March 22, 1960 G. H. YOUNG ET AL 2,929,614

ROLL SEAL FOR STRIP HEATER

Filed Feb. 11, 1954 2 Sheets-Sheet 1

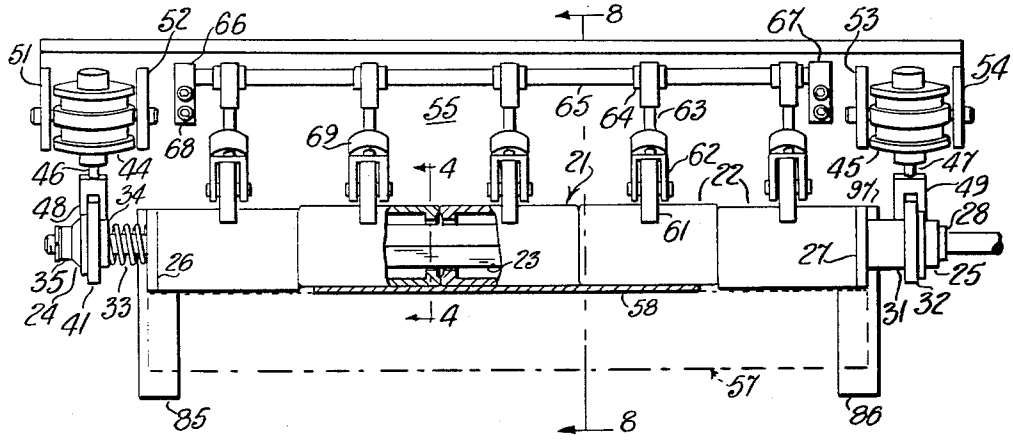


Fig. 1.

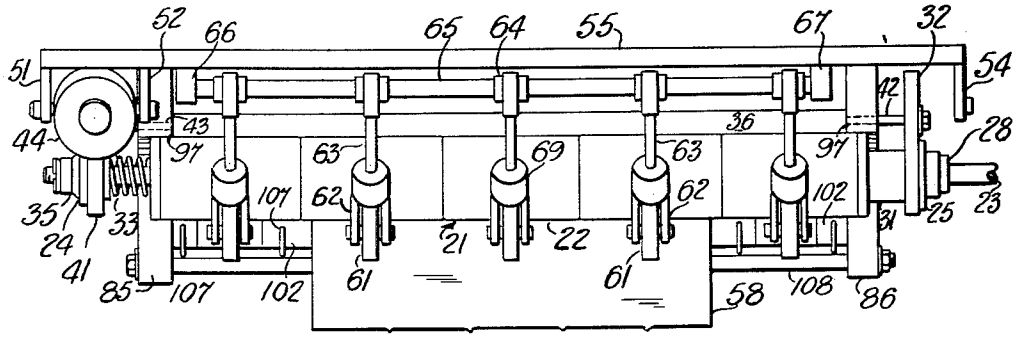


Fig. 2.

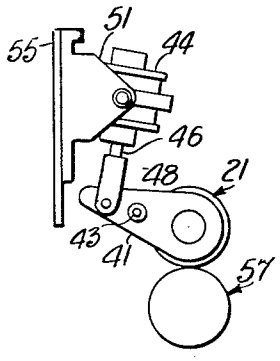


Fig. 3.

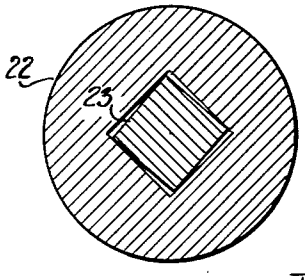


Fig. 4.

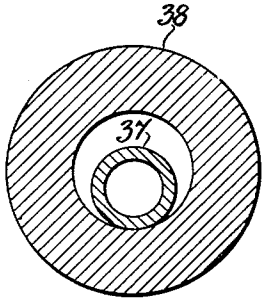


Fig. 5.

INVENTOR.
G. H. Young
BY W. H. Dailey Jr.
Charles L. Haughey
atty.

