Feb. 6, 1968 J. MOLZ 3,367,641

PUSHER TYPE FURNACE

Filed March 23, 1966

FIG.1

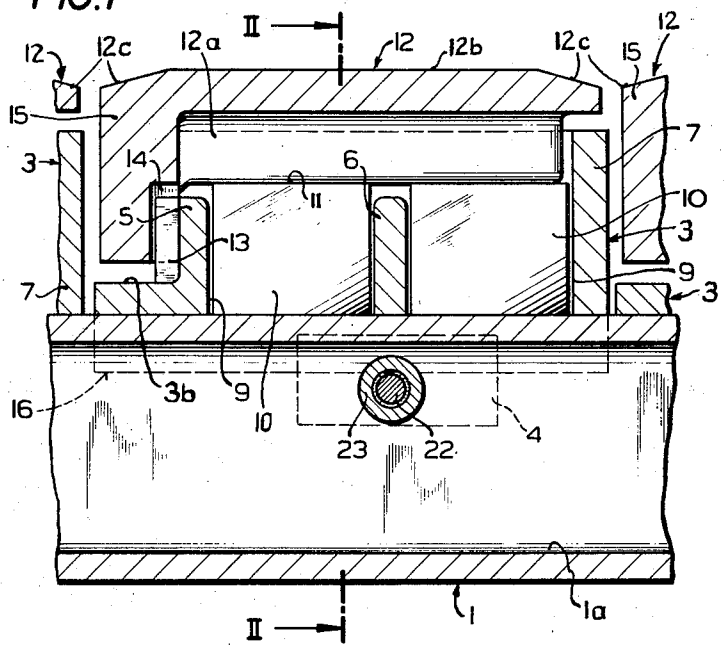
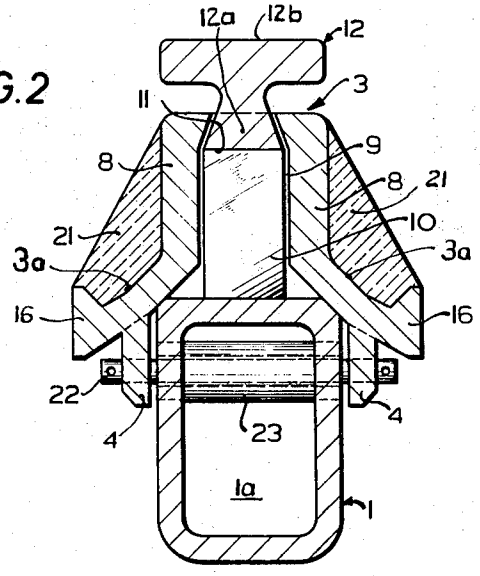


FIG.2



INVENTOR

Josef Molz

by Michael S. Striker

United States Patent Office

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PUSHER TYPE FURNACE

Josef Molz, Mulheim-Menden, Germany, assignor to Koppers-Wistra Ofenbau, G.m.b.H., Dusseldorf, Germany

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7 Claims. (Cl. 263—6)

ABSTRACT OF THE DISCLOSURE

A work supporting structure in a pusher type furnace comprises an elongated hollow support beam which can be internally cooled by water, a row of elongated frames arranged end to end and carried on top of the support beam, connecting means securing at least one frame at one end of the row to the support beam, a row of rails which are guided by the frames and are indirectly carried by the support beam to provide a composite upper surface along which a billet can be pushed through the furnace toward the one end of the row of frames. The combined length of those frames which are connected to the support beam at least equals the width of the widest workpiece and the frames hold the rails against movement upwardly and away from the support beam, against tilting and against movement longitudinally of the support beam. External pockets provided in the frames accommodate fillers of heat-resistant material.

The present invention relates to heat treating furnaces in general, and more particularly to improvements in pusher-type or tunnel furnaces disclosed in my U.S. patent No. 3,214,152.

My aforementioned patent discloses a pusher-type furnace wherein a water-cooled support beam carries blocks of heat-resistant material which in turn support a work-engaging rail composed of several sections and having an upper surface along which billets, ingots and similar workpieces are moved through the furnace. The blocks are accommodated in a multi-section frame which straddles the support beam but does not come in direct weight-carrying contact with the workpieces. Such supporting structure is very satisfactory because it allows for uniform heating of workpieces and does not exhibit any dark stripes in the region of the work-engaging rail. However, it was found that a workpiece which is heated to an elevated temperature tends to adhere to the rail and is likely to tilt the last section or sections at the discharge end of the support beam. The ends of the rail sections are preferably provided with inclined surface portions and, while being pushed from the furnace, an overheated billet which adheres to the last rail section or sections is likely to entrain not only such rail sections but also the adjoining sections of the frame.

