United States Patent

[11] 3,588,059

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[33] **Germany**
[31] P 15 83 363.3 and P 15 83 344.4

[54] **GUIDE RAIL ASSEMBLY FOR PUSHER-TYPE FURNACE**
12 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** **263/6**
[51] **Int. Cl.** **F27d 3/02**
[50] **Field of Search** ..... 266/5; 263/6, 6 (B); 148/155, 157; 214/(Inquired)

[56] **References Cited**

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Primary Examiner—J. Spencer Overholser
Assistant Examiner—R. Spencer Annear
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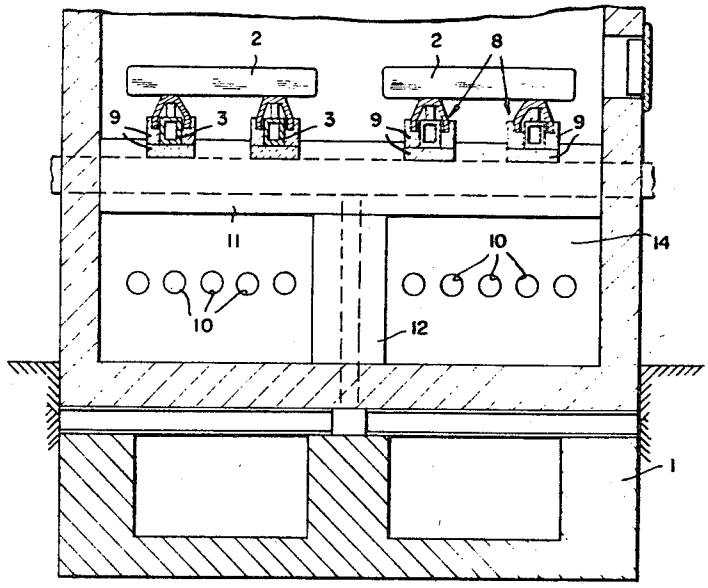
ABSTRACT: To support a succession of workpieces on a cooled guide rail of a pusher-type furnace, carrier blocks with hollow profiles and downwardly diverging side flanges are interposed between the workpieces and the rail, the flanges bracketing the upper part of the rail with lateral clearance to act as heat shields therefor. Thermally insulating spacers occupy part of the hollow cross sections of the blocks, the latter being supported on the rail either through the intermediary of these spacers or through lateral rail extensions on which the flanges rest.



