Oct. 10, 1939. E. S. FATKIN 2,175,834

HEAT TREATING FURNACE

Filed Sept. 30, 1938 3 Sheets-Sheet 1

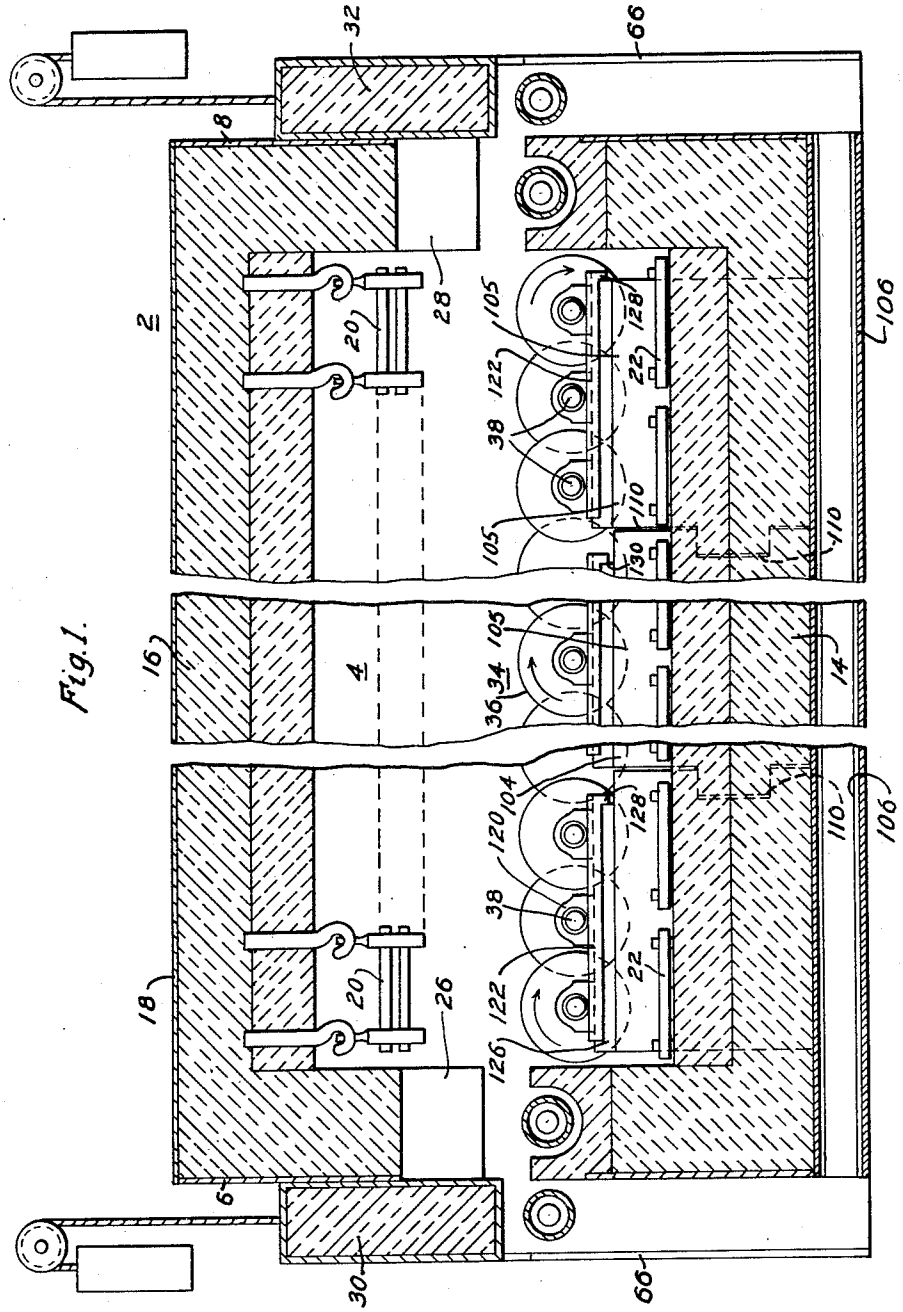


Fig. 1.

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HEAT TREATING FURNACE

Filed Sept. 30, 1938 3 Sheets-Sheet 2

Fig. 2.