March 22, 1960 G. H. YOUNG ET AL 2,929,614

ROLL SEAL FOR STRIP HEATER

Filed Feb. 11, 1954 2 Sheets-Sheet 2

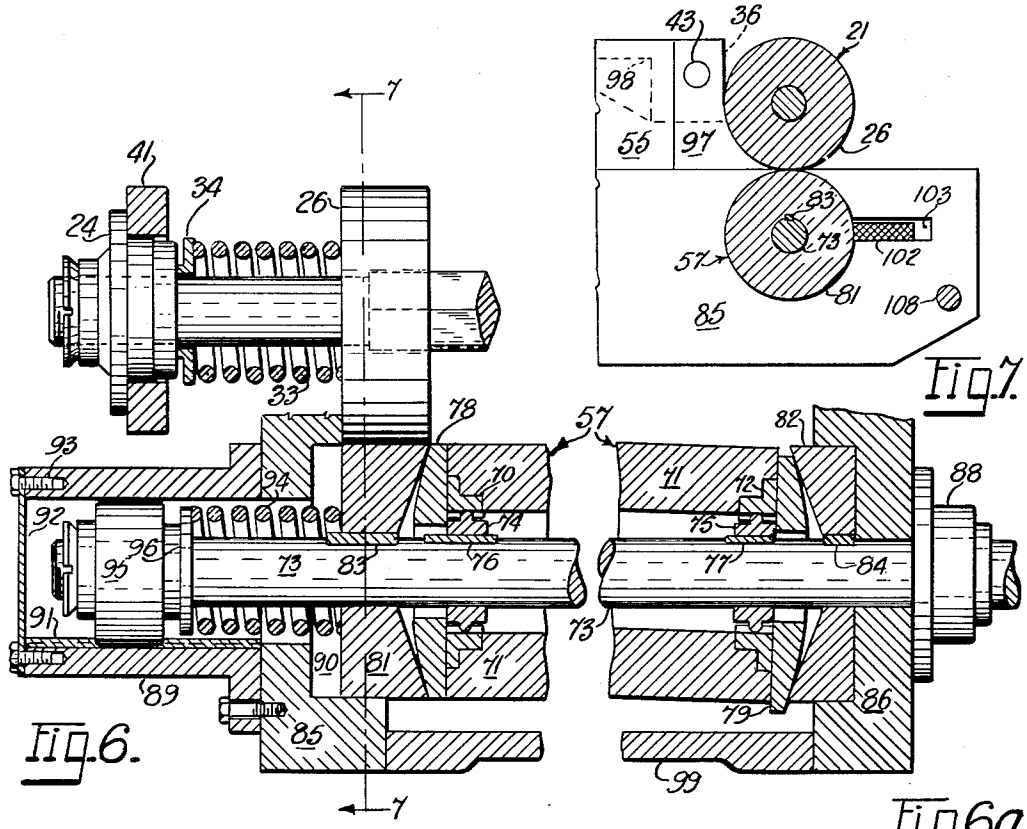


Fig. 6.

Fig. 7.

Fig. 6a

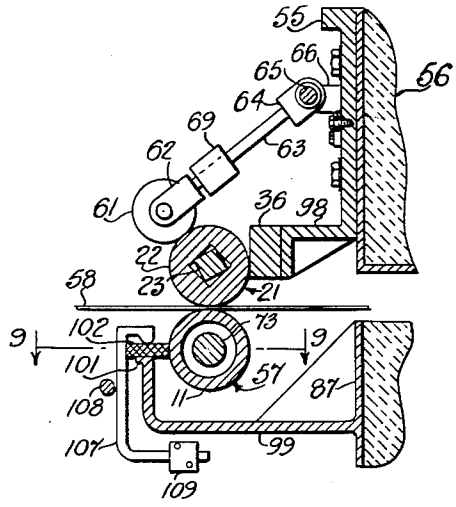


Fig. 8.

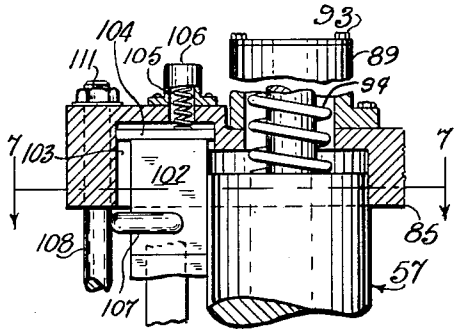


Fig. 9.

INVENTOR.
G. H. Young
W. H. Dailey Jr
Charles S. Haughey
atty.

BY

United States Patent Office 2,929,614 Patented Mar. 22, 1960

2,929,614

ROLL SEAL FOR STRIP HEATER

Gloyd H. Young, Ida, Mich., and William H. Dailey, Jr., Toledo, Ohio, assignors, by mesne assignments, to Midland-Ross Corporation, Cleveland, Ohio, a corporation of Ohio

Application February 11, 1954, Serial No. 414,164

17 Claims. (Cl. 263—3)

This invention relates to roll seals, as used for strip heaters, and is very effectively used as a roll seal for the end of a heating chamber for heating steel strip in a continuous galvanizing line.

