Oct. 9, 1928. 1,686,696

J. HIRSCHMANN

HEATING FURNACE

Filed Feb. 17, 1927 4 Sheets-Sheet 1

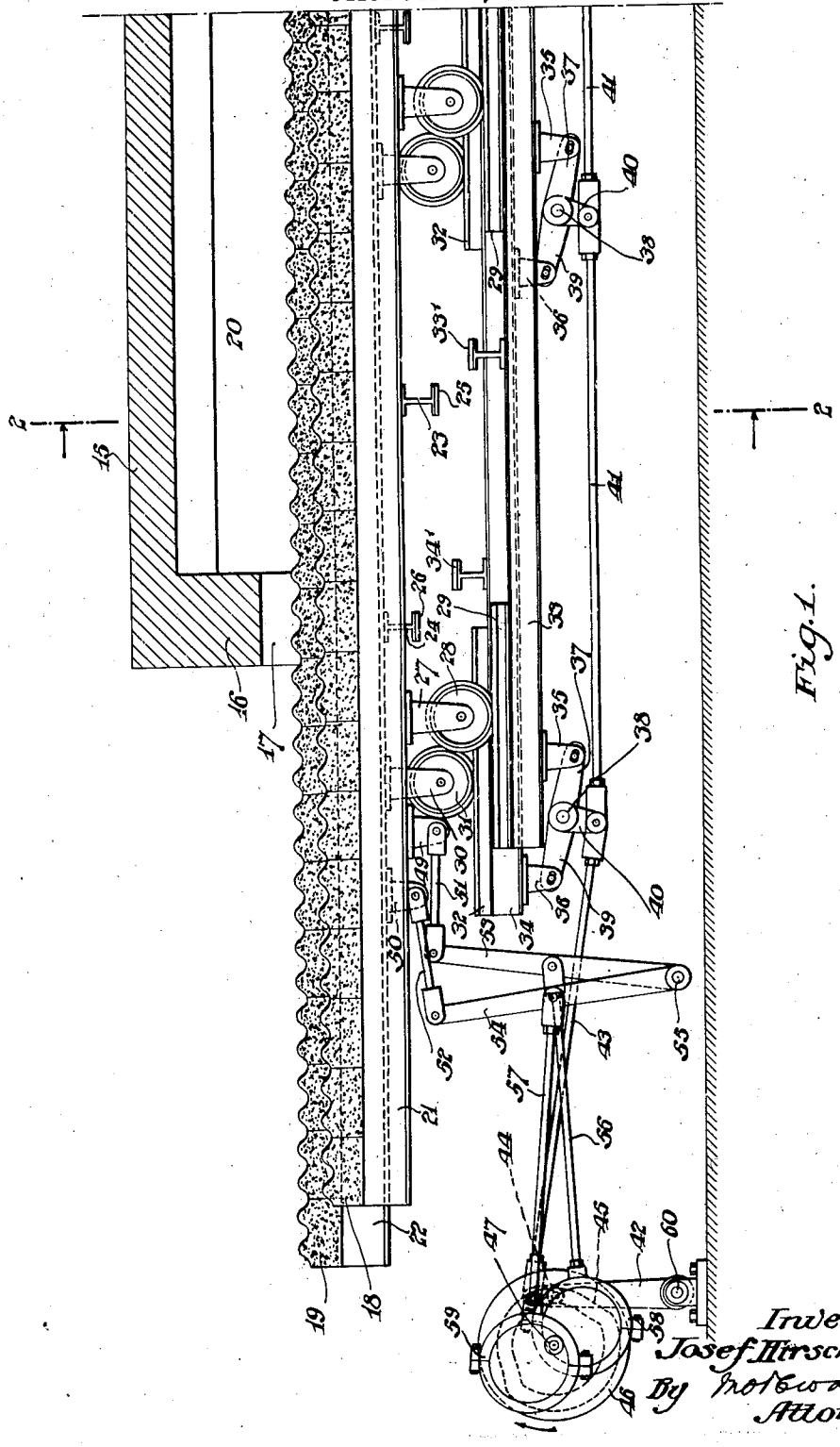


Fig. 1.