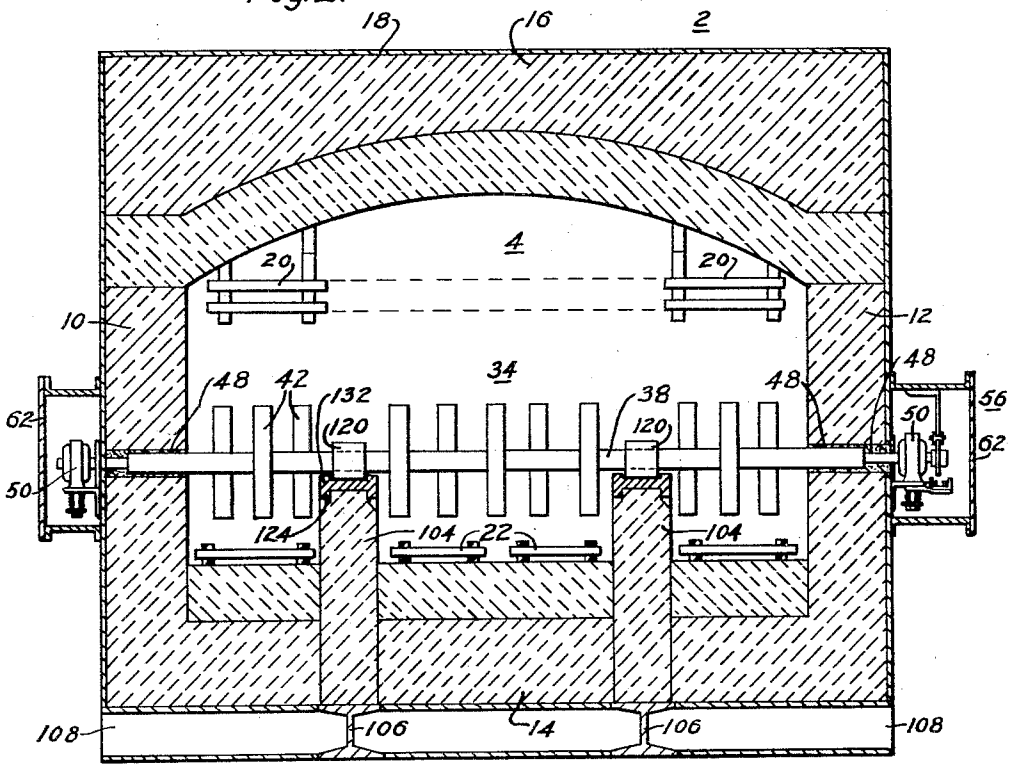


Fig. 3.

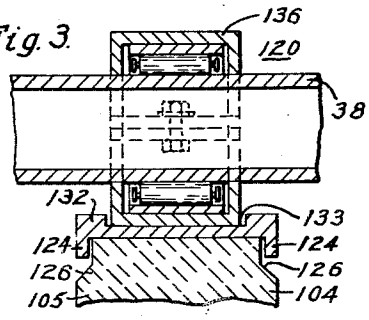


Fig. 4.

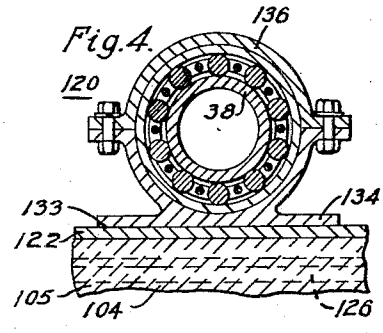


Fig. 5.

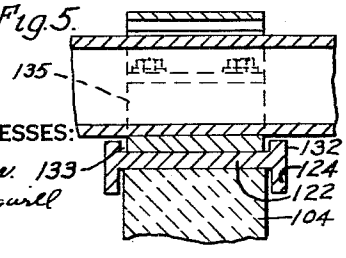
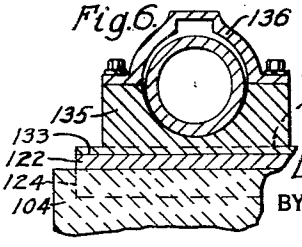


Fig. 6.



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HEAT TREATING FURNACE

Filed Sept. 30, 1938 3 Sheets-Sheet 3

Fig. 7.

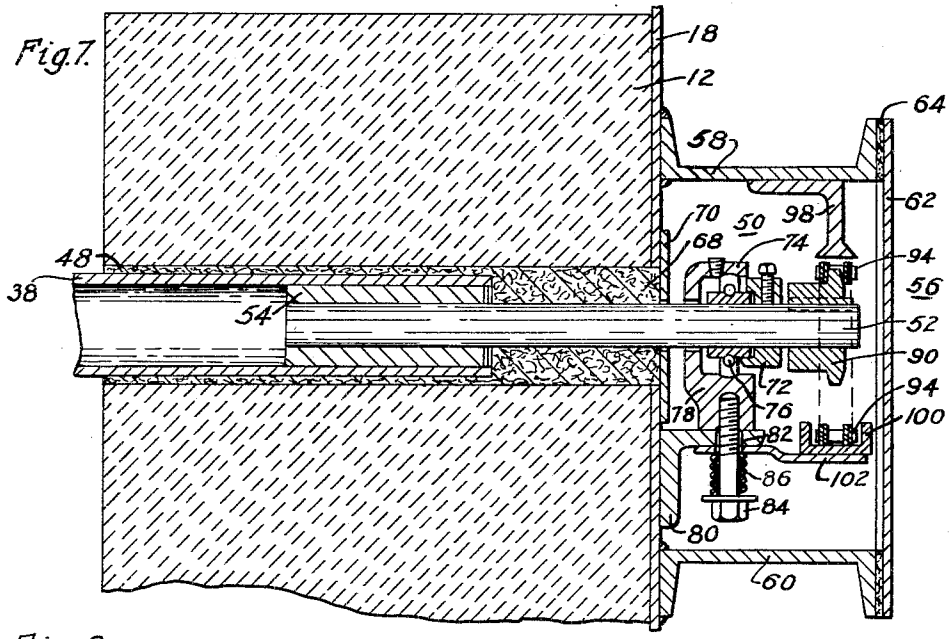


Fig. 9.

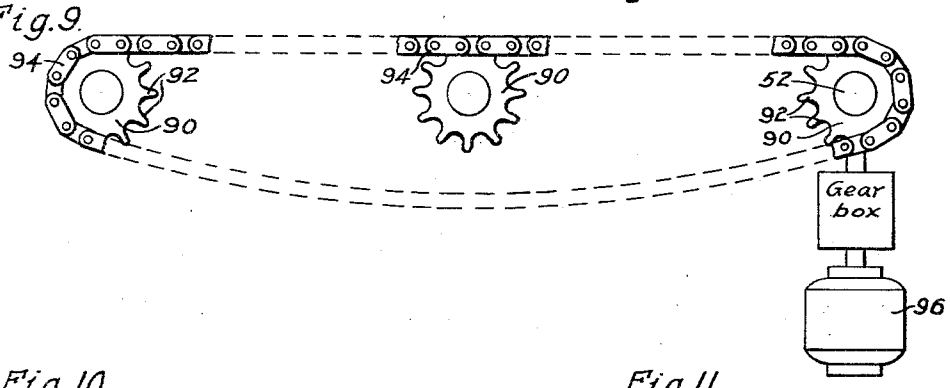


Fig. 10.