Accordingly, it is an important object of the present invention to provide in a pusher-type furnace an improved supporting structure whose components are constructed, assembled and configurated in such a way that they cannot be dislodged from their normal positions while supporting a travelling billet which is maintained at a temperature at which it tends to adhere to the adjacent section or sections of the rail.

Another object of the invention is to provide a novel multi-section frame which may be utilized in a supporting structure of the just outlined characteristics.

A further object of the invention is to provide a novel multi-section work-engaging rail which may be utilized in the improved supporting structure.

An additional object of the instant invention is to provide a novel connection between one or more sections

of the improved frame and the support beam of the above outlined supporting structure.

Still another object of the invention is to provide novel connections between the sections of the frame and the sections of the work-engaging rail.

A concomitant object of the invention is to provide the novel frame with specially configurated and specially supported fillers of heat-resistant material.

A further object of the invention is to provide a supporting structure whose components can be readily taken apart and reassambled, wherein the quantity of expensive metallic material is held to a minimum without affecting the safety and/or efficiency of the furnace, and wherein the tendency of the workpieces to adhere to the rail cannot result in tilting, shifting and/or other undesirable displacements of the rail sections and/or any other sections which are in contact with or coupled to the rail.

Briefly stated, my present invention resides in the provision of a novel work supporting structure which is embodied in a push-type furnace and comprises an elongated hollow support beam which can be cooled by water or another suitable fluid flowing through the interior thereof, a row of elongated frames arranged end to end and carried on top of the support beam, and connecting means securing at least one frame at one end of the row to the support beam. The supporting structure further comprises a row of elongated work engaging members or rails which are guided by the frames and are indirectly carried by the support beam to provide a composite upper surface along which a billet or a similar workpiece can be pushed through the furnace toward the aforementioned end of the row of frames. The number of frames which are actually connected to the support beam is preferably such that their combined length at least equals the width of the widest workpiece which is to be pushed along the row of work engaging members.

In accordance with another feature of my invention, the frames and the adjoining work engaging members are provided with cooperating male and female coupling means which hold the work engaging members against movement upwardly and away from the support beam. It is further advisable to provide one longitudinal end of each work engaging member and the adjoining longitudinal end of the corresponding frame with cooperating male and female retaining means to hold such members against tilting as well as against movement longitudinally of the support beam. Still further, each frame is preferably provided with external pockets which are located at the opposite sides of and at a level above the support beam to receive fillers or blocks of heat-resistant and heat-insulating material. Each filler can be supported from below by a suitable upturned ledge which forms part of the corresponding frame.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved furnace itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of a specific embodiment with reference to the accompanying drawings, in which:

FIG. 1 is a fragmentary central longitudinal section through a supporting structure which can be incorporated in a pusher-type furnace and is constructed in accordance with my invention; and

FIG. 2 is a transverse section as seen in the direction of arrows from the line II—II of FIG. 1.

Referring to the drawings in detail, there is shown a supporting structure which can be utilized in a pusher-type furnace and comprises an elongated support beam 1 which consists of metallic material and defines an internal

channel 1*a* serving to convey a coolant, preferably water. This beam 1 supports a row of frames 3 each of which comprises two spaced parallel upright side walls 8 resting on top of the support beam and having extensions or skirts 4 which straddle the sides of the beam. The skirts 4 also hold the frames 3 against lateral movement with reference to the beam 1. Each frame 3 further comprises three transversely extending stiffeners or partitions 5, 6 and 7 which extend between the respective side walls 8 and define therewith a pair of internal pockets 9 each receiving a heat-resistant block 10 which rests directly on the top face of the support beam 1. The blocks 10 are preferably made of pressure-resistant rock or the like having a high specific weight. The trailing partition 7 of each frame 3 extends upwardly and beyond the front partition 5 and median partition 6 as well as beyond the blocks 10. The partitions 5 and 6 terminate at a level below the blocks 10 so that the upper sides of these blocks may come in direct supporting engagement with dovetailed male coupling portions or ribs 12*a* provided on elongated work-engaging rails 12 whose upper surfaces 12*b* are engaged by billets, ingots and similar workpieces which are being pushed through the furnace and are being heated to a very high temperature. The end portions 12*c* of the surfaces 12*b* are inclined downwardly and toward the adjoining rails 12. As shown in FIG. 2, the upper portions of the side walls 8 forming part of a frame 3 constitute a female coupling portion by defining between themselves an elongated dovetailed groove 11 which can receive the corresponding rib 12*a* in such a way that the respective work-engaging rail 12 is movable lengthwise toward and away from the trailing partition 7 but cannot be tilted, lifted or otherwise displaced with reference to the support beam 1. The rib 12*a* rests on the upper faces of the corresponding blocks 10 but the rail 12 does not rest on the associated frame 3.

