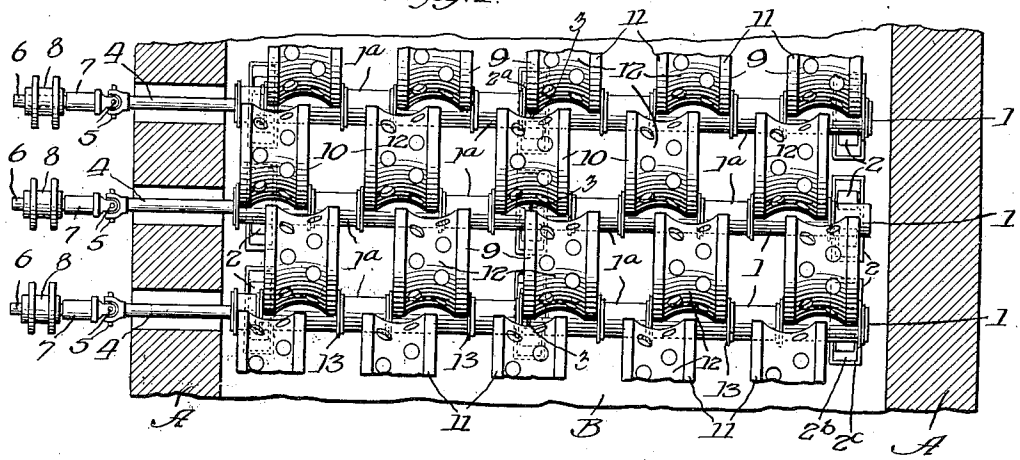
Dec. 3, 1935. F. A. FAHRENWALD 2,023,126

SUBDIVIDED ROLLER BOTTOM FOR SHEET NORMALIZING FURNACES

Filed June 9, 1934 3 Sheets-Sheet 1

Fig. 1.



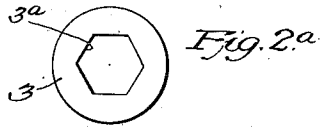


Fig. 2a

Fig. 2.

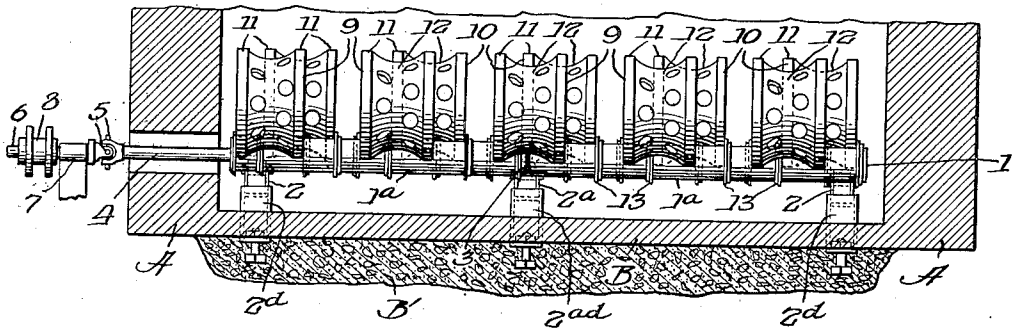


Fig. 3.

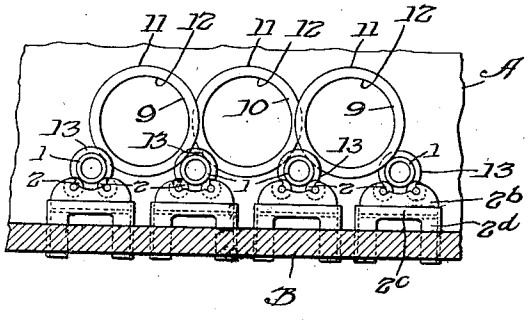


Fig. 3a

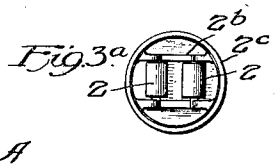


Fig. 3b

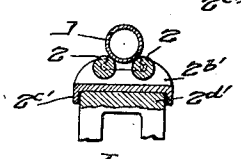
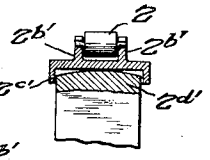


Fig. 3c



Witness

R. B. Davison.

Inventor

Frank A. Fahrenwald.