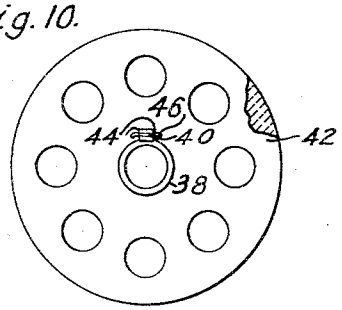


Fig. 11.

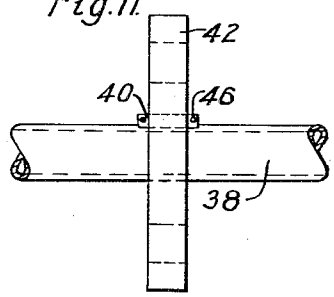
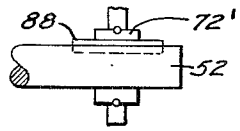


Fig. 8.



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Patented Oct. 10, 1939

2,175,834

UNITED STATES PATENT OFFICE

2,175,834

HEAT TREATING FURNACE

Edward S. Fatkin, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application September 30, 1938, Serial No. 232,635

21 Claims. (Cl. 263—6)

My invention relates specifically to a roller hearth for a furnace employed in the heat treatment at elevated temperatures of wide sheets, plates, and the like, but is by no means limited to this particular field of application, and can be employed wherever a charge of any kind is to be heat treated while supported in or conveyed through the furnace, or both, by a roller hearth for the purpose of imparting to the charge desired characteristics or qualities.

Roller hearths for this service usually comprise a series of adjacent rolls or shafts upon which are mounted roller discs forming the bed upon which the charge rests, although for some purposes the discs can be omitted and the charge supported directly on the rolls. In most instances the rolls are made of a common metal such as steel, or if high temperatures are involved, as, for example, in normalizing furnaces, of a heat-resistant alloy, the better known of which include chromium and nickel as constituents.

My invention is particularly directed to furnaces to be operated at relatively high temperatures and, therefore, I prefer to employ a heat-resistant alloy for the metallic parts of the hearth. When rolls are employed at such elevated temperatures, provision must be made for their expansion and contraction, and since the rolls have but a small fraction of their original tensile strength at the higher temperatures, further precautions must be taken either to prevent their sagging between supports or, at least, minimizing the effects thereof. Such provisions and precautions are, of course, essential if the roller hearth as a whole is to be capable of supporting the load upon it and also its own weight to the end that the supporting surface remains substantially unchanged and capable of performing its functions at all the temperatures to which the hearth is exposed.

Precautions heretofore taken to prevent warping or distortion of the rolls of the roller hearth and to bestow upon them the necessary tensile strength, involved increasing the diameter of the rolls, and perhaps, water cooling them. These were quite sufficient for furnaces in which narrow sheets or plates of metal were heat treated so that the rolls were relatively short and need be supported only at their ends with the bearings out of the heating zone. For the heat treatment of strips of sheets or plates of increased width, furnaces with roller hearths built in accordance with prior practice have proved either entirely inadequate or impractical. The width of the wider metals requires roller hearths with rolls of an individual length sufficient to span the width of the metal, and if the diameter be increased to prevent sagging the resultant dimensions are entirely out of proportion and the cost prohibitive, particularly if a high grade heat-resistant alloy be employed. In my invention I resort to features which individually and in combination enable me to construct at a low cost a roller hearth of considerable width having exceptional strength, and one which requires a minimum of attention.

In accordance with my invention, I provide one or more piers within the furnace, and preferably intermediate the side walls, as additional supports for the hearth whereby rolls of smaller diameter can be employed. The piers extend longitudinally of the furnace for the length of the hearth and as many laterally spaced piers may be employed, consistent with a given size of roll, as the width of the furnace demands. Intermediate supports for the rolls of a charge-conveying hearth are not new, being shown in Patent No. 1,025,936, granted May 7, 1912, to W. R. Valentine and Patent No. 1,992,467, granted February 26, 1935, to William B. Blythe, as examples. However, prior constructions, including those shown in these patents, required individual pedestals for each supporting point on the individual rolls, resulting in a multitude of pedestals for a hearth of even moderate size. Moreover, such pedestals have been made of the expensive heat-resistant metals, such as alloys of chromium, nickel and iron, and their relatively large temperature coefficient of expansion make necessary individual adjusting means for each pedestal, the adjusting means having parts protruding outside the furnace demanding much and awkward manipulation.

In my preferred construction I provide, rather than metallic pedestals, refractory supporting piers which require no adjusting means and which may extend a good part of the length of the furnace so that a plurality of rolls can be supported on each pier or section thereof, a feature of utmost importance from the viewpoint of economy, stability of construction, and operating efficiency. By providing inexpensive refractory roll-supporting piers, I may employ as many piers transverse of the formation as may be convenient and because so many supporting means can be made available, the rolls themselves need be ony of relatively small diameter and are hollow for the purpose of decreasing the weight of the roll as well as the amount of metal re-

quired for its formation. The decreased diameter of the rolls permitted by my invention effects a number of obvious economies which more than compensate for the additional cost for the refractory piers.

In accordance with my invention, the supporting means for the rolls is such as to permit changes in dimension and form which accompany wide temperature variations. To this end the bearings for the rolls that are supported on the piers have a limited freedom of movement, while the end bearings are of the self-aligning type. Moreover, by employing a sprocket drive for the rolls, I obtain a roller hearth with sufficient play to completely take care of changes in dimensions and form, and which will nevertheless continue to operate in a satisfactory manner even if some warpage of one or more rolls occurs.