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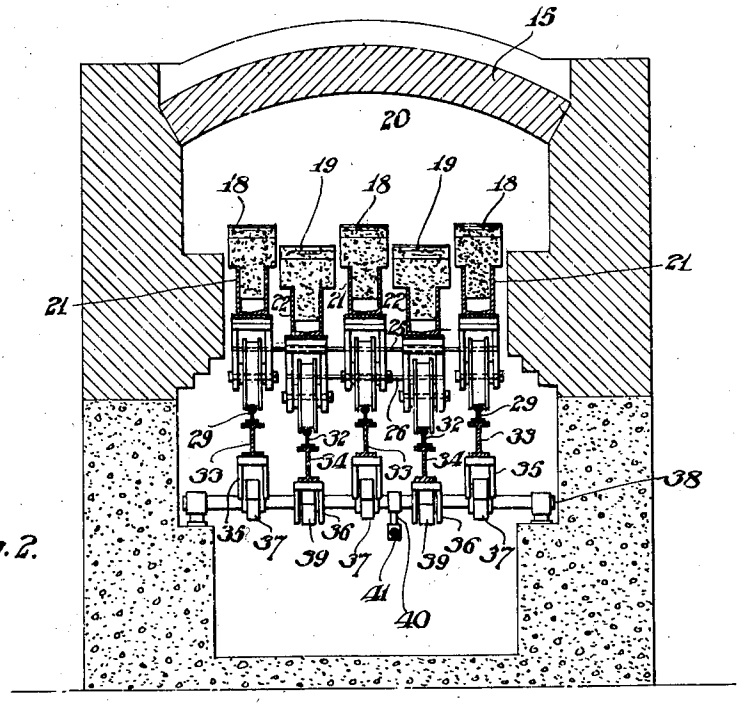


Fig. 2.

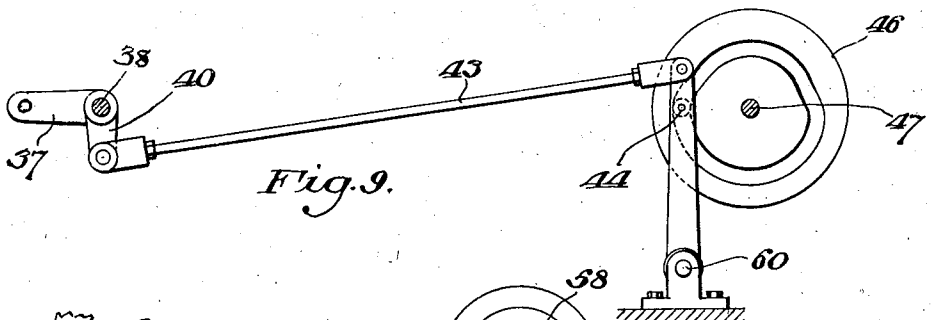


Fig. 9.

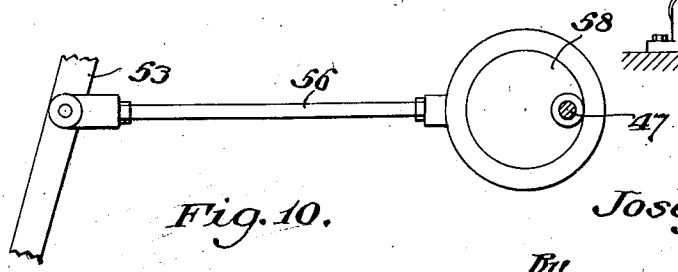


Fig. 10.

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HEATING FURNACE

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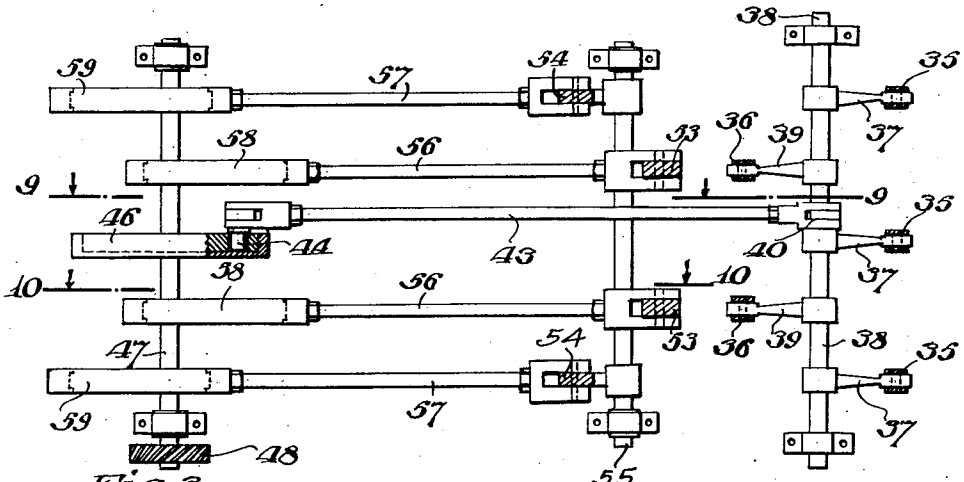


Fig. 3.

