United States Patent [19]

Brockmann

[11] **3,887,064**

[45] **June 3, 1975**

[54] **WALKING BEAM CONVEYOR IN A FURNACE**

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[22] Filed: **Oct. 26, 1973**

[21] Appl. No.: **410,238**

[30] **Foreign Application Priority Data**

Oct. 30, 1972 Germany 2253105

[52] **U.S. Cl.** **198/219;** 432/122; 432/243

[51] **Int. Cl.** **F27b 9/14**

[58] **Field of Search** 432/121–123, 432/126–127, 136–137, 234–235; 198/219; 214/519, 83.3, 23

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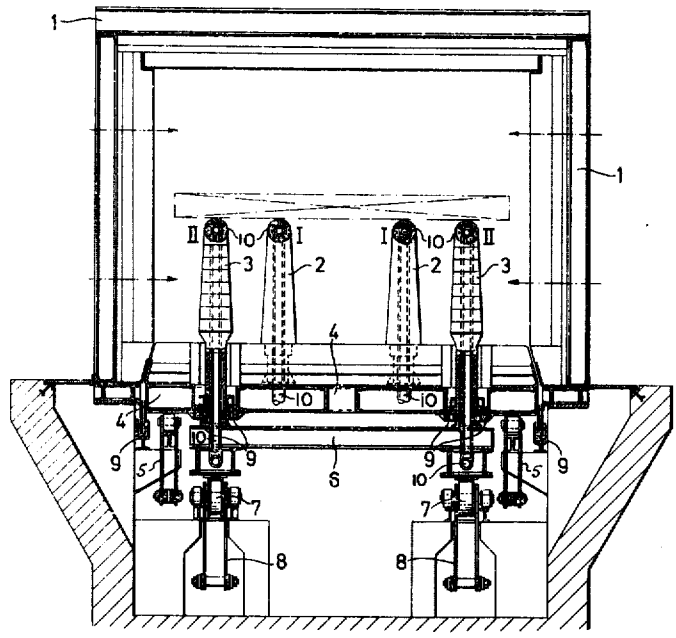
[57] **ABSTRACT**

A furnace having an elongated heat tunnel through which work passes to be heated therein. A pair of vertically reciprocally movable sets of beams extends longitudinally of the heat tunnel and forms a surface for supporting the work. At least one set of beams is simultaneously movable in the transport direction, and one set of beams is at all times situated at maximum vertical height so that the work moves only horizontally through the furnace.