It is accordingly a main object of my invention to construct in an economical manner a roller hearth of considerable width.

It is an additional object of my invention to construct a roller hearth of considerable width in which relatively light rolls of relatively small diameter can be employed.

It is a purpose of my invention to support the rolls of a roller hearth intermediate their ends on refractory piers requiring no means other than the customary expansion joints for taking care of dimensional changes in the piers due to temperature variations.

It is an important feature of my invention to construct each pier or section thereof so that more than one roll can be supported thereon.

It is a further object of my invention to permit a relative movement between the rolls and the supporting means whereby to take care of all changes in configurations or dimensions due to deformation of the rolls or to variations of temperature, or any other reason; and to further provide a driving means for the rolls whereby the operation of the roller hearth is relatively immune to such changes.

It is an additional object of my invention to provide roller discs of refractory material and maintain each in place by a simple structure in the form of cotter pins or the like.

Other novel objects, features, elements and combinations of my invention will be apparent from the following description thereof, taken in conjunction with the drawings, wherein like reference numerals denote like parts, and in which

Figure 1 is a view in vertical longitudinal section of a furnace embodying my invention;

Fig. 2 is a view thereof in vertical transverse section;

Fig. 3 is a view in section through a roll and its supporting means on an intermediate pier in the furnace;

Fig. 4 is a view of the same section at right angles to that of Fig. 3;

Figs. 5 and 6 are views similar to Figs. 3 and 4, but of a modified bearing support;

Fig. 7 is an enlarged view in section of the drive end of one of the rolls;

Fig. 8 is a fragmentary view of the off-drive end of a roll and part of the end bearing therefor;

Fig. 9 is a view diagrammatically depicting the drive for the rolls; and

Figs. 10 and 11 are plan and elevational views, respectively, at right angles of a roller disc that may be employed in the roller hearth.

Referring more particularly to the drawings, the reference numeral 2 represents a furnace of any appropriate type which incorporates my invention. The furnace comprises a heat treatment chamber 4 defined by end walls 6 and 8, lateral or side walls 10 and 12, a base wall 14 and a top wall 16. The walls, with the exception of the base wall which is modified somewhat as will later be apparent, may be constructed, in accordance with customary furnace practice, of insulating and refractory brick encased in a metallic shell 18.

The furnace may be designed for any purposes, although my particular application is for heat treating sheets or plates at temperatures in the neighborhood of 1800° F., which are obtained by any appropriate heating elements, shown in the present case as electric heating elements 20 suspended from the top wall and 22 supported on the base wall.

In accordance with my invention, the charge may be admitted to the furnace through an entrance opening 26 in the front end wall 6 and may leave the furnace through an exit opening 28 in the rear end wall 8, both openings being suitably controlled by closures 30 and 32, respectively. The charge is supported by and also conveyed through the furnace by means of a roller hearth, indicated in its entirety by the reference character 34, which comprises a plurality of complete rolls 36 extending laterally through the furnace, and spaced at suitable distances in accordance with the character of the articles to be heat treated and the overall load the rollers are to support.

The individual rolls comprise, in general, a tubular shaft 38 preferably made of a heat-resistant alloy to resist the high temperatures to which the hearth is subjected. Integral with the shaft 38 and at intervals along the length thereof are keys 40 for the purpose of transmitting movement of the shafts to charge-supporting discs 42 of dense refractory material, fitting the shafts 38 and having keyways cooperating with the keys 40. The keyways are deliberately made slightly oversize while the keys have their edges 44 somewhat rounded so that undue stresses will not be created in the refractory discs 42. To limit the movement of each disc 42 axially of the shafts 38, cotter pins 46 extend through appropriate holes in each key on both sides of the refractory disc, and are spaced somewhat from the sides of the disc to avoid the creation of undue stresses. These precautions are largely unnecessary with discs made of heat-resistant metal which may also be employed, if desired.

As shown somewhat schematically in Figs. 1 and 2, the discs on alternate shafts are staggered with respect to each other as is customary in the art, a disc of one shaft extending in the space between two adjacent discs on the alternate shaft.

In the particular embodiment disclosed, the rolls are supported at both their ends, and to permit this construction the lateral walls 10 and 12 are provided with suitable openings 48 spaced along the length of the walls and through which the ends of the rolls protrude, being supported upon self-aligning bearings 50.

Fig. 7 shows in greater detail a drive-end support for one of the rolls. Each roll terminates in a stub shaft 52 made unitary with the tubular shafts 38 by means of a metallic insert 54, which may be either solid or webbed, the three elements being suitably secured one to another so as to rotate in unison. The stub shaft 52 protrudes

beyond the metallic shell 18 of the furnace into a drive-end housing indicated in its entirety by the reference character 56. This drive end housing extends the length of the hearth and comprises a top member 58 and a bottom member 60 secured to the shell 18 by welding or otherwise. A closure plate 62 fits the top and bottom members 58 and 60 and may be suitably secured to the latter with a gasket such as 64 between the parts so that a gas-tight structure is obtained, if such is desirable. In order to reinforce the shell 18, upstanding buckstays 66 of structural steel may be employed spaced at suitable intervals.

As a precaution against excessive loss of heat through the openings 48, mineral wool 68 surrounds the stub shaft 52 and is held in place by a retaining plate 70 removably secured to the shell 18 in any suitable manner.