By Wilkinson, Huxley, Byron & Knight

Attys.

Dec. 3, 1935. F. A. FAHRENWALD 2,023,126

SUBDIVIDED ROLLER BOTTOM FOR SHEET NORMALIZING FURNACES

Filed June 9, 1934 3 Sheets-Sheet 2

Fig. 1c.

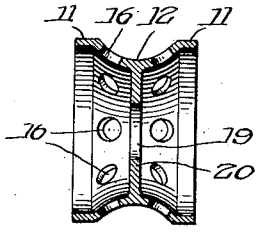


Fig. 1b.

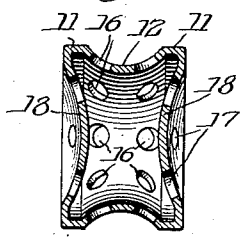


Fig. 1a.

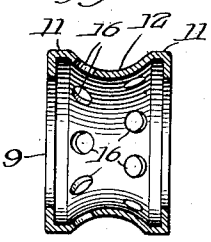


Fig. 4.

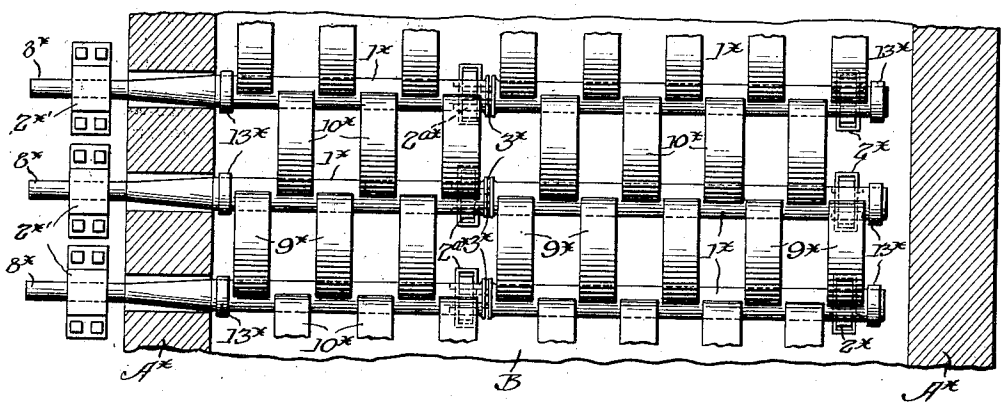


Fig. 5.

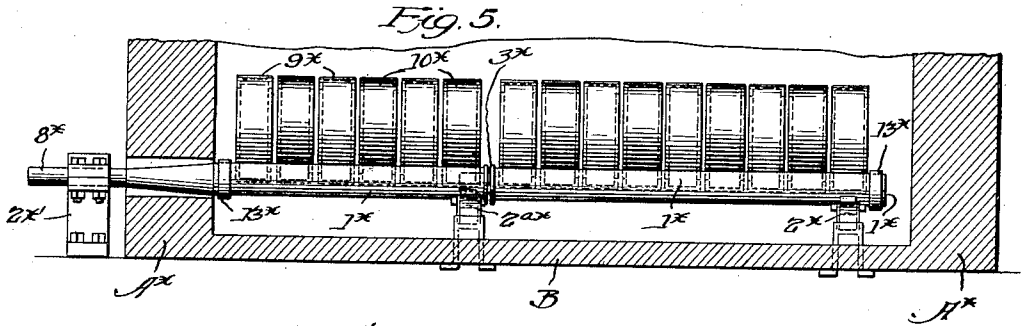


Fig. 5b.

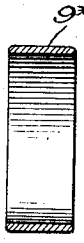


Fig. 5a.



Inventor.
Frank A. Fahrenwald.

Witness
R. B. Davison.

By Wilkinson Huxley Byron & Knight
Attys.

Dec. 3, 1935. F. A. FAHRENWALD 2,023,126

SUBDIVIDED ROLLER BOTTOM FOR SHEET NORMALIZING FURNACES

Filed June 9, 1934 3 Sheets-Sheet 3

Fig. 6.

