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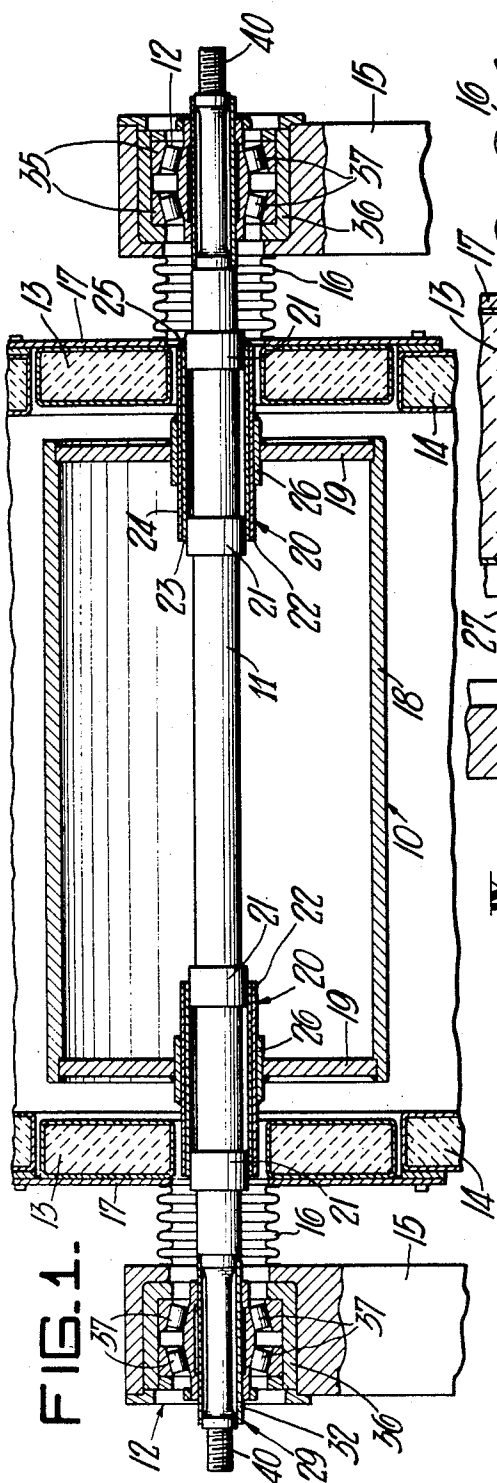
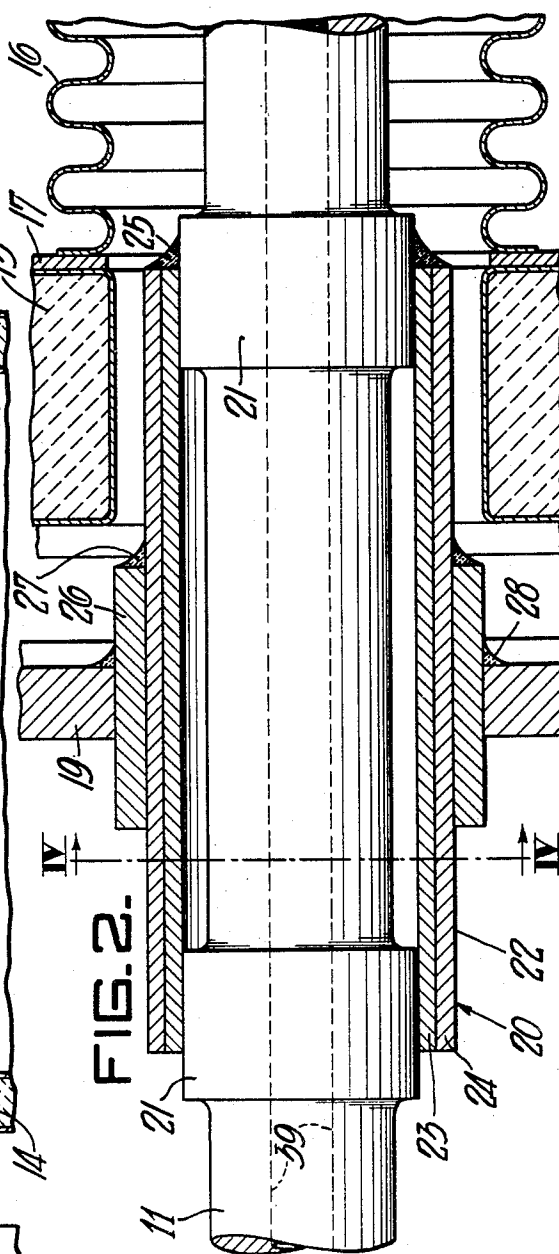
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2,497,154