The stub shafts 52 are supported in self-aligning bearings 50 each of which comprises an inner ball race 72 fitted to the stub shaft to rotate therewith and an outer ball race 74 having a spherical outer surface, as shown at 76, fitted into a similarly curved seat in bearing-retainer members 78. The member 78 rests upon a rigidly-secured angle 80 which has one or more apertures 82 for each bearing and through which pass one or more bolts 84 secured in the bearing-retainer member 78. A strong compression spring 86 extends downwardly upon the head of the bolt 84 to maintain the bearing structure flexibly in position.

The structure thus far described for the ends of the rolls and the bearing supports therefor within the enclosure 56 is substantially the same for both sides of the furnace with the exception that on the drive side the inner race 72 is rigidly secured to the stub shaft 52 while on the off-drive side a floating bearing is employed to permit axial sliding of the roll in the bearing as the roll lengthens or shortens with temperature changes. A floating bearing is well known to the art and is schematically indicated in Fig. 8 by an elongated key 88 secured in the off-drive stub shaft 52 and capable of sliding in a keyway in the inner race 72′ of the off-drive side bearing.

The drive-side stub shafts 52 have secured thereto sprocket wheels 90 having teeth 92 meshing with a sprocket chain 94 driven, through appropriate gearing if required, by a motor 96. Secured to the inside of the top member 58 of the housing 56 is a chain-confining member 98 having its lower end terminating somewhat above the upper side of the chain 94 to insure that the latter will not sway out of mesh with the sprocket wheels 90 of all of the rolls. The lower side of the sprocket chain rides in a channel 100 which can be supported by a plurality of suitable plates 102 interposed at lengths along the furnace between the lower surface of the angle 80 and the springs 86.

The bearing structures I provide, the supporting means, and the drive all cooperate to assure continuous satisfactory operation of the hearth in spite of expansion and growth of the parts and possibly slight warping or deformation of the rolls.

The end bearings 50 permit of slight eccentric movement of the stub shaft 52 by virtue of their spring mounting which gives to the bearing retaining member 78 a limited vertical movement, while the curved outside surface 76 of the outer ball race may slide in the cooperating curved seat in the retaining member 78 to conform to the movement of the stub shaft 52 even though the stub shaft 52 moves eccentrically. Because of the flexibility of the sprocket and chain drive, rotation will be transmitted to the rolls even with slight displacement of the latter, and it may thus be seen that the self-aligning end bearings and the particular flexible driving means cooperate to drive the hearth with any of the stub shafts 52 rotating concentrically or eccentrically. Moreover, any elongation of the roll will not disturb the support or the driving means since the off-drive-side stub shaft is free to slide in its floating bearing.

A primary function of my invention is to provide an internal support for the roller hearth which will enable me to use long rolls having a small diameter shaft even though the shaft is exposed to a high temperature. Ordinarily the permissible stress of a shaft of a common heat-resistant alloy metal at a temperature of approximately 1800° F. is confined at present to the neighborhood of 400 pounds per square inch as against 15,000 pounds per square inch at ordinary temperatures, and in a specific instance would require a tube 9 inches in diameter. However, by providing, in accordance with my invention, a plurality of supports within the heating chamber for the rolls, a three inch shaft will suffice even though it be subjected to the same temperature. I provide such internal supports in the form of refractory piers 104 extending the length of the roller hearth. As many piers may be employed as the width of the furnace requires, and, in the embodiment shown, two such piers are spaced from each other and from the lateral walls 10 and 12, although it is obvious that the number of piers may be decreased or increased, and their disposition within the heating chamber varied to limit or proportion the maximum stresses developed in the rolls in any desired manner.

Each pier preferably comprises one or more aligned tiles 105 of refractory material with insulating qualities, and built into the brickwork of the base wall to fix their position. The tiles preferably are supported by I-beams 106 underneath them extending the length of the furnace and which, in conjunction with other structural steel members such as transversely extending members 108, provide a suitable foundation for the furnace proper.

The individual tiles are so formed and so built into the base wall that longitudinal expansion joints 110 are provided to take care of the slight changes in the longitudinal dimensions that occur when the piers are subject to the elevated temperatures required for particular heat treating processes. The expansion joints between the tiles may be formed in any suitable manner to the end that non-continuous expansion joints are obtained, as is desirable in furnace construction. Thus, for example, one tile may have a groove into which fits the tongue of the adjacent end of the next tile to form the tongue and groove arrangement shown in Fig. 1, or, if preferred, the ends of the tile may be suitably stepped for the purpose.

The rolls of the hearth are directly supported, in a manner to be described, on bearings 120 seating on appropriately-shaped metallic intermediate-support members 122 in turn resting on the piers, all cooperating in order that the parts including the rolls have a freedom of movement for the dimensional changes that may be expected at the temperatures to which they may be subjected in the furnace.

The tiles comprising each pier and the cooperating member 122 loosely resting on each tile are

preferably of such length as to support a plurality of rolls to the end that a rigid structure of considerable strength and distributed stresses be obtained. So that it can expand longitudinally, the overall length of each member 122 is, however, somewhat less than that of the tile upon which it rests because of the greater temperature coefficient of the metal as compared to refractory.

Each member 122 seats loosely on a tile 105 to permit lengthwise relative movement between them, but has downwardly projecting edges 124 which straddle the upper end of the tile to prevent excess sideways displacement of the channel member. The upper end of the tile may be formed square, as shown in Fig. 5, or may be formed with shoulders 126, as shown in Figs. 2 and 3, of somewhat greater extent than the downwardly projecting edges 124, in order to provide a solid and firm seat fitting with some clearance the lower channel of the member 122. The projecting edges of the member 122 may be continuous or may be formed as spaced lugs protruding from the body portion, the latter construction being preferred inasmuch as a saving in metal is thereby attained.