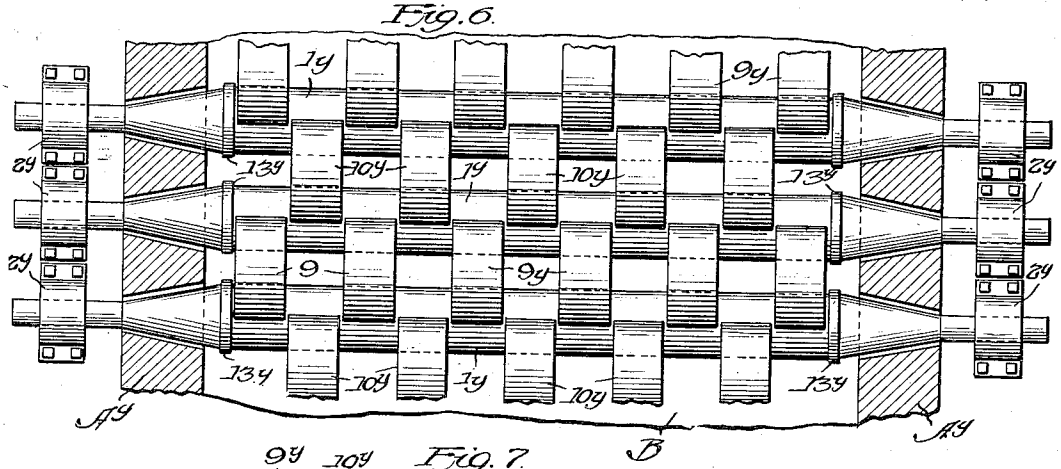


Fig. 7.

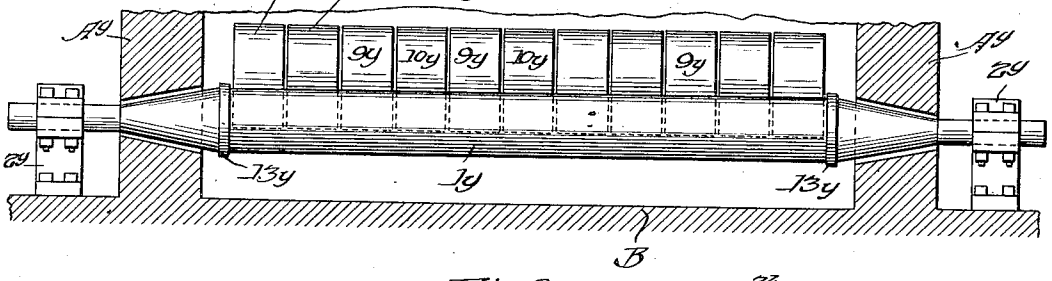


Fig. 8.

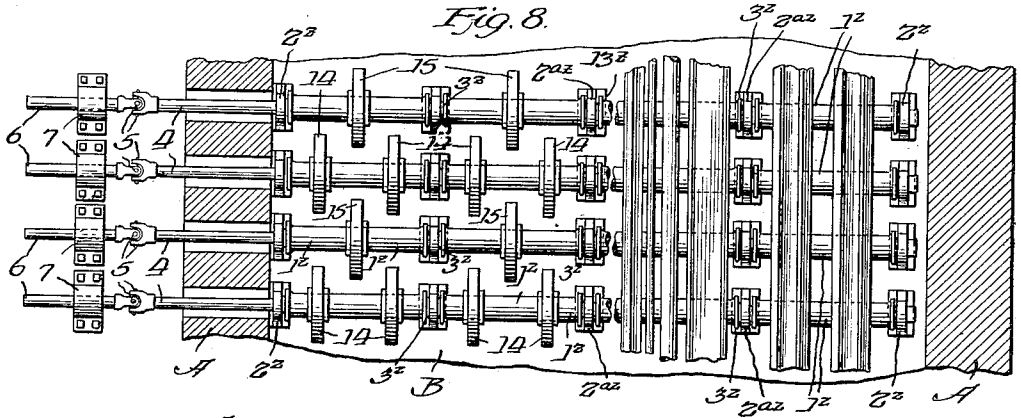
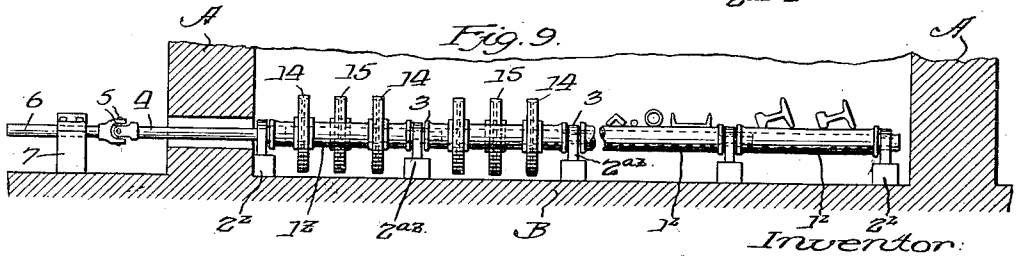