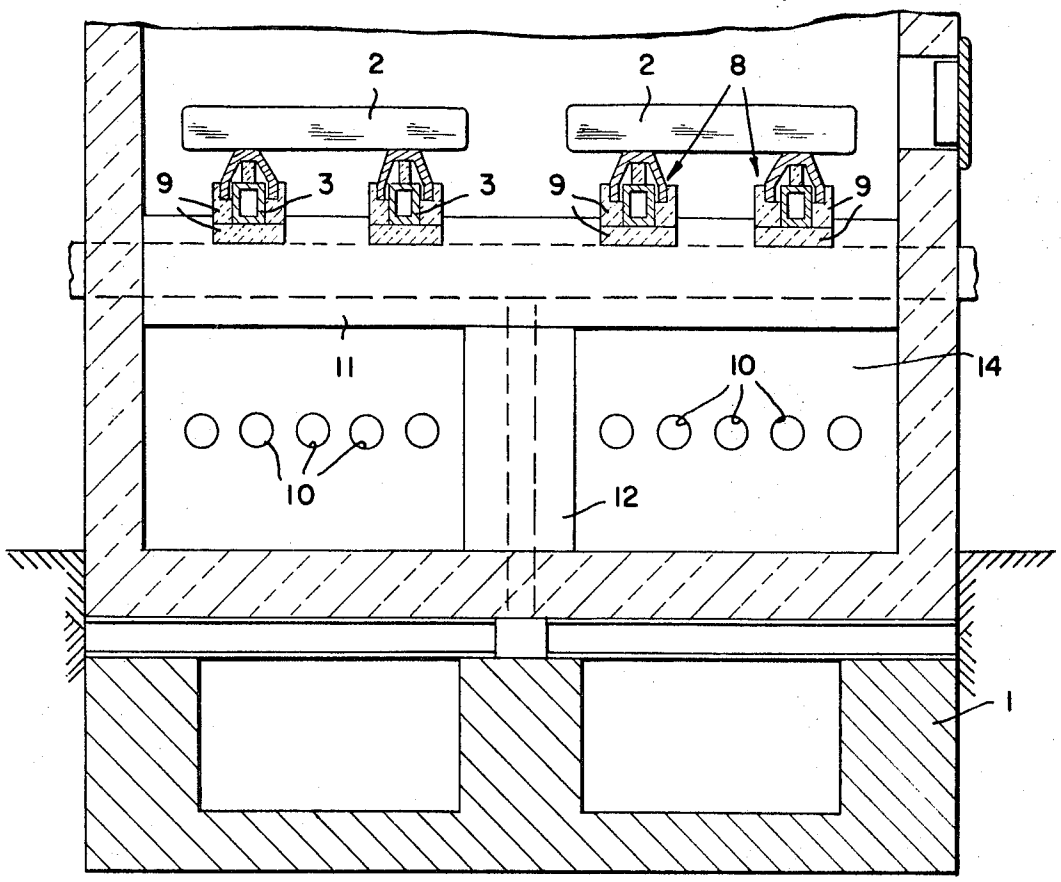


FIG. 1

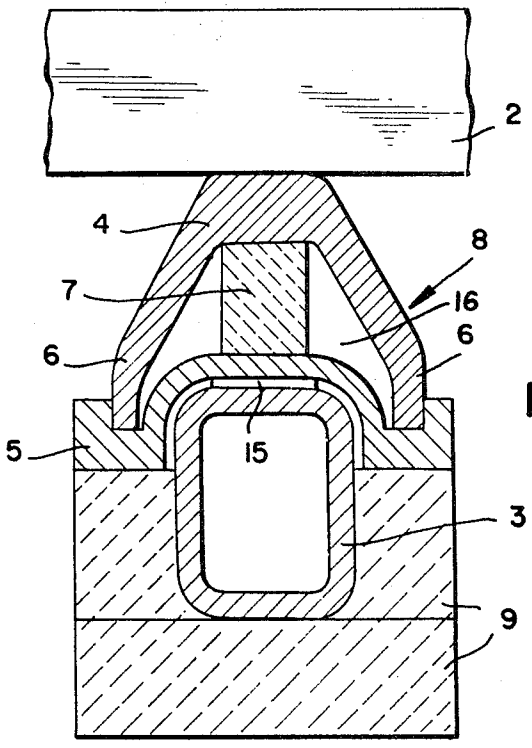


FIG. 2

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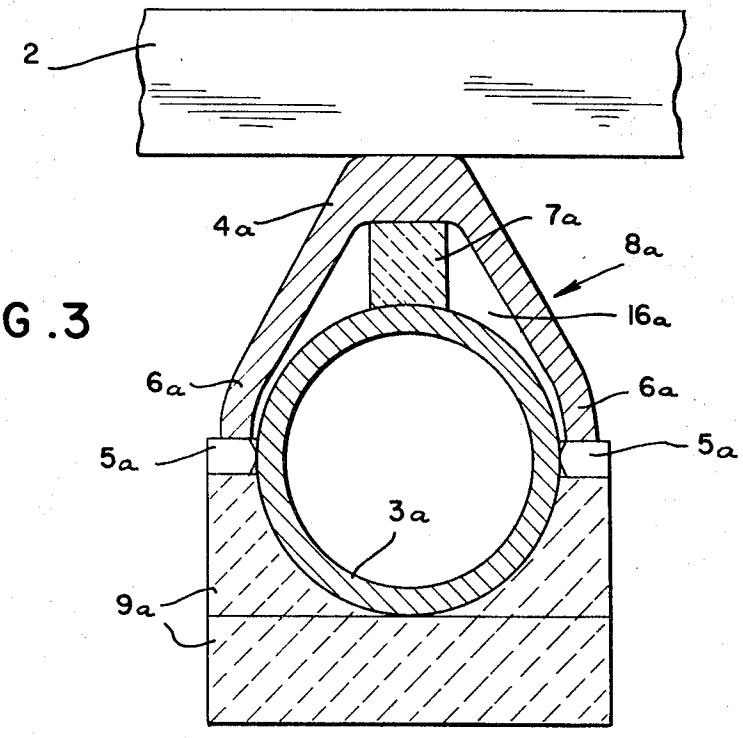