Each intermediate-supporting member 122 also has a lateral downwardly projecting lug 128 abutting a vertical side of the tile. For this purpose, the tile is formed with a shoulder 130 at one end thereof, the end being determined by the direction of rotation of the rolls. Assuming the rolls rotate as shown by the arrow in Fig. 1, the lugs 128 prevent horizontal movement to the left of the members 122 and thereby prevent them from being forced off the tile supports by the rotating forces of the rolls which are transmitted by friction through bearings 120.

Each member 122 also is formed with upwardly projecting edges 132 forming an oversize channel 133 in which the internal bearings 120 seat for supporting the rolls inside the furnace seat. These bearings resting upon the member 122 may assume a number of different forms so long as provision is made permitting limited movement to prevent binding of the rolls should they wrap to a slight degree, and permitting relative movement between the units that temperature variations may require. Two forms of internal bearings are depicted, Figs. 3 and 4 showing a roller type bearing, and Figs. 5 and 6 showing a pillow-block bearing.

The bearing shown in Figs. 3 and 4 comprises a base plate 134 resting in the channel 133 of the member 122. The width of this base plate is somewhat less than that of the channel to provide a clearance between the parts and the length is such that the bearing will tend to remain relatively fixed in its proper position. The bearing is shown as a roller bearing and preferably has an inside diameter slightly larger than the outside diameter of the rolls 38 as an additional precaution against binding.

The pillow-block bearing of Figs. 5 and 6 also may be employed at the intermediate supporting points for the rolls. This type of bearing comprises a base 135 of a width which is also slightly less than the channel 133 and a length also sufficient to maintain the bearing relatively fixed in place. The base 135 is preferably of a high-grade heat-resistant metal formed with a seat in its lower half for supporting the roll 36 with as little friction as possible. The seat of this bearing can also be made of a diameter slightly greater than that of the roll shaft 38 as a preventive means against binding between the shaft and bearings in the event undue expansion occurs.

A dust cap 136 is applied over the base 134 to confine the shaft within the bearing and also to protect the bearing against entrance of grit or dust.

The structure of my roller hearth and supporting means enables me to use relatively small rolls without fear of interrupting the continuity of operation of the furnace. In accordance with my invention, full provisions have been made for all possible contingencies that might render the operation of the hearth unsatisfactory.

The different type of possible dimensional changes and distortion are fully compensated in my construction. Longitudinal changes in the dimension of the rolls are taken care of in the off-drive-side bearing by sliding action of the key 88 in the corresponding keyway in the race 72'. The internal bearings 120 automatically align themselves with the axis of the roll by virtue of their freedom of movement in the channels 133 of the members 122, and of the members 122 themselves. Moreover, a change in the dimensions of a member 122 has no effect on the alignment of the bearings 120 supported thereon, since the member 122 is free to slide both with respect to the bearings and to the tile 105. Because of the sliding action between the tile 105, the member 122 and the bearings 120, expansion and contraction, or growth, of the parts with continued use do not affect the function of the bearings. Inasmuch as the tiles are made of a refractory or semi-refractory material their expansion vertically is much less than that which would occur if metallic pedestals were used in their place, and is so small that provision can be made therefor in calculating the height of the tile for the construction of a particular furnace.

The extreme difficulty encountered by the use of metallic pedestals has been the rapid and extensive change of height of the pedestal with temperature variations and which necessitated the use of individual adjusting means. Because of the limited extent of the change of height of the refractory piers and a correspondingly slower proportionate change with time, my construction does not require any adjusting means. However, even if excessive or too rapid expansion should occur, the over-size and mounting of the internal bearings, and the self-aligning characteristics of the bearings and their intermediate support permit a slight warpage of the roll. In this connection it will be noted that the inside bearings are free to rise and then fall to some degree vertically, and can even twist, to follow eccentric movement of the roll or slight misalignment.

The use of a flexible driving means in the nature of a sprocket and chain drive also fits admirably into my construction, since the drive will be positive even if one or more of the stub shafts 52 have a slight eccentric movement for some reason or are not horizontally aligned with the rest. In other words, the sprocket chain device will follow displacement of the sprocket wheel and nevertheless impart uniform angular rotation to the rolls. Moreover, I desire it to be distinctly understood that the self-aligning outside bearings 50 can be both of the floating type, and that a sprocket drive may be employed at both ends of the furnace. For exceptionally long rolls, this is a decided advantage inasmuch as the torsional stresses on the rolls can thereby be decreased to some extent.

In the event that a drive is applied to both sides of the rolls, it is, of course, necessary to synchronize the movement of the sprocket chains. Constructions and methods for synchronizing the movement of the sprocket chains are obvious and well known and need not be described in detail. For example, a single motor may be employed to drive both chains, or motors synchronized with each other can be employed, the clearance between the teeth **92** of each sprocket wheel in the space between the links of the sprocket chain **94** being sufficient to assure a continuous drive under all conditions.

While I have repeatedly referred to the fact that the roller hearth described by me will continue to operate in a satisfactory manner in spite of any slight eccentric rotation of the rolls, I do not desire to create an impression that the hearth is to be continually so operated when one or more of the rolls have become deformed to an intolerable degree. In prior constructions of this kind, deformation of the rolls so interfered with operation of the hearth as to require immediate shut down of the furnace to enable the defective roll to be replaced. With my construction, the shut down of the furnace can be postponed until such time as is convenient.

In general, it may, therefore, be stated that my roller hearth provides a sufficient number of supporting points to enable the use of light rolls of small diameter and that for each supporting point full provision is provided to take care of expansion and contraction of the different parts without destroying the alignment of the bearing surface contacts required for satisfactory rotation of the rolls. Additionally, even some deformation of the rolls themselves is permissible since the bearings are capable of slight vertical movement and twist with respect to the channels **133**.