Fig. 9.



Witness:
R. B. Davison

Inventor:
Frank A. Fahrenwald.

By Wilkinson Huxley, Byron & Knight
Attys.

Patented Dec. 3, 1935 2,023,126

UNITED STATES PATENT OFFICE

2,023,126

SUBDIVIDED ROLLER BOTTOM FOR SHEET NORMALIZING FURNACES

Frank A. Fahrenwald, Chicago, Ill.

Application June 9, 1934, Serial No. 729,734

12 Claims. (Cl. 263—6)

This invention relates to furnaces in which sheets of steel and the like are subjected to treatment to normalize them or render them suitable for uses to which they are put in the industries. In such treatment of sheets it is important that the sheet be supported at points distributed throughout its area and sufficiently close together to avoid sagging of the sheet while in soft condition incident to furnace temperature; and the sheet is preferably fed into and out of the furnace by imparting a driving movement to the elements (usually rolls driven from without) which support the sheet. It is important in this procedure, that the elements which support and feed the sheet through the furnace, receive the sheet through supporting surfaces that are smooth and free from irregularities; also that the sheet contacting surfaces of all of the sheet-supporting and feeding elements be caused to move at a uniform speed in order to avoid abrasion which, in the soft condition of the sheet, would impair the surface of the sheet.

It has heretofore been the practice to utilize continuous rolls extending across the furnace and in sufficient number to support the sheet throughout the furnace bottom; these rolls preferably having incorporated in their construction, concentric raised circumferential portions of short axial extent, which limited the sheet-contacting portions of each roll to a series of reduced areas spaced apart transversely of the furnace; the arrangement being such that the rolls collectively with their raised portions would afford a complete field of isolated supports throughout the furnace bottom. According to my Patent No. 1,623,469, these rolls (referred to also as "dry shafts") were supported in end bearings located outside of the furnace walls through means of reduced ends of the rolls extending through said walls. In my Patent No. 1,791,404, the supporting and conveying rolls terminate inside of the walls of the furnace and find their bearings inside the furnace upon roll-driving shafts arranged in pairs, supported outside the furnace, but intruded through the walls and terminating in roll-supporting ends upon which the sheet-supporting and conveying rolls are cradled. But as demand has developed for the treatment of larger and larger sheets, the problem of constructing sheet-supporting and feeding rolls of sufficient strength, when hot, to bridge the distance between furnace walls, has become more and more serious. Moreover, there is a disadvantage in having all of the transversely spaced sheet-supporting and driving surfaces incorporated in a single driving roll, particularly when the shaft becomes distorted in service; also when the exterior circumferential supporting and driving surfaces of such a shaft receive oxide accretions and exercise unequal drive to different portions of the sheet because this causes abrasions and impressions in the surface of the sheet.

It has been proposed to gain better support for continuous sheet driving shafts, for instance, by multiplying bearings for such a shaft within the furnace, but this did not meet the problem because it still left the disadvantages of impaired drive due to distortion, and in some cases will even add to the distortion by careless alignment of three or more bearings for a single shaft; besides, it leaves unremedied those difficulties arising from oxide accretions on the driving surfaces.