The problem of adequately sealing the strip entry-end of an atmosphere chamber involves providing for minimum clearance at the ends of the seal, i.e. the edges of the strip and the ends of rolls making that seal, for irregularities of strip surfaces, welded joints, thermal expansion of the rolls and the like, without scoring or marking the strip. The roll seal apparatus should be accessible and serviceable, adjustable, if necessary, for various strip widths, and long lasting with a minimum of attention.

For a consideration of what we believe to be novel and our invention, attention is directed to the following portion of this specification, the drawing, and the concluding claims.

In the drawing:

Fig. 1 is an elevational view of the upper portion of an entry roll seal as applied to the entry end of a continuous steel strip galvanizing line, the outline only of the lower roll being shown.

Fig. 2 is a plan view of the entry roll seal.

Fig. 3 is a partial end view of the roll seal showing means for raising one roll for threading the strip.

Fig. 4 is a sectional view of the upper roll taken through line 4—4 of Fig. 1.

Fig. 5 is a sectional view of an alternate upper roll.

Fig. 6 is a sectional view of the left-hand end of the upper and lower rolls.

Fig. 6*a* is a sectional view of the right-hand end of the lower roll showing an abnormal condition of the roll.

Fig. 7 is a sectional view of the end of the rolls taken on line 7—7 of Figs. 6 and 9.

Fig. 8 is a sectional view of the apparatus on line 8—8 of Fig. 1.

Fig. 9 is a partially sectional view of an end of a seal brush device taken on line 9—9 of Fig. 8.

The improved roll seal for sealing the end of an atmosphere chamber through which strip passes comprises a pair of rolls mounted on supports at the end of the chamber with one of the rolls on either side of the roll pass line, and at least one of the rolls being articulated to accommodate variations in the gap between the rolls to be sealed.

In the drawings a preferred form of the improved roll seal is shown as applied to the entry end of a horizontal strip heating apparatus for a continuous galvanizing line of the general type and process as shown in patent to C. Cone and J. Huebler, 2,625,495 in Fig. II thereof.

In Figs. 1, 2 and 3 the upper roll and its supporting means are shown in some detail. The upper roll is generally indicated by an arrow at 21 and comprises an assembly of right circular cylindrical segments 22 having internal axial holes therethrough. The segments 22 are assembled on a shaft 23 which is supported in flanged

bearings 24, 25 at either end of the roll. The end segments 22 are compressed between washer plates 26, 27 at either end thereof, plate 27 being spaced from the inner race 28 of bearing 25 by a spacer cylinder 31, the flanged bearing 25 being mounted on a roll lifting plate 32, by bolts, not shown. Washer plate 26 is spaced from flanged bearing 24 by a spring 33 acting between the plate 26 and a washer 34 adjacent the inner race 35 of the flanged bearing 24, shown in Fig. 6.

The inner axial bores, or holes in the segments 22 are square in shape, and the shaft 23 passing therethrough is also square, but several strip thicknesses smaller in diameter so that the segments 22 may move laterally with respect to the shaft for reasons shortly appearing. The non-circular shaft 23 and hole in segments 22 for the shaft are designed to allow the segments to roll with the shaft with the face of the segments moving at strip speed. The shaft is preferably driven, by conventional means, not shown, at the right hand end of the shaft, to insure that the segments maintain strip speed at their line of contact with the strip.

Alternatively, it may in some cases be desirable to allow the roll segments 22 to find their own rotational speed by friction on the strip, allowing end segments not contacting the strip to "idle" in contact with an atmosphere seal bar 36 on the chamber wall, to be described. In this case the shaft for the upper roll would preferably be a pipe member 37 extending through a round axial hole or bore in segments 38 of the upper roll 21.

The upper roll 21 is supported by bearings 24 and 25 mounted on roll lift plates 32 and 41 on the respective right and left-hand ends of the roll, and the plates 32 and 41 are supported by fulcrum rod portions 42, 43 at the respective ends of the atmosphere seal bar 36.

The roll lift plates 41 and 32 are actuated by fluid cylinders 44 and 45 through rods 46, 47 and yokes 48, 49, the cylinders pushing the ends of the lift plates nearest the chamber downward, thus lifting the upper roll 21. The cylinders are supported on flanges 51, 52, 53 and 54 forming a portion of an upper roll seal mounting plate 55 secured to and forming a part of the wall 56 of the atmosphere containing chamber, the cylinders 44, 45 being trunnion mounted in the usual way.