Accordingly, while I have described my invention in the form which I now believe to be the best mode and application thereof, it is obvious that many changes may be made and equivalents substituted. I desire, therefore, that the appended claims be given their broadest construction and limited only by the prior art.

I claim as my invention:

1. In a furnace of the roller hearth conveyor type having a heating chamber of considerable width and subjected to elevated temperatures at which the rolls may have low tensile strength, the combination of structures whereby rolls of relatively small diameter may be employed at the elevated temperatures which comprises a base and lateral walls defining a part of said heating chamber, a plurality of spaced rolls extending laterally in said chamber, means for supporting said rolls above said base comprising refractory piers in said chamber integrated with said base and extending upwardly therefrom in proximity to said rolls, and roll bearing means resting on said piers, said piers and bearing means being constructed and arranged with accommodations to permit relative movement between the rolls, bearing means and piers resultant from dimensional changes due to temperature variations or the like.

2. In a furnace of the roller hearth conveyor type having a heating chamber of considerable width and subjected to elevated temperatures at which the rolls may have low tensile strength, the combination of structures whereby rolls of relatively small diameter may be employed at the elevated temperatures which comprises a base and lateral walls defining a part of said heating chamber, a plurality of spaced rolls extending laterally in said chamber, and through openings in one of said lateral walls, means for supporting said rolls above said base comprising refractory piers in said chamber integrated with said base and extending upwardly therefrom in proximity to said rolls, and roll bearing means resting on said piers, said piers and bearing means being constructed and arranged with accommodations to permit relative movement between the rolls, bearing means and piers resultant from dimensional changes due to temperature variations or the like, self-aligning bearings supporting said rolls at their protruding ends, and a sprocket type drive for rotating said rolls.

3. In a furnace of the roller hearth type having a heating chamber and subjected to elevated temperatures at which the rolls of the hearth may have low tensile strength and may become deformed, the combination which comprises a base and two lateral walls defining a part of said heating chamber, a plurality of rolls extending across said heating chamber above said base and through openings in said side walls, self-aligning bearings supporting each roll substantially at their ends having provisions accommodating the expansion and contraction of the rolls, the rolls extending through the bearings slightly at both ends, sprocket wheels secured to one of the protruding ends of the rolls, and driving means including a sprocket chain cooperating with said sprocket wheels, whereby the hearth can be operated even if one or more of its rolls becomes deformed.

4. In a furnace of the roller hearth type having a heat treatment chamber comprising a base and lateral walls, a plurality of spaced rolls extending laterally in said chamber, means for supporting said rolls above said base comprising a pier spaced from said side walls and extending upwardly in proximity to said rolls, a track member on said pier and having means permitting slight displacement in use of said track member with respect to said pier, and roll bearing means supported by said track member.

5. In a furnace of the roller hearth type having a heat treatment chamber comprising a base and lateral walls, a plurality of spaced rolls extending laterally in said chamber, means for supporting said rolls above said base comprising a pier extending longitudinally in said chamber spaced from said side walls and extending upwardly in proximity to said rolls, a track member on said pier and having means permitting slight displacement in use of said track member with respect to said pier, and bearings for each of said rolls supported by said track member, means for rotating said rolls in a predetermined direction, and cooperating means between said member and said pier to prevent the said member from sliding off said pier due to rotation of said rollers.

6. In a furnace of the roller hearth type having a heat treatment chamber comprising a base and two lateral walls, spaced rolls extending laterally in said chamber, means for supporting said rolls above said base comprising a refractory pier extending longitudinally in said chamber and spaced from said side walls and having expansion joints at intervals along its length dividing the pier into sections, and supporting means below said pier, a track member resting on each of said sections of said pier and having means permitting displacement in use of said track member with respect to said last sec-

tion, bearings for each of said rolls supported by said track member, means for rotating said rolls in a predetermined direction and cooperating means between said member and said pier to prevent the said member from sliding off said pier due to rotation of said rollers, said track member being free to move along said pier when it elongates and contracts due to temperature changes.

7. In a furnace of the roller hearth type having a heat treatment chamber comprising a base and lateral walls, a plurality of spaced rolls extending laterally in said chamber, means for supporting said rolls above said base comprising a pier extending longitudinally in said chamber spaced from said side walls and extending upwardly in proximity to said rolls, a track member on said pier and having means permitting slight displacement in use of said track member with respect to said pier, and bearings for each of said rolls supported by said track member, means for rotating said rolls in a predetermined direction, and cooperating means between said member and said pier to prevent the said member from sliding off said pier due to rotation of said rollers, said track member being free to move along said pier when it elongates and contracts due to temperature changes.

8. The combination in a furnace of the roller hearth conveyor type having considerable width and subjected to temperatures at which the rolls may have low tensile strength and possibly warp slightly, said furnace characterized by a heat treatment chamber comprising a base and two lateral side walls, of a plurality of rolls extending the width of said chamber and having one end of each roll protruding through openings in one of said side walls, a sprocket wheel on each of the said protruding ends, means for rotating said rolls comprising a sprocket chain cooperating with said sprocket wheels, spaced intermediate supports for said rolls within said chamber and comprising refractory piers protruding upwardly from the base in proximity to said rolls and of a length to span a plurality of said rolls, and having occasional expansion joints, a plurality of track members resting on each pier and having means to prevent side movement of said members with respect to its cooperating pier, bearing means for each of said rolls and supported on said track member, with accommodations to take care of possible changes in structural relationships due to temperature changes and the like.