One part of the present improvement in roller bottoms for sheet normalizing furnaces proceeds upon the principle of providing transversely of the lower portion of the interior of the furnace a plurality of supporting and driving shafts and mounting upon these shafts the work-supporting and feeding hearth, comprising a plurality of rollers having axially short rims with external cylindrical surfaces through which the rollers rest upon and receive their drive from the shafts and by which they support and feed the work; said rollers being arranged coaxially in a plurality of transverse series in which they remain unconnected and individually removable and replaceable; the rollers being confined against displacement longitudinally of the furnace by resting in the troughs provided by pairs of the supporting and driving shafts; and the width of the rims of the rollers being but a fraction of the axial dimension of the series in which they lie, but sufficient to normally stabilize the rollers against lateral tipping upon the shafts.

Another part of the present improvement proceeds upon the principle of so subdividing the shafts employed in normalizing furnaces that it will not be necessary to construct a single shaft to bridge the width of the furnace, but any number of shaft units necessary to reach from side to side of the furnace may be assembled in driving relation one to another; suitable bearings being provided in which the several sections may turn; and, preferably, the meeting ends of the sections being so constructed that one section may telescope within another and be supported thereby, thus necessitating but one rotatory bearing support near each joint. These telescoping joints, while capable of transmitting drive, involve sufficient tolerance to afford some degree of flexibility and thus prevent shaft distortion and in-

sure proper seating of each shaft section in its bearing, which is of special importance when the shafts are employed in pairs and the sheet supporting and driving disks are cradled in the trough formed by two such shafts as herein described. The several shafts will preferably be driven from outside of the furnace. The part of the invention having to do with subdivision of the shafts may be used with distinct advantage in the construction of shafts which directly support and feed the work as well as shafts which merely constitute bearings for superposed sheet supporting and driving units. This part of the invention serves with especial advantage when used as bearings and driving means for the above-described sheet conveying elements in the form of disk-like sheet conveying supports arranged coaxially in series across the furnace but free from inter-connection, which, in effect, constitute floating conveyor rollers.

In developing a sheet supporting field of floating conveyor rollers are arranged in a number of series extending transversely of the furnace. Those of one series may be alternated in position with those of an adjacent series so that the rollers laterally overlap. While preferably restricted to approximate the width of support that they afford, they are of sufficient axial dimension to resist tipping in the trough between two bearing shafts in which they rest, and the several transverse series of these rollers are repeated longitudinally of the furnace until substantially the entire furnace bottom is equipped with floating conveyor rollers, free from connection one with another, receiving and driving the treated sheets by their external circumferential surfaces, and resting by gravity through these same driving surfaces upon bearings located beneath the rollers and serving alike as the driving means of the rollers and means for cleaning their sheet-receiving and feeding surfaces.

The roller supporting and driving bearings, while constructed to receive and individually drive each roller independently of the others, may be in the form of continuous shafts of one piece or subdivided into flexibly connected shafts having a common drive; or they may have individually supported driven bearings.

In the accompanying drawings—

Figures 1, 2 and 3 are, respectively, a plan view, a vertical transverse section, and an end view of a portion of a furnace for heat treating sheets, in which the preferred embodiments of the several features of the invention are included.

Figures 1*a*, 1*b* and 1*c* are sectional detail views of three different constructions of sheet-supporting and feeding units.

Figure 2*a* is a detail view of the telescopic intersupporting and driving connection between two drive shaft sections, and Figs. 3*a*, 3*b* and 3*c* show modifications of bearings.

Figures 4 and 5 are views corresponding to Figures 1 and 2, showing a modified construction of bearing and driving shaft for the rollers and a modified arrangement of the rollers on these shafts.

Figures 5*a* and 5*b* are sectional detail views of two different constructions of roller having the external form of the roller shown in Figures 4 and 5.

Figures 6 and 7 are views corresponding to Figures 4 and 5, showing the use of still another construction of shaft for bearing and driving the rollers; and

Figures 8 and 9 are, respectively, a sectional plan and a vertical transverse section of a portion of a furnace showing the sectional drive shaft of Figures 1 and 2, the left-hand portion of which is equipped with disks concentrically incorporated therewith for directly driving sheets to be treated, while the right-hand portion is equipped for receiving goods to be treated directly upon the surface of the shaft.