FIG. 3

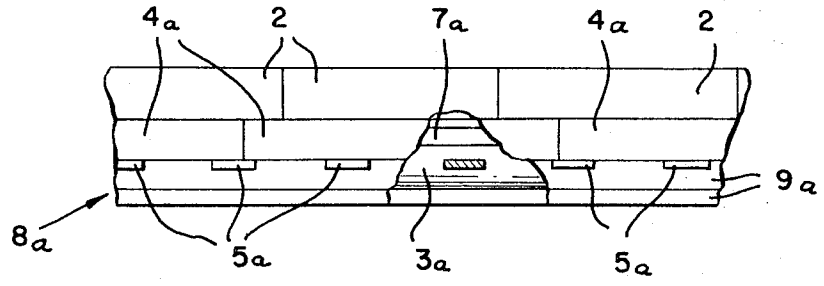

FIG. 4

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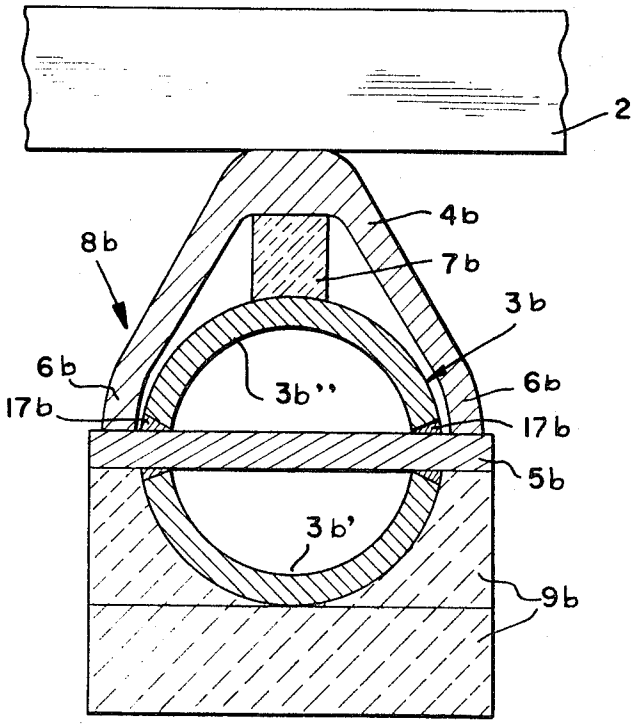
FIG. 5