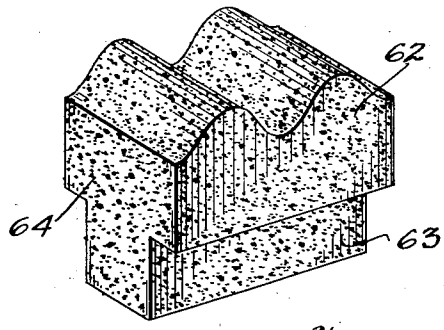
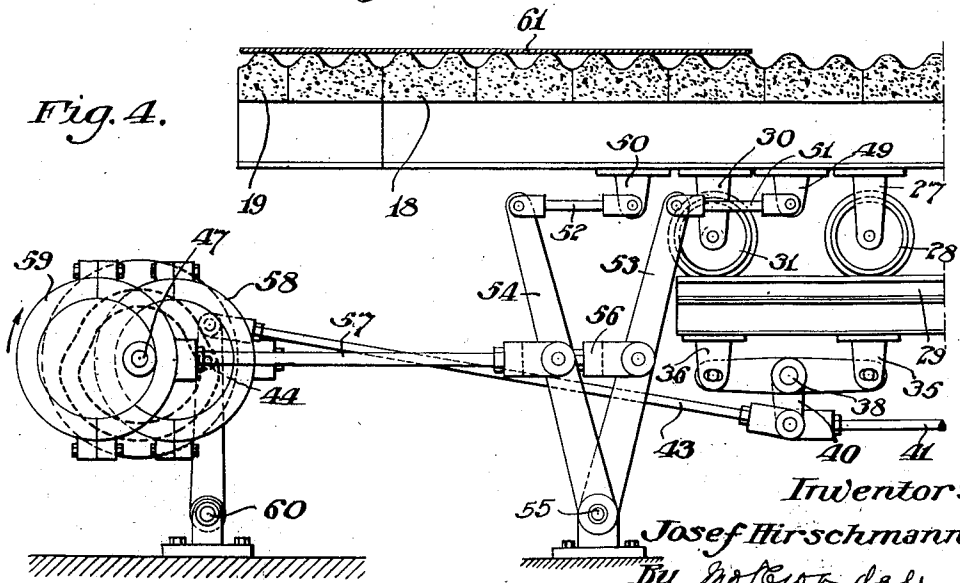


Fig. 5.

Fig. 4.



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HEATING FURNACE

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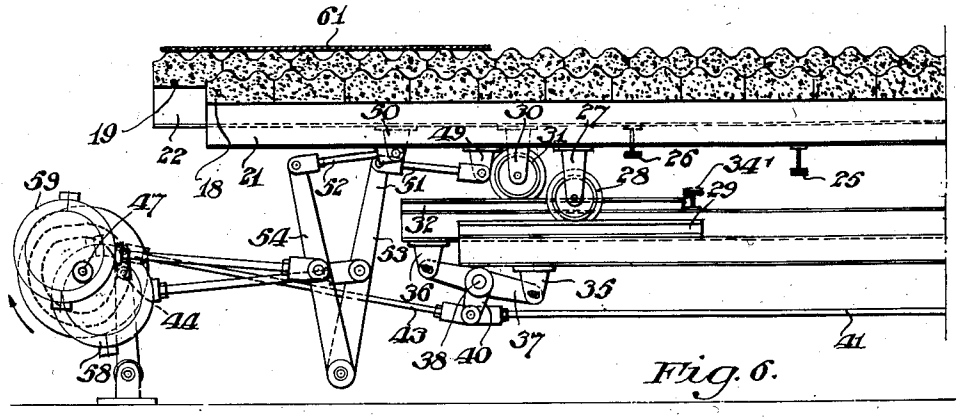


Fig. 6.

