APPARATUS FOR CONVEYING MATERIAL THROUGH HEAT TREATING FURNACES

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APPARATUS FOR CONVEYING MATERIAL THROUGH HEAT-TREATING FURNACES

This invention relates in general to conveyors for moving metal sheets or bars through heat-treating furnaces, and more particularly to that type of conveyor which includes reciprocating members, commonly known as "walking beams."

An object of the invention is to provide a novel conveyor of this type for economically transporting metal bars, sheets or the like through the furnace.

Another object of the invention is to provide a novel furnace construction for affording a maximum degree of protection of the bearings of the walking beams against the destructive action of the gases which are employed for heating the metal bars, sheets or the like.

A further object of the invention is to provide means for permitting expansion of those parts of the conveyor which are exposed to the hot gases, and for controlling the effects of such expansion.

With the above and other objects in view, which will be more readily apparent as the nature of the invention is better understood, the same consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated and claimed.

A preferred and practical embodiment of the invention is shown in the accompanying drawings, wherein

Fig. 1 is a transverse cross-section through the furnace, taken on the line 1—1 of Fig. 2;

Fig. 2 is a longitudinal cross-section through a portion of the furnace, taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary enlarged plan view, showing the novel arrangement of the stationary and walking beams;

Fig. 4 is a cross-section, taken on the line 4—4 of Figs. 1 and 3;

Fig. 5 is a view, partly in elevation and partly in section, taken on the line 5—5 of Fig. 1 and showing the mechanism for imparting motion to the walking beams;

Fig. 6 is a fragmentary cross-section through the furnace, taken on the line 6—6 of Fig. 2;

Fig. 7 is a perspective view of one end of the stationary beam and either end of the walking beam;

Fig. 8 is a perspective view of one of the joint supports for supporting and retaining one end of the stationary beams.

Fig. 9 is a perspective view of one of the expansion joints for supporting the other ends of the stationary beams.

Fig. 10 is a diagram showing the path of motion of the walking beams, the relative position of the stationary beams being indicated in dotted lines.

Referring more particularly to the drawings, wherein similar reference characters designate corresponding parts throughout the several figures, the present arrangement includes a furnace having a bottom 1, lower side walls 2, upper side walls 3 having portions 3a which overhang the lower side walls, and a roof 4. The overhanging portions 3a of the upper side walls have spaced openings 3b extending upwardly therethrough, and are partially supported by spaced cross-walls 5. The walls 2 and 3 are also provided at spaced points with openings 6, in which suitable burners may be inserted.

The walls of the furnace are maintained in proper position by means of a frame-work consisting of spaced upright channels 7 and cross- channels 8 secured to the upper ends thereof.

The upper edges of the walls 5 are provided at spaced points with integral piers 8a. The piers of alternate cross-walls are surrounded by joint supports 9 and the piers of the remaining cross-walls are surrounded by expansion joints 10.

Each joint support 9 comprises a base 9a having depending flanges 9b which are adapted to embrace the piers 8a, and oppositely disposed U-shaped members 9c spaced from each other to provide vertically extending slots 9d.

Each expansion joint 10 comprises a base 10a having depending flanges 10b which are adapted to embrace the piers 8a of alternate cross-walls, and inverted L-shaped members 10c spaced from each other to provide a longitudinally extending slot 10d.

Stationary beams 11, T-shaped in cross-sec-
tion, are notched near one end, as at 11a. In placing the beams 11 in position, one end of each beam is inserted in the expansion joint 10 in such manner that its web enters the slot 10a, and the notched end is then dropped into the space between the U-shaped members 9c of the joint supports 9 in such manner that the notches 11c embrace the U-shaped members, as shown in Fig. 3. Clearances, indicated at A, are provided between the ends of the beams which enter the expansion joints 10.

It will be noted that the joint supports 9 prevent longitudinal displacement of the beams 11, but that the connection of successive beams at the expansion joints 10 permit the beams to expand freely when the furnace is heated. It will also be noted that the clearances A prevent the expansion of the beams 11 from being cumulative, as is the case in furnaces where no provision is made for clearance between beams.

Mounted upon the cross-channels 8, and extending substantially the full length of the furnace, are spaced H-beams 12. These beams support spaced brackets 13, upon which are pivotally mounted bell cranks 14.

The upper ends of the bell cranks 14 are pivotally secured to connecting rods 15, and pivotally suspended from the lower ends of the bell cranks, through the intermediary of links 16, which are rigidly secured stiff-legs 18, and pivotally secured links 19. The legs 18 and links 19 extend downwardly through the openings 3b in the walls 3, and pivotally secured to the lower ends of these members are cradles 20.

The cradles 20 are in the form of truss-like members, I-shaped in cross-section, and provided at their upper edges with spaced joint supports 20a, which, except for the fact that they are integral with the cradles 20, are similar in construction to the joint supports 9.

Walking beams 21, notched at both ends in a manner similar to that in which one end of the stationary beams 11 is notched, are supported on the joint supports 20a in the same manner in which the notched ends of the stationary beams 11 are supported on their joint supports 9, as clearly shown in Figs. 3 and 4.

It will be noted that this method of supporting the walking beams serves to prevent their longitudinal displacement.

When the furnace is cold, the beams 21 are of such length that the links 19 occupy the angular positions shown in solid lines in Fig. 2, but when the furnace is heated, the expansion of these beams causes these links to occupy the position shown in dotted lines in this figure. The notches in the ends of the beams 21, which are immediately to the right of the stiff-legs 18 are somewhat longer than the notches in the opposite ends of these beams or in any of the other beams, a provision which permits accumulated expansion of all of the walking beams between successive stiff-legs to be taken up at these points.