The front side of each front partition 5 is formed with a vertically extending elongated rib 13 which constitutes the male component of a retaining unit and extends into a vertically extending elongated groove 14 provided in a projection 15 at the front end of the corresponding rail 12. This projection 15 constitutes a female retaining portion and extends into a cutout 3*b* located in front of the foremost partition 5.

The outer sides of the side walls 8 on each frame 3 are provided with external pockets 3*a* whose lower portions are bounded by upturned longitudinally extending ledges 16. Each such external pocket 3*a* accommodates a filler or block 21 of stamped fire-resistant material. Each filler 21 extends all the way between the front and rear partitions 5 and 7 of the respective frame 3. The lateral sides of the partitions 5 and 7 are flush with the exposed surfaces of the corresponding pair of fillers 21, i.e., such partitions 5 and 7 extend laterally and beyond the respective side walls 8.

FIG. 1 merely shows three frames 3 and three rails 12 each located above one of the frames. Such frames 3 form part of a row which may comprise a larger number of frames, and the same holds true for the rails 12. At least one frame 3 at the discharge (left-hand) end of the support beam 1 is positively connected with the support beam so that it cannot follow an overheated billet which tends to adhere to the surface 12*b* of the corresponding rail 12. As a rule, two or three foremost or leftmost frames 3 will be positively connected with the support beam 1 so that the combined length of such frames will at least equal the width of the widest workpiece which is contemplated to be pushed along the surfaces 12*b* of the work-engaging rails 12. The connecting means between each such frame 3 and the support beam 1 may comprise a metallic sleeve 23 whose ends are sealingly received in and welded or otherwise secured to the side walls of the beam 1 so that the central portion of the sleeve 23 extends across the internal channel 1*a* of the beam, and a connecting rod 22 which is received in the sleeve and

whose ends are anchored in the extensions or skirts 4 of the respective frame 3. The connections between the foremost frames 3 and the beam 1 are preferably of the readily separable type, i.e., the rod 22 shown in FIGS. 1 and 2 can be withdrawn to allow for replacement of the corresponding frame. The parts 22, 23 cooperate to hold the respective frames against tilting with reference to the beam 1, for example, when the corresponding rails 12 exhibit the tendency to tilt while their surfaces 12*b* adhere to a hot workpiece which is being pushed beyond the left-hand end of the beam 1.

It is equally possible to resort to modified connections between the frames 3 and the support beam 1. For example, each rod 22 can be anchored in the side walls of the beam 1 and the extensions 4 of one, two, three or more frames at the discharge end of the beam 1 could be provided with suitable bayonet slots or the like to receive the laterally extending portions of the respective rods. Other connections may be devised as long as they can insure that the frames at the discharge end of the furnace cannot be tilted or shifted in response to discharge of a heated workpiece at the corresponding end of the composite rail.

A very important advantage of my improved supporting structure is that its component parts may be readily assembled and/or taken apart and that such components invariably remain in optimum positions while a series of workpieces are being pushed along the surfaces 12*b* of the rails 12. Such rails cannot be lifted, shifted, tilted or otherwise displaced, and the same holds true for the frames 3 at the discharge end of the furnace. The intermediate frames are less likely to be tilted or otherwise displaced, and, furthermore, if a single frame at the discharge end is positively connected to the beam 1, the remaining frames are automatically held against lengthwise displacement with reference to the beam.

The fillers 21 were found to be far superior to customary heat-resistant panels which are used in presently known pusher-type furnaces. Such panels are normally suspended on but are not received in pockets of the frames.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of my contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is:

1. In a pusher-type furnace, an elongated hollow support beam adapted to be cooled by a cooling fluid flowing through the interior thereof; a row of frames arranged end to end and supported on top of said support beam, said row of frames having a first end and a second end; connecting means securing at least one frame at one end of said row to said support beam; a row of work-engaging members guided by said frames and indirectly carried by said support beam, said members having upper surfaces along which a workpiece can slide while being pushed through the furnace toward said one end of said row of frames, said connecting means being arranged to secure to said support beam such a number of frames that the combined length of the thus connected frames at least equals the width of the widest workpiece which is to be pushed along said work-engaging members; and cooperating male and female coupling means provided on said frames and on said work-engaging members to prevent movement of such members upwardly and away from said support beam.