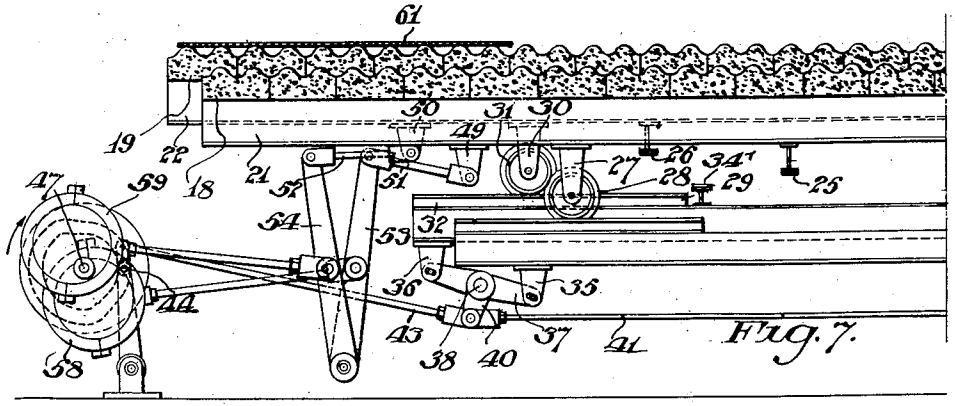


Fig. 7.

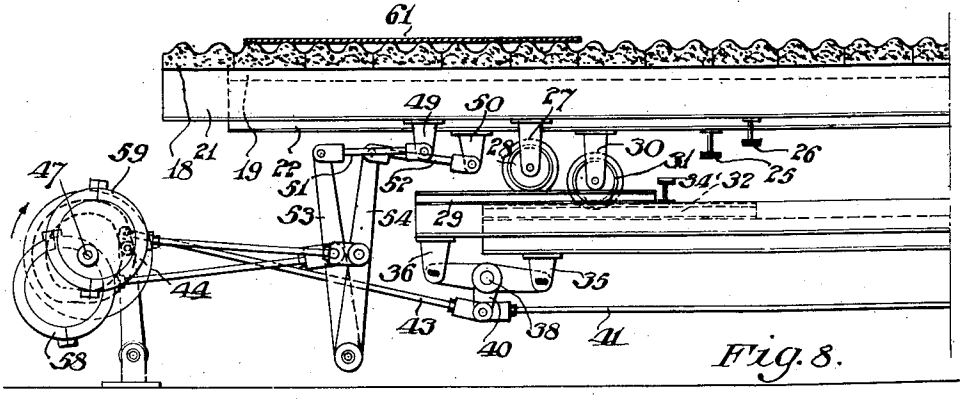


Fig. 8.

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Patented Oct. 9, 1928. 1,686,696

UNITED STATES PATENT OFFICE.

JOSEF HIRSCHMANN, OF BALTIMORE, MARYLAND, ASSIGNOR TO THE EASTERN ROLLING MILL COMPANY, A CORPORATION OF MARYLAND.

HEATING FURNACE.

Application filed February 17, 1927. Serial No. 168,894.

My invention relates to improvements in heating furnaces. The purpose is to provide improved method and means for conveying objects, through a heating zone, and is especially applicable to the treatment of material to be heated, annealed, or normalized, by passing the same through the furnace in a required period of time.

The method consists essentially in moving material by applying thereto the supporting effect of a group of alternately arranged parallel surfaces and simultaneously withdrawing therefrom the supporting effect of another group of similar surfaces and causing forward movement of each group while exercising the supporting function.

This method may be effected, for example, by means of a plurality of parallel longitudinally extending elements, with means for connecting the alternate elements in groups, means for raising and lowering said groups alternately, and means for moving said groups longitudinally, in one direction when raised, and in the opposite direction when lowered, so that said groups will alternately engage the said objects or material to move the same through the furnace in a substantially continuous movement and in an approximately horizontal plane, and with required velocity without undue shock or slip between the said material and said conveyor elements.

The invention also comprises improvements in details of construction.

Referring to the drawings, which illustrate merely by way of example, a suitable embodiment of my invention;—

Fig. 1 is a side elevation showing one end of the furnace provided with said improvements.

Fig. 2 is a vertical cross-section on line 2, 2 of Fig. 1, the elements 18 and 19 however being in reverse position.

Fig. 3 is a plan of the actuating cam, eccentrics and associated mechanism.

Fig. 4 is an enlarged fragmentary side elevation.

Fig. 5 is a view in perspective, on an enlarged scale, of a refractory block.

Figs. 6, 7 and 8 are side elevations showing the actuating mechanism in different positions.