While I have shown six links 19 (three on each side of the furnace) between successive stiff-legs 18, it will be understood that any number of links, consistent with the amount of expansion to be taken up, may be provided between successive stiff-legs.

Means for imparting motion to the walking beams may be located adjacent the furnace at any suitable point, and may include a motor 22 and a speed reducing unit 23. For the purpose of imparting vertical motion to the walking beams a cam 24 may be employed, and is secured to one end of the shaft of the reducing unit. This cam, through the intermediary of a lever 25, a link 26 and a crank arm 27, causes partial rotary motion of a shaft 28, which is mounted in suitable bearings, secured to the H-beams 12. This rotary motion is translated into horizontal motion of the connecting rods 15 by means of gear segments 29.

Where the furnace is not of sufficient length to cause undue stresses in the connecting rods 15, only two connecting rods (one on each side of the furnace) need be employed, and the use of the gear segments 29 dispensed with, but where the furnace is of unusual length, as in a sheet normalizing furnace, four or more connecting rods may be employed, as shown in Fig. 2. In this case, additional gear segments 30, in mesh with the segments 29, may be employed to impart motion to the additional connecting rods, as will be readily understood by those skilled in the art.

For the purpose of imparting horizontal motion to the walking beams, a cam 31, secured to the opposite end of the shaft of the reducing unit, may be employed. This cam, through the intermediary of a lever 32, a link 33 and a crank arm 34 causes partial rotary motion of a shaft 35, which is mounted in suitable bearings, depending from the H-beams 12. This rotary motion is translated into horizontal motion of the channels 17 by means of lever arms 36 and links 37.

In the operation of the furnace, metal sheets or other material to be heat treated, is conveyed through the furnace in successive steps by the walking beams. As indicated diagrammatically in Fig. 10, each successive step includes a lifting movement a, caused by upward pivoting of the bell cranks 14, a horizontal transporting movement b, caused by horizontal movement of the channel members 17, and a depositing movement c, caused by downward pivoting of the bell cranks 14. In the depositing movement, the sheets are deposited upon the stationary beams, and the walking beams are then returned to their initial position by a retraction movement d, caused by reverse horizontal movement of the channel members 17. Since the sheets are deposited on the stationary beams on the down-
ward movement, they are not returned to their initial position, but are advanced by stages through the furnace.

An important feature of the invention resides in the fact that all of the moving bearings of the conveyor as well as the supporting members 18 and 19 are positioned outside of the heated zones of the furnace. This permits the bearings to be properly lubricated and reduces maintenance costs. In furnaces, wherein the bearings are exposed to the heat, proper lubrication of the bearings is virtually impossible, and expansion of the bearings must be compensated by providing excessive clearances, which result in undue wear and seriously impair the operation of the conveyor. In addition, the excessive heat softens the metal of the bearings and thus causes them to wear out rapidly. It will also be noted that portions of the overhanging walls 3a serve as baffles between the hot gases in the heating chamber and the members 18 and 19, thereby protecting the latter from the destructive effects of such hot gases.

From the foregoing, it will be apparent that the present construction provides an arrangement which will fulfill the objects herein set forth, and provides a simple, practical and reliable means for conveying material through a furnace.

Without further description, it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to without departing from the scope of the appended claims.

Claims:

1. In combination with a furnace having side walls provided with openings extending vertically therethrough, means for conveying material through said furnace including reciprocating members, cradles for supporting said reciprocating members, members for supporting said cradles extending through said openings and connecting members secured to the upper ends of said supporting members.

2. A structure as defined in claim 1, in which the connecting members are positioned outside of the furnace.

3. A structure as defined in claim 1, in which the connecting members are positioned outside of the furnace, and means for imparting vertical and horizontal movement to said connecting members.

4. A structure as defined in claim 1, in which the supporting members are pivotally secured to the cradles at their lower ends.

5. A structure as defined in claim 1, in which certain of said supporting members are pivotally secured to said connecting members at their upper ends.

6. A structure as defined in claim 1, in which certain of said supporting members are rigidly secured to said connecting members at their upper ends.

7. Apparatus for conveying material through a furnace including reciprocating members, cradles for supporting said reciprocating members, members for supporting said cradles and connecting members secured to the upper ends of said supporting members.

8. A structure as defined in claim 7, in which the supporting members are pivotally secured to the cradles at their lower ends.

9. A structure as defined in claim 7, in which certain of said supporting members are pivotally secured to said connecting members at their upper ends.

10. A structure as defined in claim 7, in which certain of said supporting members are rigidly secured to said connecting members at their upper ends.

11. A structure as defined in claim 7, and means for imparting vertical and horizontal movement to said connecting members.

12. In combination with a furnace, spaced cross-walls in said furnace, joint supports and expansion joints mounted respectively on alternate cross-walls and stationary members mounted on the supports and joints, the supports maintaining the members against longitudinal and lateral displacement, and the joints permitting longitudinal expansion of the members.

13. Apparatus for conveying material through a furnace including members adapted to support and convey material through a furnace, cradles supporting said members, supports for the cradles and members secured to and connecting the upper ends of said cradle supporting members.

14. A structure as defined in claim 13, in which the cradle supporting members are pivotally secured to the cradles at their lower ends.

15. A structure as defined in claim 13, in which certain of said cradle supporting members are pivotally secured to said connecting members at their upper ends.

16. A structure as defined in claim 13, in which certain of said cradle supporting members are rigidly secured to said connecting members at their upper ends.

17. A structure as defined in claim 13, in which certain of said cradle supporting members are pivotally secured to said connecting members at their upper ends and the remaining cradle supporting members are rigidly secured to said connecting members at their upper ends.

In testimony whereof I affix my signature.

LEONARD LARSON.