CONVEYER ROLL FOR HEATED STRIPS OR THE LIKE

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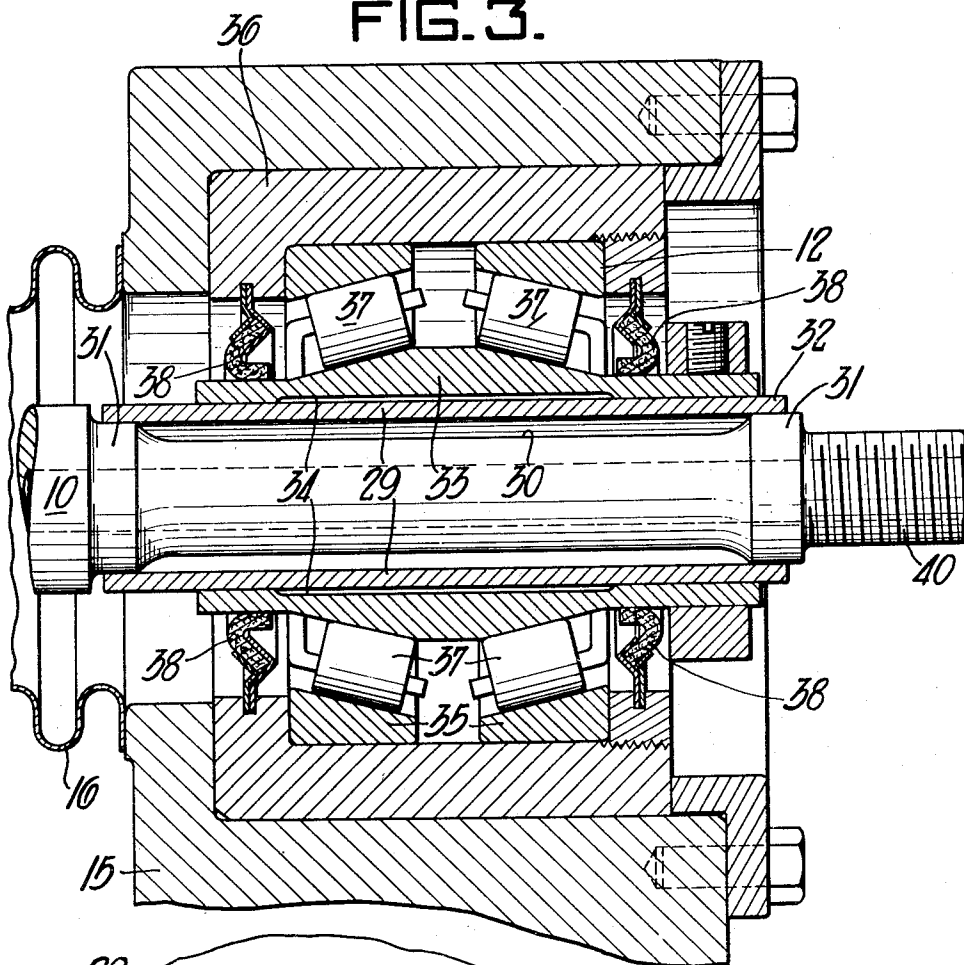
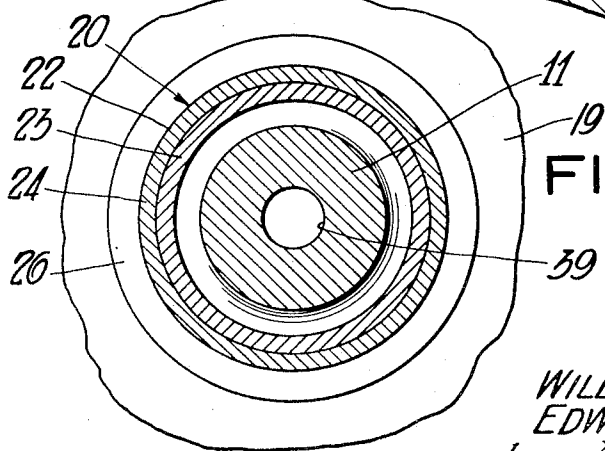
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2 Sheets--Sheet 2