Fig. 9 is an elevation in the plane of line 9, 9 of Fig. 3.

Fig. 10 is an elevation in the plane of line 10, 10 of Fig. 3.

Similar numerals refer to similar parts throughout the several views.

In Fig. 1, a portion of the top wall 15 of the furnace is shown. In the end wall 16 an opening 17 is provided, a similar opening being provided in the other end of the furnace, through which project the ends of the conveyor elements 18 and 19. These conveyor elements extend entirely through the furnace chamber 20 and beyond each end of the furnace chamber a substantial distance, as indicated in this Fig. 1. The extension beyond one end is to receive the objects to be introduced into and to be carried through the furnace. These objects, in the present example, are sheets or plates of steel. From the other portion of the conveyor, extending beyond the discharge opening of the furnace, the treated sheets are removed in any suitable way.

The conveyor elements 18 and 19 comprise rows of blocks 62 of fire clay or similar refractory material set in close formation in metallic channels 21 and 22. These blocks 62, as shown in Figs. 2 and 5, are preferably provided with shanks 63 adapted to fit within the channels, and shoulders 64 overhanging the top margins of the channels. The upper surface of the block is of undulating formation as shown. The blocks when arranged in said close formation form a continuous undulating surface thereby providing separated lines of support for the sheets 61, which permits free access, for the heat of the furnace to the underside of the sheet. In the present example five such conveyor elements are shown, as in Fig. 2. These elements are supported on a series of short I-beams or blocks 23 and 24. The three series of blocks 23 are connected together by cross-bars 25, and the two series of blocks 24 are connected together by the cross-bars 26, so that all of the elements 18 move together as one group, and all the elements 19 move together, as another group, the said groups being adapted to move simultaneously in opposite directions.

The group comprising elements 18 is provided with yokes 27 carrying the flanged

wheels 28 running on tracks 29. The group comprising elements 19 is provided with similar yokes 30 carrying the flanged wheels 31 running on tracks 32.

Tracks 29 are supported on beams 33, while tracks 32 are supported on beams 34 all as shown in Fig. 2. The beams 33 are tied together by cross-bars 33′ and the beams 34 are tied together by cross-bars 34′.

The groups of elements 18 and 19 are provided with a plurality of flanged wheels 28 and 31 respectively and supporting tracks 29 and 32, spaced apart, for supporting said groups as required. The several track sections 29 and 32 are each of sufficient length to permit the necessary horizontal movement thereon of the flanged wheels supporting said groups 18 and 19.

The beams 33 and 34 are provided with yokes 35 and 36 respectively, each yoke 35 is pivotally secured to an arm 37 on one side of a shaft 38, while each yoke 36 is pivotally secured to an arm 39 on the opposite side of a shaft 38. A number of shafts 38 are provided, spaced apart for supporting the beams 33 and 34. Each shaft 38 is also provided with the arm 40. The several arms 40 are connected together by the connecting rods 41, and to the cam lever 42 by the connecting rod 43. The cam lever 42 is pivotally mounted, as at 60, and is provided with the roller 44 traveling in the channel 45 of channel cam 46 on shaft 47. This shaft 47 is driven through the gear 48 from any suitable source of power.

The groups of elements 18 and 19 are provided with lugs 49 and 50 respectively which are connected by connecting rods 51 and 52 to the ends of levers 53 and 54, loosely mounted on shaft 55. These levers 53 and 54 are connected by connecting rods 56 and 57 to the eccentrics 58 and 59 also mounted on and rotating with shaft 47. In the example shown there are two eccentrics 58 and two eccentrics 59, and connecting mechanism, for each group of elements 18 and 19.

The operation.

The sheets or plates of metal 61 are placed upon the extension of the upper group of conveyor elements 18 or 19, which projects beyond the entrance mouth 17 of the furnace chamber 20, as shown in Fig. 1. The shaft 47, with its cams and eccentrics, rotates in clockwise direction. The rotation of cam 46 causes the rocking of the shafts 38 to raise one group of elements, as for example 19, and to lower the other group of elements 18. The shape or contour of the channel 45 of this cam 46 is such as to maintain the two groups, with a slight dwell, in the positions shown in Fig. 1. During this period of dwell the eccentrics 58 and 59 operate to actuate the levers 53 and 54 to shift the group of raised elements 19 to the right to carry the sheet a step toward the furnace mouth 17, while the lower group of elements 18 is shifted in the opposite direction. These shifting movements are in horizontal planes. At the end of this shifting movement, the channel cam 46 reverses the positions of shafts 38 thereby causing the group of elements 18 to be raised and the group of elements 19 to be lowered, with a dwell as above described, and during this dwell, the groups are again shifted in opposite horizontal directions, causing a further step forward movement of the sheet which rests upon the upper group of elements. Thus the operation is continued until the sheets are carried entirely through the furnace.