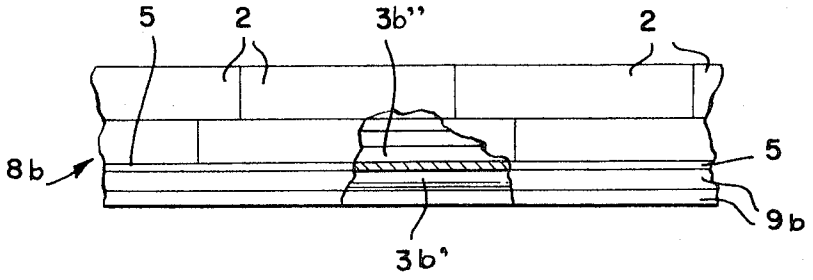


FIG. 6

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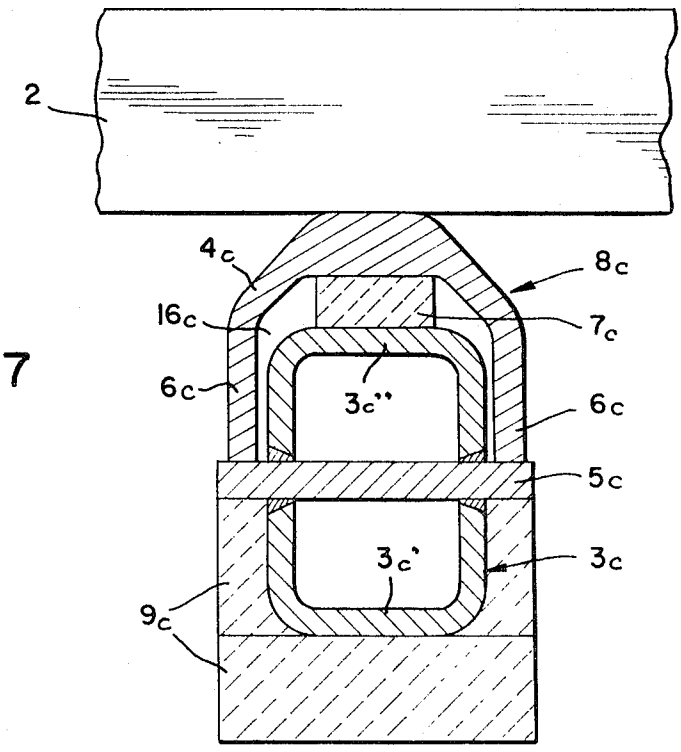

FIG. 7

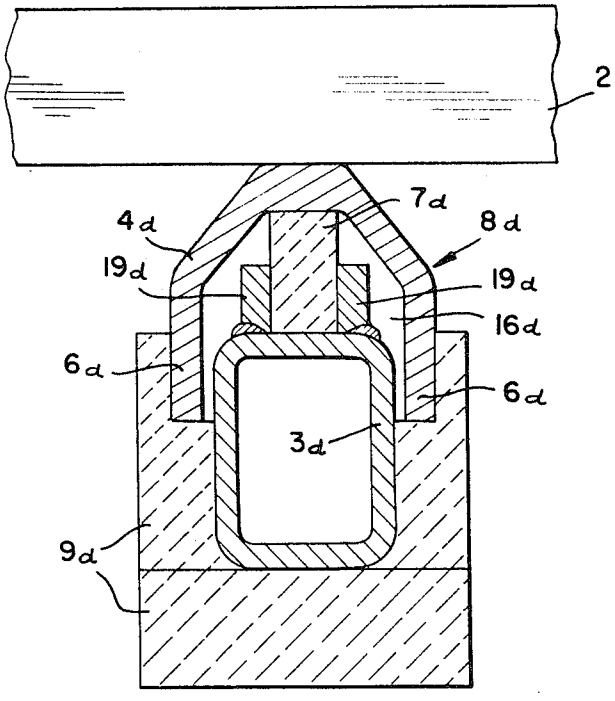

FIG. 8

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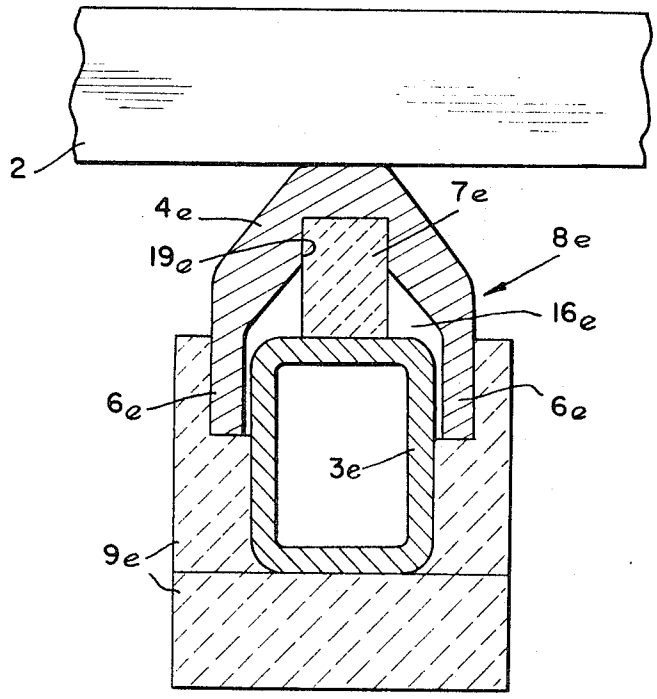
FIG. 9