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CONVEYER ROLL FOR HEATED STRIPS OR
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This invention relates to a roll construction suited for furnace conveyors or other conveyors handling heated material such as metal strip.

In the processing of certain classes of material such as metal strip, it is passed through a heating chamber or furnace in single ply, being supported by a plurality of rolls spaced along the chamber, journaled in suitable bearings for rotation, and together constituting a continuous conveyor. Similar rolls are usually installed beyond the end of the heating chamber proper, e. g., in a cooling chamber connected therewith. It has been customary to provide water-cooling for the roll shafts, or at least the ends of the rolls or the bearings, to prevent them from being heated to undesirably high temperatures by the heat within the furnace or by contact with the heated strip. In any event, the bearings being mounted on suitable supports, usually of thermally conducting material, are cooled by conduction and atmospheric convection.

As a result of these conditions, a relatively steep temperature gradient exists between the hottest point of a conveyor roll, usually the surface thereof at the medial transverse plane, and the ends of the roll adjacent the bearings. This temperature difference, which may be as great as 100° F., causes greater expansion of the mid-portion of the roll body, thus creating a crowned roll effect. When wide, thin strip is processed, the strip, which is relatively plastic at the annealing temperatures employed, is in intimate heat-exchange contact with the roll and assumes the contour thereof across its full width. The crowned roll thus stretches the center of the strip to such an extent that, when cooled, the strip surface is characterized by waves or buckles throughout the length of the central portion. The difficulty is particularly pronounced in the cooling chamber where the strip regains its normal elastic strength which is greatly reduced at the elevated temperatures required by certain processes, such as annealing.

This difficulty can be partially overcome in rolls of conventional design by grinding the roll surface, under conditions of uniform temperature, to a particular degree of concavity which will cause the roll surface to assume a flat contour when the roll is subjected to an elevated temperature within a narrow temperature range. Practically, this method alone is insufficient to meet the requirements of flat strip since variations in either strip speed, temperature, thickness or other variables will result in deviation from the desired flat contour of the roll.

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We have invented a novel conveyor roll which retains a stable contour of the working surface over a wide temperature range, thus obviating the need for grinding a new contour to meet each operating condition encountered, and which also overcomes the difficulties enumerated above. Our improved roll is constructed to minimize the flow of heat to its supporting bearings, without interfering with the normal cooling of the latter. As a result, the ends of the roll adjacent the bearings are maintained at a temperature differing but little from that at the middle of the roll, thus avoiding the crowning effect and the buckling or other distortion of the strip from a condition of substantial flatness. In a preferred embodiment, we provide the shaft supporting the roll with spaced heat barriers or mountings of low thermal conductivity and dispose thereon the webs or discs which are fitted in the ends of a metal cylinder of a length suitable to form the roll body. We also provide heat barriers on the shaft adapted to serve as journals of low thermal conductivity for seating in suitable bearings. The bearings employed are of special construction to limit the flow of heat therethrough. Preferably each of the heat barriers forming the low-conductivity mountings and journals comprises a sleeve coaxial with the shaft but spaced outwardly thereof for the most part, leaving a space in which there is no direct contact between the sleeve and shaft. The sleeve is preferably of metal having a low thermal conductivity, such as stainless steel.

