washers 5. Because of the limited horizontal and vertical movement of the retainer pins R which may occur as previously described, there will be no restriction to such movement of the blocks as may take place during this initial shrinkage.

In order again to provide a solid wall lining it is only necessary to move the blocks of each row horizontally until any looseness or clearance that has been left between the blocks is taken up. The blocks will retain proper contact between their top and bottom surfaces as they may move downwardly by gravity and any clearance due to vertical shrinkage will all occur at the top of the top row of blocks. In the resetting operation this clearance, as well as any clearance at the ends of the rows of blocks after they have been reset laterally into proper engagement with each other, may be filled by suitably cut blocks, refractory cement, or the like and after resetting, the washers 5 are again pushed inwardly into firm engagement with the outer faces of the blocks to take up any reduction that may have occurred in the thickness of the blocks.

From the above it will be observed that my improved furnace wall structure firmly secures the furnace lining blocks against the furnace shell while permitting very rapid, inexpensive and effective resetting of the blocks to take up the shrinkage which occurs in new installations.

It will also be understood that, although I have illustrated my wall structure as applied to a vertical furnace wall, it may also be used in ceiling or inclined wall structures with the same advantages.

Furthermore, it will be understood that other types of locking means than the dished slit washers 5 herein illustrated may be employed between the retainer pins R and the blocks 2 and the specific form of the support bars, block retainer members, etc. may be changed without departing from the spirit of my invention. I do not therefore wish to be limited to the exact structure and devices herein shown and described but claim as my invention all embodiments thereof coming within the scope of the appended claims.

I claim:

1. A wall structure including a metallic outer shell member; a plurality of parallel pairs of parallel support bars secured at longitudinally spaced attaching points to the inner face of said shell member in inwardly spaced relation thereto; a plurality of rows of wall lining blocks extending in the same direction as said support bars, said blocks being arranged in adjacent edge to edge relation and said rows of blocks being disposed one row in alignment with each of said pairs of support bars; a plurality of block retainer members comprising U-shaped pins each having a base portion retained between said shell member and a pair of said supporting bars and a pair of spaced apart arm portions extending from said base portion, the length of said base portions being greater than the distance between the parallel support bars of a pair and said arm portions being spaced apart sufficiently to permit limited movement of said retainer members transversely of said pairs of support bars, the length of said arm portions of said retainer members being greater than the thickness of said lining blocks; and locking means comprising self-locking washer members freely slidable on said arm portions in a direction toward said lining blocks and resisting movement in the opposite direction.

2. A wall structure as defined in claim 1 in which said spaced apart arm portions of said U-shaped pins extend between the edges of pairs of adjacent blocks of a row of blocks and said locking washers on said arm portions each overlies the inner faces of the pair of blocks between which the arm extends and retains said blocks in position in the wall structure.

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