4 Claims, 2 Drawing Figures



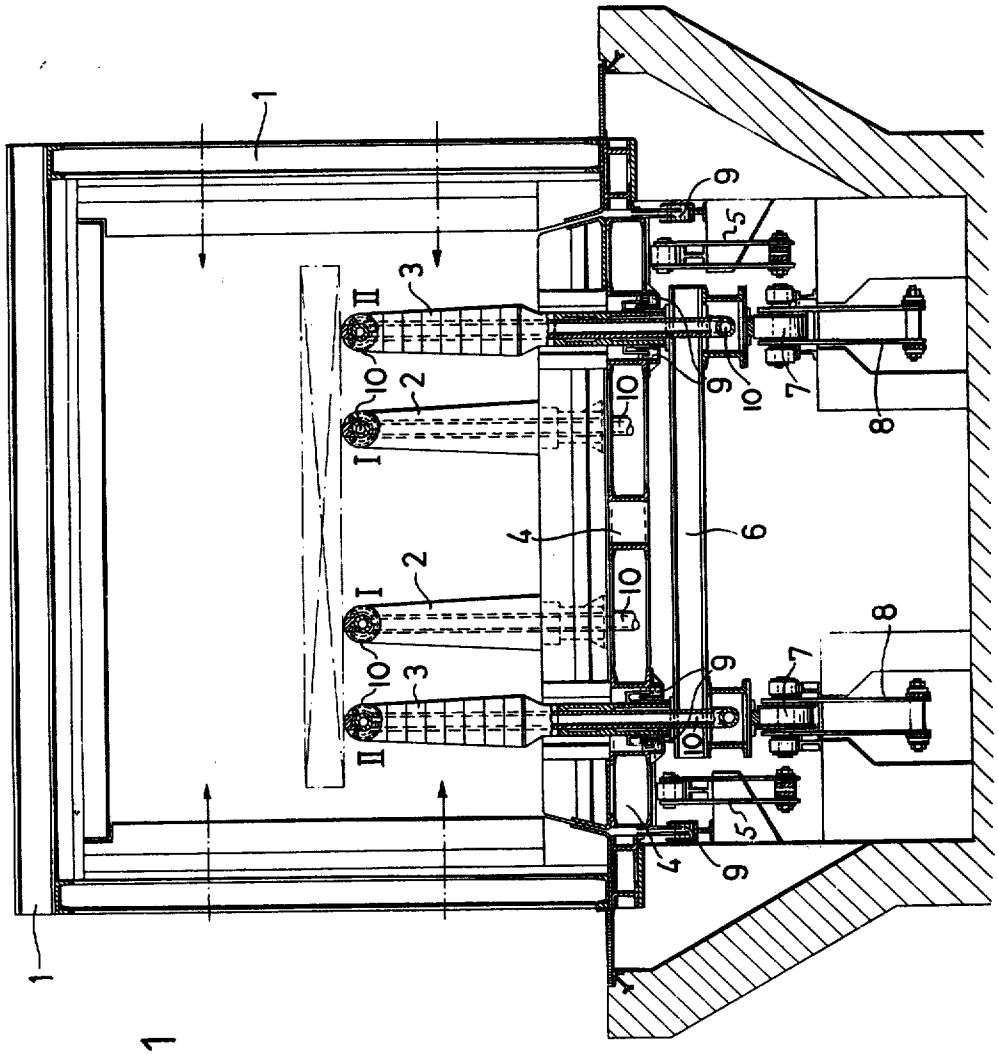


FIG. 1

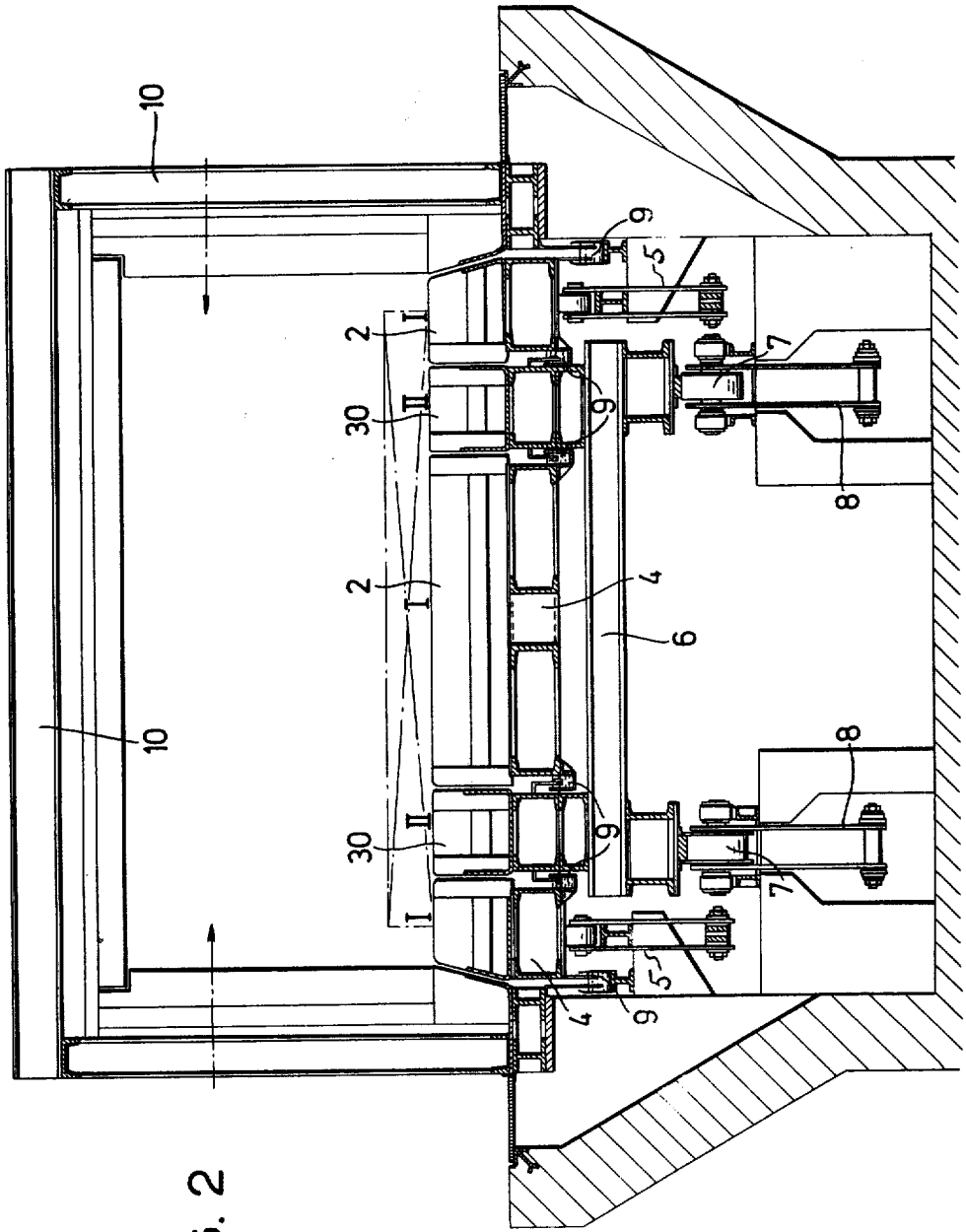


FIG. 2

WALKING BEAM CONVEYOR IN A FURNACE

BACKGROUND OF THE INVENTION

The invention relates to a walking beam conveyor structure for heating work travelling through a heat furnace or tunnel having at least two sets of beams vertically reciprocally movably mounted to move the work in a feed direction through the heat tunnel or furnace. Such walking beam conveyors in heat tunnels and furnaces are already known; these walking beam conveyors have generally, in addition to a set of movable beams, a set of stationary beams. The work is moved through the furnace or tunnel in a stepwise manner by the movable set of beams. The work is transported by means of a first set of beams lifting the work off the second set of stationary beams, and again depositing the work on the stationary beams at a horizontal distance from the position at which the work was lifted off the stationary beams, and the movable set of beams then return to this lifting-off position.

Since the work is often constituted of metallic material weighing several tons, the lifting-off of the work by means of a movable set of beams often requires extremely large forces. Thus, a set of movable beams must be very strong and consequently very large. Furthermore, shock forces appear at the lifting-off points which is a particularly important drawback if the movable set of beams have ceramic layers as contact surfaces.

Furthermore, the heating of the work produces a layer of scales which is destroyed by the constant lifting and lowering of the work. This causes the scales to fall between the stationary and movable beams and can easily cause a malfunctioning of the movable beams driving means unless the scales are removed periodically which causes frequent down-times of the entire installation. Furthermore, scales accumulate on the movable and stationary beams and cause the work pieces to be unevenly supported thereon.

SUMMARY OF THE INVENTION

It is accordingly a primary object of the present invention to provide a walking beam conveyor in a heated furnace or tunnel wherein the aforedescribed drawbacks are eliminated.

According to the invention, this object is attained by having at least one set of beams at its highest vertical position at all times during the movement of the work through the furnace or tunnel.

The supporting beams of each set then take over the work from the other set of supporting beams. The work thus taken over by one set of supporting beams or one supporting beam is transported horizontally without undergoing any vertical movement in the transport direction through the oven or furnace, a horizontal distance corresponding to one operational cycle of the apparatus. Thus the apparatus, according to the invention, transports the work through the oven or furnace without lifting or lowering the work. The supporting beams of the prior