A complete understanding of the invention may be obtained from the following detailed description and explanation thereof which refer to the accompanying drawings illustrating the preferred embodiment. In the drawings,

Figure 1 is a partial section taken vertically through the axis of a conveyor roll and the wall of a furnace or other heating chamber in which it is mounted;

Figure 2 is a similar view showing one of the roll mountings to an enlarged scale;

Figure 3 is a partial vertical section through one of the roll-supporting bearings showing the construction of the journal; and

Figure 4 is a transverse section through a roll mounting taken along the plane of line IV—IV of Figure 3.

Referring in detail to the drawings, a conveyor roll 10 includes a shaft 11 journaled in bearings 12. The shaft 11 extends through holes in a cover-plate 13 overlying an opening in the side wall of a furnace or other heating chamber in-

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licated at 14. The bearings 12 are mounted on suitable posts or standards 15 independent of the furnace wall. The clearance spaces between the holes in the cover plates 13 and the shafts 11 are sealed by expansible bellows 16 secured to the standards 15 and the metal sheathing 17 overlying the cover plates. This particular feature, however, forms no part of our invention.

The roll 10 comprises a body 18 which may conveniently be a suitable length of pipe or tube of appropriate diameter and wall thickness, into the ends of which webs or walls 19 are set. The webs 19 have circular holes therethrough to accommodate mountings 20 on the shaft 11 which constitute barriers to the flow of heat from the webs to the shaft. The mountings 20 are similar in construction except for one detail. Each comprises spaced shoulders or collars 21 on the shaft, the portion of the shaft between the collars being turned down to a diameter smaller than that of the collars themselves. A cylindrical sleeve 22 is fitted on the shoulders or collars 21. The construction described leaves a void space between the shaft and sleeve intermediate the collars 21.

The sleeve 22, as illustrated, includes a pair of inner semi-cylindrical members 23 and an outer cylinder 24 telescoped therewith. These members are preferably of metal having a relatively low thermal conductivity, such as stainless steel. The outer end of one of the sleeves 22 is welded to its collar 21, as at 25. The sleeve at the other end is not welded to the shaft, but is slidable on its shoulders to permit longitudinal expansion and contraction of the roll body independently of the shaft 11. A ring 26 is slipped over the sleeve 22 to a position intermediate the shoulders 21 and is welded to the sleeve, as at 27. The holes in the webs 19 are dimensioned snugly to receive the rings 26 which thus afford seats on the sleeves 22 for supporting the webs. The webs are welded in place on these seats, as at 28.

At each end of the shaft 11, we provide a heat barrier 29 adapted to serve as a journal fitting in one of the bearings 12. To this end, a portion of the length of the shaft adjacent each end is turned down as at 30 leaving spaced shoulders or collars 31. A sleeve 32 is fitted on these collars at each end of the shaft leaving a space between it and the shaft intermediate the collar. As shown in Figure 3, the heat-barrier journals 29 extend through the inner races 33 of the bearings 12, fitting tightly therein. The bore through each race which accommodates the journal is recessed intermediate its ends as indicated at 34. This limits the flow of heat from the journals into the inner races. The bearings 12 also include outer races 35 seated in housings 36. These housings are secured in suitable recesses in the standards 15. Anti-friction rollers 37 are disposed between the inner and outer races of the bearings. The housings 36 have sealing rings 38 at their inner and outer ends slidably engaging the ends of the inner races 33.

It will be apparent from the foregoing that the mountings 20 on which the webs 19 of the conveyor roll are seated impede the flow of heat from the webs to the shaft, as previously stated. This follows from the relative low thermal conductivity of the metal of which the sleeves 22 are composed and the limited area of contact between the webs 19 and the sleeves and between the sleeves and the shoulders 21 spaced along the shaft. As clearly shown in the drawings, the sleeves are spaced from the shaft throughout the

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greater portion of their length and have contact with the shoulders only adjacent the ends of the sleeves. In the same manner the journals 29 impede the flow into the bearings of any heat which may be transferred from the roll to the shaft. The bearings 12 are thus doubly guarded against flow of heat thereinto from the roll body.