Referring to Figures 1 and 2, A represents side walls and B the bottom of a heat treating furnace in which shafts 1 are mounted on bearings 2 and intermediate bearing 2*a* located within the furnace. Shafts 1 are composed of a plurality of aligned sections 1*a* united by joint 3 that causes the shaft units to rotate together but without relating them with any such rigidity as would prevent distribution of the load of the shaft over all of its bearings, and therefore without possibility of imposing upon the intermediate portion of the shaft undue stresses that would result from supporting the shaft at its two ends alone, or imposing upon one end of the shaft undesirable stresses that would result from excessive application of the intermediate bearing and consequent support of the shaft upon said intermediate bearing and the bearing at the other end of the shaft. In this way, distortion of the shaft, which is liable to result from improper distribution of loads, unequal heating, flaws in the castings, etc. when the shaft is at high temperature, is avoided and resultant aberration of path in the work-feeding surfaces will not occur whether the work-feeding surfaces are provided by the individually supported eccentric floating rollers 9 and 10, about to be described, or concentric disks 14 and 15 shown in Figures 8 and 9, or surfaces of shaft 1*z*.

A desirable but not indispensable feature of the invention resides in the relation of intermediate shaft bearing 2*a* and joint 3, according to which the shaft bearing serves for both shaft sections 1*a* because of the telescopic assembly of said shaft sections at the joint 3 which enables one section to support the other. As will be seen in Figure 2*a*, shaft sections 1*a* are compelled to rotate together by the polygonal or other non-circular design of their telescoping connection 3*a*.

Shaft 1 is provided with a driving spindle 4 extending through a furnace wall A and connected preferably through flexible joint 5 with the drive shaft 6 mounted in bearings 7 and carrying drive-connecting element 8. Shafts 1 are related in pairs in a manner to form between them a trough in which are placed sheet receiving and conveying units in the form of rollers 9, 10, which rest through their external circumferential faces, by gravity alone, upon shafts 1 forming driving bearings for them. These rollers are arranged coaxially in series extending across the furnace, but they are spaced apart, are free from connection one with another, and have axial dimension sufficient to enable each to sustain itself in position without lateral tipping. Thus, this part of the invention contemplates a sheet supporting and feeding field subdivided into separate, self-contained, independent units in the form of series of floating conveyor rollers, those of each series being in axial alignment transversely of the furnace, free from inter-connection with one another, and having bearings upon which they individually rest by gravity through their exterior circumferential surfaces by which they receive the workpiece that is fed through the furnace. Each shaft, other than those occurring at the ends of the furnace chamber, serves in common for cradling two rows of

rollers. The rollers 9, 10, in one row are laterally offset relatively to those in the other row and they are preferably made to laterally overlap to an extent that will prevent the edge of a thin sheet following the surface of a roll and entering between two rows. When treating sheets that do not require overlap of the rollers, the rollers may be of smaller diameter and without overlap.

In the particular embodiment shown in Figures 1 and 2, each roller has two workpiece receiving and feeding surfaces 11 and an intermediate reentrant portion 12; and one feeding surface 11 of each roller is presented to the reentrant portion of a roller in an adjacent row. 13 represents positioning collars incorporated in the construction of the shafts and so embracing the rollers 9, 10, that the rollers will be prevented from lateral displacement relatively to the shaft. Each roller has this confining interengagement with one shaft alone, and these confining collars are in such limited relief upon the shafts that they will not interfere with the intermediate reentrant portions of the rollers of an adjacent row which are located astride of the collars.

An important advantage accruing from the arrangement illustrated in Figures 1, 2 and 3, and which obtains likewise in the embodiment shown in Figures 4 and 5, as well as that shown in Figures 6 and 7, is that the rollers are supported upon their driving and bearing elements 1, 1*x*, or 1*y*, as the case may be, through the external cylindrical work-bearing surfaces of the rollers, with the result that the accumulation upon said work-bearing surfaces—such as oxide accretion and the like—is constantly removed by the rolling of the rollers upon their said bearing members and the contingency of building up projections of foreign substance to injure the sheets in their soft state is eliminated.