art walking beam conveyors, on the other hand, do undergo vertical as well as horizontal movements. The fact that the work does not undergo any vertical movement as it travels through the furnace reduces the amount of scales produced in a walking beam conveyor, and also reduces the wear of the supporting beams. Furthermore, the output of the driving mechanism for lifting and lowering the supporting beams can be substantially smaller, since the movement of the work in the vertical direction is eliminated.

If the horizontal movement of the work through the oven must be interrupted, and consequently there exists a danger of an uneven heating of the work pieces, particularly along the surfaces which are in contact with the supporting beams, in accordance with a further feature of the invention, the supporting beams are moved reciprocally without imparting the horizontal movement in the transportation direction to the work pieces, and are reciprocally moved in the vertical direction only while maintaining the work pieces at all times at the same height.

The alternate contacting of the work piece by the two sets of supporting beams produces a temperature equalization between the two contacting surfaces of the work piece and the two sets of supporting beams respectively, on the one hand, and the remainder of the surface of the work piece, on the other hand.

When the work has to be heated from above and below, the supporting beams are formed preferably as supporting bridges, having water-cooled pipes. When the work is only to be heated from above, the supporting beams are formed from special fire clay material and can be moved completely or partially outwardly of the furnace for waiting or taking over work from preconnected transportation and conveying means.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated by way of example, on the accompanying drawings which form part of this application, and in which:

FIG. 1 illustrates a cross-sectional, elevational view of a first embodiment of a walking beam conveyor in a furnace, which is adapted for the heating from above and below of work being transported through the furnace; and

FIG. 2 is a cross-sectional, elevational view of a second embodiment of the invention wherein the walking beam conveyor in the furnace is illustrated, which is adapted for heating the work pieces being transported therethrough only from above.

DESCRIPTION OF PREFERRED EMBODIMENT

In the first embodiment, according to FIG. 1, the oven grate consists of the supporting beams 2 and 3, having water-cooled pipes 10 which extend in the transportation direction of the oven. The beams 2 and 3 are mounted on separate supporting structures. The supporting structure for the beams 3 can also impart onto the supporting beams 3 a movement in the transportation direction of the oven. The supporting beams 2 are mounted on supporting structure 4 which is reciprocally, vertically movable by means of the lifting mechanism 5.