It will be noted that, as these groups are raised and lowered relatively to each other, their supporting surfaces pass each other in a horizontal plane, midway between the plane of the raised group and the plane of the lowered group, so that the vertical movement of the sheets or plates is only half of the vertical movement of each group, and the sheets are moved forward by one group while the other group is returning to initial position, so that the movement of the sheets through the furnace is almost a continuous movement, which can be regulated with precision by simply controlling the speed of rotation of shaft 47.

Fig. 4 shows the relative positions of the cam, eccentrics and connecting mechanism, when the groups of conveyor elements 18 and 19 are in the same horizontal plane.

Fig. 6 shows the group 19 raised and the group 18 lowered from the middle horizontal plane, the upper group carrying the plates 61.

Fig. 7 shows the raised group 19 moving forward and the lower group 18 moving backward.

Fig. 8 shows the group 18 raised and the group 19 lowered.

The next operation being the shifting of the groups horizontally in opposite directions and then reversing their vertical position and so on.

Where one group contains three elements and the other group two elements, as in the present example, extra metal may be provided in connection with the smaller group, in order to counterbalance the weight on opposite sides of the supporting shafts 38.

What I claim is:—

1. In combination with a heating furnace, means for conveying material therethrough, comprising a plurality of longitudinally extending parallel supporting and conveying elements, means for connecting alternate elements into different independently movable groups, supporting wheels connected to and positioned directly beneath the middle lines of said elements, supporting rails for supporting with said wheels, said rails also connected together in corresponding groups, means for alternately raising and lowering

the groups of rails, and means for reciprocating the groups of conveying elements upon the rails.

2. In combination with a heating furnace, means for conveying material therethrough, comprising a plurality of longitudinally extending parallel supporting and conveying elements, means for connecting alternate elements into different independently movable groups, supporting wheels connected to and positioned directly beneath the middle lines of said elements, supporting rails for supporting with said wheels, said rails also connected together in corresponding groups, a common shaft provided with a plurality of rock levers extending oppositely from said common shaft, each lever positioned directly beneath a supporting rail and movably connected thereto, an actuating lever connected to said shaft and a cam and means controlled thereby and associated with said actuating lever for rocking the shaft, and means for reciprocating the groups of conveying elements on the rails.

3. In combination with a heating furnace, means for conveying material therethrough, comprising a plurality of longitudinally extending parallel supporting and conveying elements, means for connecting alternate elements into different independently movable groups, supporting wheels connected to and positioned directly beneath the middle lines of said elements, supporting rails for supporting with said wheels, said rails also connected together in corresponding groups, means for alternately raising and lowering the groups of rails, means comprising loosely pivoted levers each having a free end in operative relationship with a group of conveying elements, and connecting rods and eccentrics in operative relationship with the levers for cooperation in reciprocating said conveying elements.

4. In combination with a heating furnace, means for conveying material therethrough, comprising a plurality of longitudinally extending parallel supporting and conveying elements, each element comprising a metallic channel provided with elements of refractory material having portions fitted in the channel said elements so shaped and combined to form an undulating surface presenting separated lines of support for the sheets, means for connecting alternate elements in separate independently movable groups, and means for causing alternate vertical and longitudinal reciprocation of said groups.

5. In combination with a heating furnace, means for conveying material therethrough, comprising a plurality of longitudinally extending parallel supporting and conveying elements, each element comprising a metallic channel provided with blocks of refractory material having portions fitted in the channel in close formation, said blocks so shaped and combined to form an undulating supporting surface for the sheets, means for connecting alternate elements in separate independently movable groups, and means for causing alternate vertical and longitudinal reciprocation of said groups.

6. In combination with a heating furnace, means for conveying material, such as sheet metal, therethrough, comprising a plurality of longitudinally extending parallel supporting and conveying elements arranged alternately in different independently movable groups, supporting wheels connected to said elements, wheel-supporting rails also arranged in different independently movable groups, means for alternately raising and lowering the groups of rails and means for reciprocating the groups of conveying elements upon the rails.

JOSEF HIRSCHMANN.