Rollers 9, 10, etc. may partake of various structural designs, some of which are suggested in Figures 1*a*, 1*b* and 1*c*. They are made very light in construction to lessen the burden on the shafts and reduce inertia resistance to turning, and hollow (and preferably perforated) to insure free circulation of furnace gases through them.

According to Figures 4 and 5, rollers 9*x* and 10*x* have cylindrical workpiece receiving and feeding surfaces through which they bear upon the shafts 1*x*, and each roller is bodily offset laterally with relation to rollers of adjacent rows in providing for lateral overlap of the rollers. In this arrangement, also, collars 13*x* are located only at the ends of the shafts, lateral contact of one roller with another being relied upon to resist lateral displacement. In this embodiment, joints 3*x* are employed for subdividing the shafts 1*x* while retaining them in driving relation one to the other, and intermediate bearing 2*ax* is employed in addition to end bearing 2*x* at the inner end of the shaft, as in Figures 1 and 2, but shaft 1*x* is continued through the wall A*x* of the furnace in a manner to enable the shaft to receive its remaining bearing 2*x'* on the outside of the wall, where it will also receive driving connection 8*x* as in Figures 1 and 2.

Rollers 9*x* and 10*x* may, as shown in Figures 5*a* and 5*b*, have various light, hollow structural designs 9*x*, 9*x'*, etc.

According to Figures 6 and 7, the driving bearings for the rollers 9*y*, 10*y*, may consist of shafts 1*y* designed so that they may project through and have their bearings 2*y* located beyond the furnace walls A*y*; the shafts in this instance being designed in accordance with Letters Patent No. 1,623,469; and the subdividing joints in the roller bearing and driving shafts being omitted.

As shown in Figures 8 and 9, shafts 1*z*, made in sections and inter-supported in driven relation one section to another by joints 3*z*, may be employed with work-supporting disks 14 and 15 mounted concentrically with and incorporated in the construction of the shafts themselves; and these shafts may be supported between furnace walls by intermediate bearings 2*az* in addition to end bearings 2*z*, which said intermediate bearings will correspond in position to the joints 3*z* as in Figures 1 and 2, so that one end of each section receives support from an intermediate shaft bearing 2*az* indirectly by reason of its telescopic assembly with the meeting end of the adjacent section.

As also shown in Figures 8 and 9, at the right-hand end thereof, the same arrangement of sectional shaft 1*z*, having joints 3*z* mounted upon end shaft bearings 2*z* and intermediate shaft bearings 2*az*, may be employed to receive heat treated articles directly upon the surface of the shaft.

As shown in Figures 1*a*, 1*b* and 1*c*, the roller like sheet supporting and feeding unit may have perforations in one or more of those surfaces which do not contact with the sheet in service, for instance, perforations 16 in the reentrant surfaces or grooves 12 between the treads 11 (Figures 1*a*, 1*b*, 1*c*); or perforation 17 in web surfaces 18 (Figure 1*b*); or the central perforation 19 in the central web 20 of Figure 1*c*.

As shown in Figures 1, 2 and 1*a*, it is desirable to have perforations 16 staggered in their positions in order to get better dissipation of stresses set up by expansion and contraction; but the perforations may occupy positions in the same radial planes, as shown in Figures 1*b* and 1*c*.

As shown more clearly in Figure 3, saddle bearings 2 are mounted in pillow blocks 2*b* removably confined in seats formed by flanges 2*c* on the upper end of pedestals 2*d*, and flanged seats 2*c* may be either rectangular as indicated at 2 in Figure 1, or they may be circular in horizontal section as shown in Figure 3*a*, in which case the axes of the shaft bearing rollers 2 are free to adjust themselves in parallelism with the axes of the shafts 1. With this construction, the pillow blocks 2*b* may be fitted in their flanged seats 2*c* with sufficient tolerance to admit of slight displacement of the pillow blocks in a direction transverse to the roller axes and thereby insure alignment of three or more bearings relatively to a given shaft 1, whereas it might otherwise be difficult to attain accuracy of alignment by setting the pedestals 2*d* in concrete B' which usually underlies refractory bottom B. Where the shaft 1 is divided into two parts 1*a*, 1*a*, as shown in Figure 2, and tolerance is left in the connection between the two members sufficient to avoid rigidity of alignment, the use of a single intermediate bearings 2*a* in its relation to the two end bearings 2 establishes for each shaft section what is in effect a two-point support in which rotary self adjustment would so align the bearings with the respective ends of a shaft as to insure proper distribution of load to the respective bearings and upon the saddle rolls of each bearings, with slight tolerance in confinement of the intermediate bearing to further assist automatic distribution of the load in case of slight inaccuracy of alignment of the middle pedestal 2*ad* with the two end pedestals 2*d*.