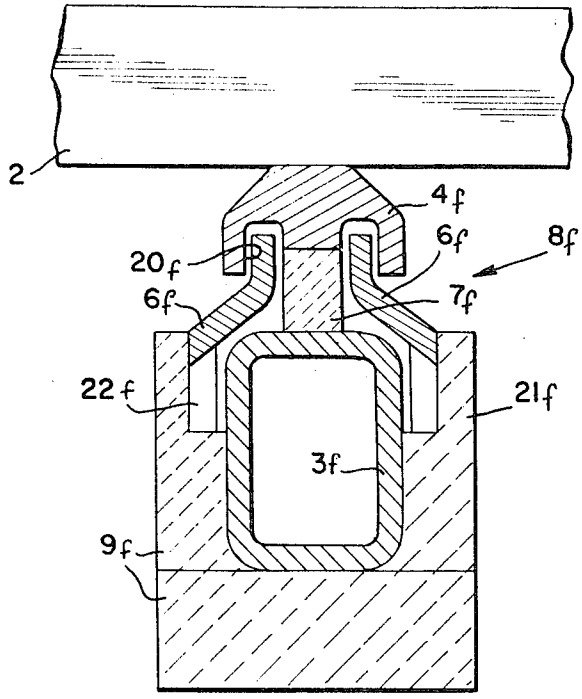


FIG. 10

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GUIDE RAIL ASSEMBLY FOR PUSHER-TYPE FURNACE

Our present invention relates to a guide rail assembly for a pusher-type industrial furnace as disclosed, for example, in commonly owned U.S. Pat. Nos. 3,245,672 and 3,296,039 to K. Loeck et al.

In a furnace of this type, designed for the heat treatment of metallic bodies such as steel billets, blooms or ingots, the workpieces are supported on tubular, substantially horizontal rails, traversed by a cooling fluid, through the intermediary of a series of heat-conductive carrier blocks; in view of the high furnace temperatures, e.g. between 1,250° and 1,300° C., these mounting blocks must be made of highly heat-resistant metal, generally steel. The blocks should have a relatively large surface area exposed to the furnace atmosphere in order to help equalize the temperature along the workpiece surface by distributing the heat of an enveloping circulation of hot gases to the undersides of the workpieces in contact with the blocks. The proximity of the cooled rail, however, tends to develop so-called black stripes on these undersides since some of the heat from the supported regions is conducted away toward the rail so that treatment is incomplete along the zone of contact; this is objectionable because of its detrimental effect upon subsequent processing stages in which, e.g. during rolling, differences in thickness may occur as a result of the nonuniform heating.

To minimize this conductive loss of heat from the supported workpiece portions, the carrier blocks were heretofore provided with relatively tall webs representing a path of restricted thermal conductivity. This construction, however, requires the use of substantial amounts of expensive heat-resistant metal and may also inconveniently increase the required internal dimensions of the furnace. Furthermore, we have found that the exposed web surfaces tend to absorb thermal radiation from the nearest workpiece surfaces so as to act as heat sinks. The radiant heat so absorbed is directly transmitted to the rail and raises the temperature of its cooling fluid which therefore must be circulated at a faster rate or cooled more intensely.

Thus, the general object of our present invention is to provide improved supporting means for workpieces traveling in the aforedescribed manner from an inlet to an outlet of a furnace, with avoidance of the aforementioned drawbacks and reduction in the overall size of the carrier blocks made from high-quality metal.

This object is realized, pursuant to our present invention, by a shaping of the carrier blocks with hollow profiles bounded by downwardly diverging side flanges which bracket the upper part of the associated guide rail with lateral clearance therefrom, the carrier blocks being supported on the rail with the aid of mounting means of limited thermal conductivity.

The aforementioned mounting means may include lateral extensions of the rail and/or thermally insulating spacers inserted between the rail and the tops of the hollow blocks. In the first instance, the rail extensions may be web portions projecting from the outer rail surface, preferably in a horizontal midplane thereof, or may form part of a yoke straddling the rail. In the second instance the spacers may be ceramic members strong enough to sustain all or part of the load and flanked, advantageously, by lateral abutments formed by the flanges of the blocks or rising from the rail itself. The lateral flanges, which need not be integral with the central part or head of the block, may also rest on bricks or the like secured to the underside of the rail and forming a refractory encasement for its lower part.