The roll seal also comprises a lower roll generally indicated at 57 over which a strip 58 is passed through the seal and the wall 56 into the chamber. The upper roll segments 22 in normal operation tend to follow the strip or the lower roll 57 in contact therewith and to turn against the face of the atmosphere seal bar 36. However, occasional strip welds or imperfections will hit a segment and bump it upwards. To hold the segments from jumping off the strip and loosing the seal, a plurality of hold down rollers 61 are provided, supported by yokes 62 mounted on rods 63 out of bearings 64 which are secured to a shaft 65. The shaft 65 is supported at its ends in brackets 66, 67 secured to the plate 55 by bolts 68. Weights 69 are provided on the rods 63, movable thereon to provide an adjustable biasing means tending to hold the segments 22 in their normal operating position.

The lower seal roll 57 comprises a seal face tube 71 having internally splined rings 70, 72 set into its respective ends, and a shaft 73 passing through the tube and carrying next adjacent the splined rings 72 a pair of toothed gear-like rings 74, 75 keyed to the shaft 73 by keys 76, 77. Adjacent the ends of the tube 71 are spherical faced washers 78, 79 having a flat face toward the tube and the spherical face toward tubular end pieces 81, 82 mounted on the shaft by keys 83, 84 to turn therewith. The lower roll 57 is mounted in flange portions 85, 86 of a lower roll seal mounting bracket 87 forming a part of the wall 56 of the chamber. A bearing 88 mounted on the right-hand flange portion 86 accu-

rately aligns that end of the lower roll with a recess in the flange portion therefor so that the tubular end piece 83 projects into a recess in the flange portion 86, clearing the surfaces thereof with a close running fit and thus sealing that end of the lower roll 57.

At the other, left-hand end of the roll 57, the shaft extends through a hole 90 in the flange portion 85 and into a housing 89 having an axial key 91 set thereinto, and covered by a plate 92 secured by bolts 93. A bearing 95 is set upon the end of the shaft 73 in the housing 89 supporting the left-hand end of the shaft 73 in accurate alignment with the hole 90 in the flange portion 85. The tubular end piece 81 sets accurately within the hole 90 with a close running fit, thus sealing that end of the roll with the flange portion 85. A spring 94 acting between a washer 96 adjacent the bearing 95 and the end piece 81 exerts a force tending to hold the assembly of end pieces 81, 82 spherical faced washers 78, 79 and seal face tube 71 in contact as a unitary structure. This lower roll structure is designed so that the roll seal face tube 71 may, as it will under adverse temperature conditions, bend or warp as much as ⅜ inch out of a straight line in a four foot length, and the shaft 73 can and will remain straight, hence end pieces 81, 82 will remain in proper alignment in a close running fit in the respective flange portions 85, 86. The roll seal face tube 71 may even go skew, as shown in Fig. 6*a* under stress of abnormal operations without loss of an adequate seal.

To complete the seal of the upper roll 21, a pair of end support blocks 97 are mounted on the upper roll seal mounting plate 55. The blocks 97 have a cylindrical face portion forming a 90° curve around the roll face adjacent the flange portions 85, 86 to receive the end washer plates 26, 27 of the upper roll. Between the blocks 97 the atmosphere seal bar 36 extends, forming with the blocks 97 a continuous contact with the upper roll 21 from end to end thereof. The seal bar 36 rests on an extended web portion 98 of the plate 55 to form a continuous seal to the wall 56 of the chamber from the upper roll 21.

To complete the seal of the lower roll 57 with the wall 56 of the chamber, the lower roll seal mounting bracket forming a part of that wall includes a web or cover portion 99 extending outward from the wall 56, under the roll 57, and terminating in a lip 101 upon which a series of brush elements 102 rest in closely adjacent relationship extending from the right-hand flange portion 86 to the left-hand flange portion 85 and into a slot 103 formed therein. The brush elements are preferably formed of carbon blocks, although in many cases porous bronzes, carbon- or lubricant-impregnated bronzes, cast iron and hardened tool steel would perform very satisfactorily. To hold the brush elements 102 in contact with each other in a lateral line on the lip 101, and to accommodate motion in the slot by the end brush element, an end block 104 in the slot 103 is held against the end brush element 102 by a spring 105 retained within a cap structure 106. The block 104 is machined to a close fit with the slot 103 to seal end of the end brush element 102 as it moves toward or away from the lower roll 57. A series of weighted hooks 107 rest one on each brush element to hold the same upon the lip 101, and by falling against a bar 108 which is secured at its end to flange portions 85, 86 by nuts 112, the weighted springs also hold the brush elements in contact with the lower roll 57.