As shown in Figure 3*b*, the pillow block 2*b'*

may carry flanges 2c', confining it with rotary and horizontal tolerance upon the upper end of the pedestal 2d' with all the effects described in connection with Figure 3a and without trapping foreign matter in the pedestal bearing.

In addition to the adjustments stated, there will preferably be a slight rocking adjustment of the pillow block upon its pedestal, as suggested in Figure 3c, in order to enable the surface of the rollers 2 to remain parallel to the surfaces of the shafts which rest upon them.

What is claimed is:

1. In a roller bottom for heat treating furnaces, a plurality of supporting and driving shafts adapted to be arranged transversely in the lower portion of the interior of the furnace, and a work-supporting and feeding hearth comprising a plurality of rollers having external substantially cylindrical surfaces through which they rest upon and receive their drive from said shafts and by which said rollers support and feed the work; said rollers being arranged unconnected, individually replaceable and coaxially in a plurality of series; the respective series extending parallel with the supporting and driving shafts and with the rollers thereof confined against displacement longitudinally of the furnace by resting in troughs provided by pairs of their supporting shafts; and the rims of the individual rollers having an axial dimension which is but a fraction of the transverse dimension of the furnace but sufficient to normally stabilize the individual rollers against lateral tipping upon the rollers against which they rest.

2. In a furnace roller bottom as described in claim 1, a roller constructed with a rim having a plurality of cylindrical work-receiving surfaces and an intermediate reentrant portion spacing said surfaces apart.

3. In a furnace roller bottom as described in claim 1, a sheet supporting unit comprising a thin shelled hollow roller body having an external peripheral work-bearing surface adapted to support it upon its bearings.

4. In a furnace roller bottom as described in claim 1, a sheet supporting unit comprising a thin-shelled hollow roller body having an external peripheral work-bearing surface adapted to support it upon its bearings; said unit having perforations through the walls of the unit other than said work-bearing surface.

5. In a furnace roller bottom as described in claim 1, an axially short work-supporting roller comprising a circumferential wall providing an external workpiece-receiving surface and inwardly extending flange means stiffening said wall.

6. In a furnace roller bottom as described in claim 1, a work-supporting roller constructed with a peripheral wall of circular section having two workpiece-receiving and shaft-engaging treads spaced apart in the direction of the axis of the roller, and having perforations in the portion of said peripheral wall that lies intermediate of said treads.

7. A roller bottom for furnaces as described in claim 1, comprising rollers the rim of each of which has a plurality of cylindrical work-receiving surfaces spaced apart by intermediate reentrant portion of said rim, and the rollers in one series are laterally offset relatively to those in an adjacent series a distance which presents a work-receiving surface of a roller in one series to an intermediate reentrant portion of a roller in an adjacent series.

8. A roller bottom for furnaces as described in claim 1, in which the rollers are without supporting contact other than that which exists between their work-bearing surfaces and their driving members.

9. A roller bottom for furnaces as described in claim 1 in which the roller driving shafts are substantially continuous transversely of the furnace and provide bearing for a plurality of rollers.

10. A roller bottom for furnaces as described in claim 1 in which the roller driving shafts are substantially continuous transversely of the furnace and provide bearing for a plurality of rollers; and said shafts are subdivided into units, multiplication of which adapts the bearing for surfaces of furnaces of increased width.

11. A roller bottom for furnaces as described in claim 1, in which the roller driving shafts are subdivided into units in driving relation one to another, and shaft bearings within the furnace support intermediate portions of said shafts.

12. A roller bottom for furnaces as described in claim 1, in which the roller driving shafts comprise sections jointed within the furnace, an end of one section being supported by an opposed end of another section, and there being within the furnace a shaft bearing located adjacent the joint between the sections.

FRANK A. FAHRENWALD.