9. The combination in a furnace of the roller hearth conveyor type having considerable width and subjected to temperatures at which the rolls may have low tensile strength and possibly warp slightly, said furnace characterized by a heat treatment chamber comprising a base and two lateral side walls, of a plurality of rolls extending the width of said chamber and having the ends of each roll extending through openings in said side walls, bearing means for each end of said rolls having limited movement whereby the rolls are free to rotate without binding in spite of any axial distortion of any roll or its expansion and contraction, means for rotating said rolls, spaced intermediate supports for said rolls within said chamber and comprising refractory piers protruding upwardly from the base in proximity to said rolls and of a length to span a plurality of said rolls, and having occasional expansion joints, a plurality of track members resting on each pier and having means permitting slight displacement in use of said members with respect to its cooperating pier, bearing means for each of said rolls and supported on said track member, with accommodations to take care of possible changes in structural relationships due to temperature changes and the like.

10. The structure of claim 8 wherein said means to rotate said rollers comprises a sprocket wheel on each roll on a protruding end thereof, and a sprocket chain cooperating with said sprocket wheel.

11. In a furnace of the roller hearth type having a heat treatment chamber comprising a base and two lateral walls, a plurality of spaced piers in said chamber extending longitudinally thereof, a plurality of spaced rolls in said chamber extending through openings in said side walls, supporting means for said rolls supported on said piers comprising single bearings as intermediate supporting points for said rolls and supported on said piers with accommodations for dimensional changes due to temperature variations and having a curvature to avoid binding with said rolls, sprocket means to rotate said rolls at one end thereof, and self-aligning end bearings for said rolls.

12. A roller hearth comprising rolls having integral keys with rounded edges, insulating refractory discs having cooperating loose keyways of lengths less than said keys, and means limiting the sidewise movement of the discs on the keys, said means including said keys, each having apertures at each end and disc-confining means extending through said apertures on both sides of said discs.

13. In a furnace of the roller hearth type having a heat treatment chamber comprising a base and lateral walls, a plurality of spaced rolls extending laterally in said chamber, means for supporting said rolls above said base comprising an insulating refractory pier extending upwardly in proximity to said rolls and longitudinally of the furnace to span a plurality of rolls, and roll-bearing means on said pier having accommodations for displacement in use with respect to said pier whereby to provide for dimensional changes due to temperature variations and the like.

14. In a furnace of the roller hearth type having a heat treatment chamber comprising a base and lateral walls, a plurality of spaced rolls extending laterally in said chamber, means for supporting said rolls above said base comprising a pier spaced from said side walls and extending upwardly in proximity to said rolls, a track member on said pier and having means permitting slight displacement in use of said track member with respect to said pier, and roll bearing means displaceably supported by said track member.

15. In a furnace of the roller hearth type having a heat treatment chamber comprising a base and lateral walls, a plurality of spaced rolls extending laterally in said chamber, means for supporting said rolls above said base comprising a pier extending longitudinally in said chamber spaced from said side walls and extending upwardly in proximity to said rolls, a track member loosely mounted on said pier, said track member having sides projecting downward over the sides of the pier and roll bearing means supported by said track member.

16. In a furnace of the roller hearth type having a heat treatment chamber comprising a base and lateral walls, a plurality of spaced rolls extending laterally in said chamber, means for

supporting said rolls above said base comprising a pier extending longitudinally in said chamber spaced from said side walls and extending upwardly in proximity to said rolls, a track member on said pier, said track member having sides projecting downward over the sides of the pier, and sides projecting upward to form a channel, and roll bearing means resting in said channel.

17. In a furnace of the roller hearth type having a heat treatment chamber comprising a base and lateral walls, a plurality of spaced rolls extending laterally in said chamber, means for supporting said rolls above said base comprising a pier extending longitudinally in said chamber spaced from said side walls and extending upwardly in proximity to said rolls, a track member loosely mounted on said pier and having sides projecting upward to form a channel, and roll bearing means resting loosely in said channel.

18. In a furnace of the roller hearth conveyor type having a heat treatment chamber of considerable width and subjected to elevated temperatures at which the rolls may have low tensile strength and may become deformed, the combination of structures whereby rolls of relatively small diameter may be employed, which comprises an insulating base and lateral walls defining part of said chamber, pedestal means intermediate said walls and extending upward from said base, bearing means for said rolls and resting on said pedestal means, said pedestal means and rolls bearing means having co-operating accommodations to maintain the pedestal means and bearing means relatively fixed but permitting slight displacement of said bearing means with respect to said pedestal means in the event of deformation or changes due to temperature variations.

19. The structure of claim 18 characterized by said co-operating accommodations for said pedestal means and bearing means comprising a channel structure for one into which the other loosely fits.

20. The structure of claim 18 characterized by said co-operating accommodations for said pedestal means and said bearing means comprising an upwardly-extending channel having a substantially flat cross member, and a substantially flat base for said bearing means loosely resting on said cross member in a manner to be capable of slight twisting movement in said channel.

21. The combination in a furnace of the roller hearth conveyor type, and subjected to temperatures at which the rolls may have low tensile strength and possibly warp slightly, said furnaces having a heat treatment chamber comprising a base and two side walls, said rolls extending the width of the furnace which is relatively wide, the rolls being of relatively small diameter for the width of the furnace, the ends of said rolls extending through openings in said side walls, of bearing means for each end of the rolls having provisions accommodating limited expansion and contraction of said rolls, sprocket chain means for driving said rolls, the said bearing means at the drive end being self-aligning, so that the drive means is operative even if any one or more of the ends of rolls should rotate eccentrically, insulating refractory piers protruding upwardly from the base and in proximity to said rolls, intermediate bearing means for said rolls supported on said piers, said piers and said intermediate bearing means having co-operating accommodations to maintain the said piers and intermediate bearing means relatively fixed but permitting slight displacement of said intermediate bearing means with respect to said piers in the event of deformations or changes due to temperature variations.

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