The supporting beams 3 are also rigidly mounted on a supporting structure 6, while the supporting structure 4 is not horizontally movable; the supporting structure 6 has this additional horizontal moving capability by virtue of the rollers 7 on which the supporting structure 6 is movably mounted. The rollers 7 are themselves reciprocally, vertically movable by means of a lifting mechanism 8. All of the gaps present in the floor of the oven are sealed off by means of water-seals 9, so that the lower space of the oven remains relatively cool.

During the operation of the walking beam conveyor, the supporting beams 2 and 3 are alternately raised and

lowered. One set of beams, as is clearly shown in the drawing, remains at the uppermost vertical position until the other set of beams have reached their uppermost vertical position. By means of this operational characteristic, the desirable effect is obtained of the work not undergoing any vertical movement while being transported horizontally through the oven. Such vertical movement of the work pieces can cause a secondary lateral movement or harsh impact forces on the supporting beams 2 and 3 which, due to the aforementioned operational characteristic, is avoided.

Due to the horizontal movement of the supporting beams 3, the work pieces are moved through the oven in a horizontal direction at the level of the uppermost vertical position of the supporting beams. After a horizontal step-wise movement has been carried out by the supporting beams 3, the latter after supporting beams 2 have reached the uppermost vertical position, can return to their starting position.

If there is a long dwelling time of the work piece in the oven during which the work piece is not transported in the transporting direction, the supporting beams 2 and 3 are alternately raised and lowered to effect temperature equalization between the contacting surfaces with the supporting beams 2 and 3 and a work piece, on the one hand, and the remainder of the surfaces of the work piece, on the other hand. The interruption of the work piece movement can be caused by employing different conventional commonly adjusted driving mechanisms, which by switching off the driving means for the supporting beams 3 for moving these beams in a horizontal direction, can thereby produce a vertical reciprocal movement only of the supporting beams 2 and 3 by maintaining the operation of the vertical movement driving means for the supporting beams 2 and 3.

FIG. 2, illustrates a walking beams conveyor in a furnace 11, wherein the work is only heated from above in the oven 1. By heating the work from above only, the driving means for the oven can have a cover made of a special fire clay material and thus the beams do not require water-cooling means. Consequently, the supporting beams in FIG. 2 are designated with the reference numeral 3o because they are formed differently than the supporting beams 2 and 3 of FIG. 1. The embodiment of FIG. 2 corresponds in every other respect to the embodiment of FIG. 1. The individual parts of FIG. 2 are therefore designated with the same reference numbers as the corresponding parts of FIG. 1.

Returning once again to the embodiment of FIG. 1 it should be noted that the supporting beams 2 can also be provided with a driving mechanism for moving them in a horizontal direction. If the supporting beams 3 are only movable in a horizontal direction, the work piece is moved horizontally through the oven in a step-wise manner with intermittent periods of rest, and intermittent periods of horizontal movements. If, on the other hand, the supporting beams 3 are also movable in a horizontal direction, the work piece is moved through the oven 1 in a continuous quasi-uniform movement and of course, the work piece travels more quickly through the oven.

Although the invention is illustrated and described with reference to the plurality of embodiments thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a plurality of preferred embodiments but is capable of numerous modifications within the scope of the appended claims.

What is claimed is

1. In a heat tunnel having a walking beam conveyor arrangement for transporting work through said heat tunnel in a horizontal feed direction wherein the conveyor arrangement comprises, in combination, a first vertically reciprocable work-supporting beam, a second horizontally reciprocable work-supporting beam, each of the first and second beams having a substantially horizontal work-contacting surface, and actuating means for relatively moving the first and second beams in timed relation in alternate engagement with the work to advance the work through the heat tunnel, the improvement wherein the second beam is provided with facilities for vertical reciprocation to a height chosen such that the uppermost position of its work-supporting surface is substantially level with the uppermost position of the work-supporting surface of the first beam, and wherein the actuating means includes facilities for maintaining the work-supporting surface of each of the first and second beams in its uppermost position when in contact with the work.

2. In a heat tunnel, the walking beam conveyor arrangement as set forth in claim 1, wherein said actuating means are adapted to be selectively disconnected from said first beam so that said first and second beams only move vertically reciprocally and the movement of the work in the feed direction through said heat tunnel is thereby interrupted.

3. In a heat tunnel, the walking beam conveyor arrangement as set forth in claim 2, including water-cooling means operatively connected to each said first and second beams for cooling the associated work-contacting surface.

4. In a heat tunnel, the walking beam conveyor arrangement as set forth in claim 2, wherein said first and second beams are at least partially movable outside of said heat tunnel.

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