The invention will be described in greater detail with reference to the accompanying drawing in which:

FIG. 1 is a vertical cross-sectional view of an industrial furnace of the general type described above and shown in the aforementioned Loeck et al. patents;

FIG. 2 is an enlarged cross-sectional view of a guide rail and carrier block according to the invention, forming part of the furnace of FIG. 1;

FIG. 3 is a view similar to FIG. 2, showing a modification;

FIG. 4 is a fragmentary side view (parts broken away) of the assembly of FIG. 3;

FIG. 5 is another view similar to FIG. 2, showing a further modification;

FIG. 6 is a view similar to FIG. 4, relating to the assembly of FIG. 5; and

FIGS. 7—10 are still other cross-sectional views similar to FIG. 2, representing additional embodiments.

In FIG. 1 we have shown an industrial furnace 1 of the type described in which two rows of billets 2 are pushed along two pairs of guide rails 3 through the intermediary of carrier-block assemblies 8 as more fully described hereinafter. The rails 3, of generally rectangular cross section, are tubular and are connected to a source of cooling fluid, not shown, in the usual manner. The rails themselves are mounted via refractory bricks 9, which encase their lower parts, on traverses 11 (only one shown) supported by uprights 12. Ports 10 in a bulkhead 14 serve for the circulation of a stream of hot gas below and above the workpieces 2 as they travel over the rails 3 from an inlet to an outlet of the furnace 1.

FIG. 2 shows details of the workpiece-supporting assembly 8 associated with each rail 3. This assembly includes a series of carrier blocks 4 of generally prismatic profile, following one another in close succession along the rail, and a yoke 5 (or a succession of such yokes) straddling the rail 3 by resting on a series of longitudinally spaced bosses 15 thereof. A ceramic spacer bar 7, or a series of individual spacer blocks, is inserted between the tops of carrier blocks 4 and the yoke 5 while leaving voids 16 on both sides along lateral flanges 6 which rest on outrigger-type edge portions of the yoke. The refractory bricks 9, which may be made of the same material as the spacer member 7, can be secured to the underside of rail 3 in any convenient way not further illustrated and help balance the yoke 5 on the rail.

The carrier block 4 of heat-resistant steel is designed without any high-rising central web so that the workpieces 2 pass at a relatively low level above the rail 3. Nevertheless, the voids 16 and the thermally insulating spacer 7 minimize the flow of heat through the blocks 4 toward the rail 3 whose only direct connection with the yoke 5 is through the spaced-apart bosses 15. The lateral flanges 5 of block 4 also act as radiation shields to prevent the transmission of radiant heat from the workpieces to the rail 3.

The assembly 8*a* of FIGS. 3 and 4 comprises a set of blocks 4*a*, similar to the blocks 4 of the preceding embodiment, whose flanges 6*a* rest on laterally projecting lugs 5*a* of rail 3*a* which is here shown as a round tube. The refractory encasement 9*a* has recesses receiving the lugs 5*a* which, however, could also be extended into continuous webs overlying the edges of this encasement. Voids 16*a* on opposite sides of spacer 7*a* again provide clearance between the flanges 6*a* and the rail 3*a* whose only heat-conductive connection with the blocks 4*a* is through the lugs 5*a*.

FIGS. 5 and 6 show a tubular rail 3*b* split into lower and upper halves 3*b*′ and 3*b*″ which are separated by a through-going web 5*b* supporting the blocks 4*b* of assembly 8*b*. The arrangement is otherwise similar to that of the preceding embodiment, with corresponding elements identified by suffixes *b* in lieu of *a*. The web 5*b* is shown welded to the rail halves 3*b*′ and 3*b*″ at 17*b*.

In FIG. 7 we show a modified assembly 8*c* which differs from assembly 8*b* only by the more angular profile of its rail 3*c* and its blocks 4*c*. Elements previously identified have been designated in FIG. 7 by the same reference numerals followed by the suffix *c*.

In FIG. 8, where the suffix *d* is used to designate elements described in connection with the preceding FIGS., the spacer 7*d* of assembly 8*d* supports the block 4*d* whose flanges 6*d* also rest on the lower encasement 9*d*. Ribs 19*d* rising from rail 3*d* form lateral abutments alongside the spacer 7*d* and hold it in position.