2. In a pusher-type furnace, an elongated hollow support beam adapted to be cooled by a cooling fluid flowing through the interior thereof; a row of frames arranged

end to end and supported on top of said support beam, said row of frames having a first end and a second end; connecting means securing at least one frame at one end of said row to said support beam; and a row of work-engaging members guided by said frames and indirectly carried by said support beam, said members having upper surfaces along which a workpiece can slide while being pushed through the furnace toward said one end of said row of frames, said connecting means being arranged to secure to said support beam such a number of frames that the combined length of the thus connected frames at least equals the width of the widest workpiece which is to be pushed along said work-engaging members, one of said work-engaging members being guided by each of said frames and each of said frames and each of said members having a longitudinal end respectively provided with cooperating male and female retaining portions to prevent longitudinal displacement of said work-engaging members with respect to the corresponding frames.

3. A structure as set forth in claim 2, wherein said male retaining portions include substantially vertically extending dovetailed ribs and said female retaining portions are provided with complementary grooves receiving the respective ribs.

4. In a pusher-type furnace, an elongated hollow support beam adapted to be cooled by a cooling fluid flowing through the interior thereof; a row of frames arranged end to end and supported on top of said support beam, said row of frames having a first end and a second end and each of said frames comprising a pair of spaced upright side walls extending longitudinally of and resting on top of said support beam and at least two transverse partitions connecting said side walls and defining therewith at least one internal pocket; connecting means securing at least one frame at one end of said row to said support beam, at least said one frame being provided with a pair of transversely aligned extensions straddling the sides of said support beam and said connecting means comprising a sleeve sealingly received in the sides and extending transversely across the interior of said support beam between said extensions and a rod extending through said sleeve and having end portions anchored in said extensions; blocks of heat-resistant material received in said internal pockets and resting on top of said support beam; and elongated work-engaging members guided by said side walls against lateral movement and resting solely on top of said blocks, said members having upper surfaces along which a workpiece can slide while being pushed through the furnace.

5. In a pusher-type furnace, an elongated hollow support beam adapted to be cooled by a cooling fluid flowing through the interior thereof; a row of frames arranged end to end and supported on top of said support beam, said row of frames having a first end and a second end and each of said frames comprising a pair of spaced upright side walls extending longitudinally of and resting on top of said support beam and at least two transverse partitions connecting said side walls and defining therewith at least one internal pocket, the side walls of adjoining frames being provided with downwardly extending cutouts located at one end of the respective frame; blocks of heat-resistant material received in said internal pockets and resting on top of said support beam; connecting means securing at least one frame and one end of said row to said support beam; and elongated work-engaging members guided by said side walls against lateral movement and resting solely on top of said blocks, said members having upper surfaces along which a workpiece can slide while being pushed through the furnace, each of said members comprising a projection extending into one of said cutouts and provided with retaining means engaging the respective frame to hold the work-engaging member against tilting and against movement longitudinally of said support beam.

6. In a pusher-type furnace, an elongated hollow support beam adapted to be cooled by a cooling fluid flowing through the interior thereof; a row of frames arranged end to end and supported on top of said support beam, said row of frames having a first end and a second end and each of said frames comprising a pair of spaced upright side walls extending longitudinally of and resting on top of said support beam and at least two transverse partitions connecting said side walls and defining therewith at least one internal pocket; blocks of heat-resistant material received in said internal pockets and resting on top of said support beam; connecting means securing at least one frame at one end of said row to said support beam; and elongated work-engaging members guided by said side walls against lateral movement and resting solely on top of said blocks, said members having upper surfaces along which a workpiece can slide while being pushed through the furnace, said partitions being disposed at the longitudinal ends of the respective frames and one partition of each frame comprising an upper portion extending beyond the corresponding block to serve as a stop against longitudinal displacement of the associated work-engaging member, the other partition of each frame terminating at a level below the top face of the associated block.

7. In a pusher type furnace, an elongated hollow support beam adapted to be cooled by a cooling fluid flowing through the interior thereof; a row of frames arranged end to end and supported on top of said support beam, said row of frames having a first end and a second end and each of said frames comprising a pair of spaced upright side walls extending longitudinally of and resting on top of said support beam and at least two transverse partitions connecting said side walls and defining therewith at least one internal pocket, said partitions being disposed at the longitudinal ends of the respective frames and extending laterally beyond the side walls of such frames; connecting means securing at least one frame at one end of said row to said support beam; blocks of heat-resistant material received in said internal pockets and resting on top of said support beam; and elongated work-engaging members guided by said side walls against lateral movement and resting solely on top of said blocks, said members having upper surfaces along which a workpiece can slide while being pushed through the furnace.

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FREDERICK L. MATTESON, JR., *Primary Examiner.*

JOHN J. CAMBY, *Examiner.*