As a result of the construction described, even though the shaft and bearings be provided for the circulation of cooling water therethrough, this will not cause the ends of the roll body to be cooled materially below the temperature which exists at the medial transverse plane. In the illustrated embodiment, the shaft has a passage 39 drilled axially therethrough for cooling water and has its ends threaded as at 40 for receiving the movable elements of swiveling connections, the fixed elements of which are secured to inlet and discharge pipes. Because of the limited loss of heat from the roll body into the shaft, there is only a slight difference between the temperature of the ends of the roll body and the middle thereof. Such difference as may exist will ordinarily not be sufficient to cause any crowning of the roll resulting in buckling of the strip or other noticeable distortion thereof in the way of a departure from the substantially flat condition.

The invention also has other advantages. The heat-barrier journals are effective to limit the flow of heat from the shaft into the bearings as stated above. This reduces the temperature gradient through the bearings, i. e., from the inner to the outer races thereof. This, in turn, reduces the maintenance necessary to keep the bearings in proper working order. It will be observed, furthermore, that cooling of the bearings by conduction to the supporting standards and convection to the atmosphere is not impaired. Any heat which may flow through the barriers afforded by the mountings 20 and journals 29 and ultimately reach the bearings is quickly absorbed either by the adjacent metal parts or the surrounding atmosphere. This makes it possible, in many cases, to use standard bearings and seals without special water-cooling or other means for removing heat. In addition to the foregoing, the roll construction of our invention is simple and inexpensive. When once installed, the rolls require practically no maintenance, the bearing maintenance heretofore required being obviated by the fact that the bearings operate at a temperature but slightly in excess of that of the ambient atmosphere.

Although we have illustrated and described only a preferred embodiment of our invention, it will be recognized that changes in the details of the construction disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. In a furnace conveyor roll, a tubular body, a web fitted in each end thereof and a shaft extending coaxially through the body and webs, a pair of spaced shoulders adjacent each end of the shaft and a sleeve fitted on each pair of shoulders leaving a void space intermediate the shoulders between the sleeve and the shaft, one of the webs being seated on each sleeve intermediate the shoulders on which it is fitted.

2. Means for mounting a furnace conveyor roll including a tubular body and a plurality of webs spaced therealong on a supporting shaft, comprising a pair of spaced shoulders on the shaft, one on each side of each web, and a sleeve fitted on each pair of shoulders, said shoulders afford-

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ing a void space between the sleeve and shaft intermediate the shoulders, each sleeve having a seat thereon intermediate said shoulders for one of said webs.

3. In a furnace conveyor roll including a tubular body, a web fitted in each end thereof and a shaft extending coaxially through the body and webs, a pair of spaced collars on the shaft adjacent each end of said body and a sleeve fitted on said collars, one of the webs being seated on each sleeve intermediate the collars on which the sleeve is fitted.

4. Means for mounting on a supporting shaft one of a plurality of webs spaced along a tubular body of a furnace conveyor roll, said means comprising a pair of collars spaced along the shaft, the shaft portion between the collars having a diameter smaller than that of the collars and a sleeve fitted on said collars, the web being seated on the sleeve intermediate the collars.

5. The apparatus defined by claim 1 characterized by a seating ring on the sleeve, and the webs having a hole therein to accommodate said ring.

6. The apparatus defined by claim 2 characterized by a ring fitting on each sleeve, said seat being on said ring.

7. In a furnace conveyor roll, a tubular body, disc webs spaced along said body, a supporting shaft extending axially through said body and webs, pairs of collars spaced along said shaft adjacent each web and extending radially beyond the periphery of the shaft, and a sleeve fitted on each pair of collars, said webs being seated on said sleeves.

8. In a furnace conveyor roll including a

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tubular body and a supporting shaft extending axially therethrough, a journal comprising a portion of the shaft length at one end of the shaft turned down to reduced diameter leaving collars spaced along the shaft, a sleeve fitted on said collars and an anti-friction bearing including a fixed outer race and an inner race rotatable therein, said sleeve extending through said inner race and fitting tightly therein.

9. The apparatus defined by claim 8 characterized by one of the mating surfaces of the sleeve and said inner race being recessed intermediate the ends of the race.

10. The apparatus defined by claim 3 characterized by one of said sleeves being secured to the shaft and the other slidable thereon.

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