The assembly 8*e* of FIG. 9 differs from that of FIG. 8 by the fact that the flanges 6*e* of block 4*e* form lateral abutments 19*e*

for the spacer 7*e*, thus dispensing with the need for separate ribs integral with rail 3*e*.

In the assembly 8*f* of FIG. 10 we have shown a block having a generally trapezoidal head 4*f* formed with bottom grooves 20*f* to receive the top edges of angularly bent strips 6*f*, of the same heat-resistant steel as head 4*f*, which play the part of the flanges 6, 6*a*, etc. shown in the preceding FIGS. as integral parts of the respective blocks. The lower edges of the strips 6*f* rest on the refractory encasement 9*f* of rail 3*f*; since the lower edge portions of these strips are shielded against the furnace atmosphere by adjoining ribs 21*f* of encasement 9*f*, they need not be continuous but may be toothed or crenellated at 22*f* for further restricting the direct heat exchange between the block 4*f* and the rail 3*f*.

While we have described and illustrated a variety of ways in which our present improvement can be carried into practice, it will be apparent that other modifications are possible without departing from the spirit and scope of our invention as defined in the appended claims.

We claim:

1. In an industrial furnace having a heating chamber provided with a tubular, substantially horizontal rail connected to be traversed by a cooling fluid, said rail extending from an inlet to an outlet of said chamber and being formed with lateral extensions, a row of heat-resistant metallic carrier blocks on said rail for the support of a series of workpieces to be heat-treated while passing through said chamber, the improvement wherein said carrier blocks have a hollow profile bounded by downwardly diverging side flanges which rest on said extension and bracket the upper part of said rail with lateral clearance therefrom, and thermally insulating spacer means inserted between said rail and the tops of said blocks, said blocks having generally trapezoidal heads formed with bottom slots alongside said spacer means, said flanges being angularly bent strips with upper edges received in said slots.

2. In an industrial furnace having a heating chamber provided with a tubular, substantially horizontal rail connected to be traversed by a cooling fluid, said rail extending from an inlet to an outlet of said chamber, and a row of heat-resistant metallic carrier blocks on said rail for the support of a series of workpieces to be heat-treated while passing through said chamber, the improvement wherein said carrier blocks have a hollow profile bounded by downwardly diverging side flanges which bracket the upper part of said rail with lateral clearance therefrom, said rail being provided with mounting means of limited thermal conductivity supporting said carrier blocks thereon, said rail being further provided with lateral extensions forming part of said mounting means, said flanges resting on said extensions.

3. The improvement defined in claim 2 wherein said extensions are web portions projecting from said rail substantially in a horizontal midplane thereof.

4. The improvement defined in claim 2 wherein said extensions form part of a yoke straddling said rail.

5. The improvement defined in claim 4, further including thermally insulating spacer means inserted between said yoke and the tops of said blocks.

6. The improvement defined in claim 3 wherein said mounting means includes thermally insulating spacer means inserted between said rail and the tops of said blocks.

7. The improvement defined in claim 6 wherein said flanges form lateral abutments for said spacer means.

8. The improvement defined in claim 6 wherein said rail is provided with upstanding ribs forming lateral abutments for said spacer means.

9. The improvement defined in claim 6 wherein said blocks have generally trapezoidal heads formed with bottom slots alongside said spacer means, said flanges being angularly bent strips with upper edges received in said slots.

10. In an industrial furnace having a heating chamber provided with a tubular, substantially horizontal rail connected to be traversed by a cooling fluid, said rail extending from an inlet to an outlet of said chamber, and a row of heat-resistant metallic carrier blocks on said rail for the support of a series of workpieces to be heat-treated while passing through said chamber, the improvement wherein said carrier blocks have a hollow profile bounded by downwardly diverging side flanges which bracket the upper part of said rail with lateral clearance therefrom, said rail being provided with mounting means of limited thermal conductivity supporting said carrier blocks thereon, said rail being further provided with a refractory encasement for its lower part, said flanges resting on said encasement.

11. The improvement defined in claim 10 wherein said encasement is provided with upstanding ribs externally adjoining said flanges.

12. The improvement defined in claim 11 wherein said flanges have discontinuous lower edges in the region of said ribs.