Weights 109 on the hooks 107 may be adjusted as desired so that as projections or elements of dirt clinging to the lower roll momentarily force the brush element out of position, the weighted hook will return the same to its normal operating and sealing position.

We claim:

1. A roll seal assembly for sealing the end of a chamber through which strip passes, the assembly comprising, in combination: a pair of elongated rolls mounted across the end of the chamber and between which the strip passes; means for supporting each of said rolls in substantially parallel relation and in rolling contact with the strip passing therethrough; one of said rolls being an articulated assembly of roll segments maintained in substantially axial alignment as the strip passes between the rolls; and a plurality of individual hold down element means each comprising a roller supported on a shaft for rotation thereof, and each adapted to apply force through said roller tending to hold an individual roll segment in contact with the strip.

2. A substantially non-articulated roll for a roll seal which comprises said non-articulated roll and another roll disposed on either side of a strip pass line, said substantially non-articulated roll comprising, in combination: an elongate shaft; roll end piece cylinders concentrically mounted on the shaft at either end thereof; an intermediate roll face tube having an inner axial bore substantially larger than the diameter of the shaft, mounted on the shaft between said end piece cylinders; and ring support means mounted on the shaft adjacent and within the respective ends of the roll face tube providing support therefor only at circumferential lines of support on said ring support means.

3. A substantially non-articulated roll according to claim 2: wherein said roll face tube comprises internally splined portions at its ends adjacent the ring support means, and the ring support means each comprising a circular series of teeth engaging said splines to concentrically support the roll face tube on the shaft and drive the same from the shaft.

4. A substantially non-articulated roll according to claim 2, comprising: a pair of washers between the roll face tube and each of the respective end piece cylinders, each of the washers having a flat face towards the roll face tube and a spherical face towards the end piece cylinders, and having internal bores therethrough substantially larger than the diameter of the shaft passing therethrough; and each end piece cylinder having a conical face towards said washers whereby to contact the same on a circular line of contact and allow the roll face tube to bend with respect to the shaft without disturbing axial alignment of the end piece cylinders.

5. A roll seal for sealing the end of a chamber through which strip passes, comprising, in combination: an articulated upper seal roll mounted above the strip pass line, the upper roll comprising a plurality of cylindrical segments having axial bores therethrough and a shaft passing through the bores, the shaft being of substantially less diameter than the bores; end seal blocks at either end of the upper roll contoured to fit to the roll for a substantial portion of its face from the strip pass line around the periphery of the roll on the chamber side thereof, said blocks forming an extension of the wall forming the chamber to seal the roll end to the chamber; and an atmosphere seal bar forming a portion of the end of the chamber to be sealed, extending between said blocks to form therewith a continuous line of contact with the upper roll.

6. A roll seal according to claim 5 wherein the shaft extends beyond the outer ends of the segments, and comprising lift means cooperating with the ends of said shaft for raising the upper roll off said blocks and off the strip pass line sufficient for passing a strip threading bar through the strip pass line.

7. A roll seal for sealing the end of a chamber through which strip passes, comprising, in combination: a pair of seal rolls on either side of the strip pass line for contacting the strip passing therethrough; one of said rolls being supported on end brackets forming a cylindrical recess for the said roll closely fitted in a running fit to the diameter of the roll; a support bracket extending between said end brackets and forming therewith a continuous closure with the wall of the chamber; an articulated series of brushes mounted on the support bracket and contacting said roll between the end brackets to form

a seal between the roll and the wall of the chamber; one of said end brackets forming a recess adjacent said series of brushes to receive at least a portion of one brush of said series; and means in said recess for sealing the end brush of said series to said end bracket and for maintaining on said series a compressive force tending to hold the brushes in continuous contact between said end brackets.

8. A substantially non-articulated roll for a roll seal which comprises said non-articulated roll and another roll disposed on either side of a strip pass line, said non-articulated roll comprising, in combination: an elongate shaft; roll end piece cylinders concentrically mounted on the shaft at either end thereof; an intermediate roll face tube having an inner bore substantially larger than the diameter of the shaft; ring support means mounted on the shaft adjacent and within the respective ends of the roll face tube supporting the same concentrically on the shaft at the said ring support means; and means comprising the end surfaces of the roll face tube and the adjacent faces of the end piece cylinders forming a spherical surface to conical surface end joint at each end of the roll face tube.

9. A non-articulated roll according to claim 8 and comprising washers between the end piece cylinders and the respective ends of the roll face tube, the washers each having a central axial bore substantially larger than the shaft through which the shaft passes, and each washer having one spherical face and a plane face.

10. A roll seal assembly for sealing the end of a chamber through which the strip passes, the assembly comprising, in combination: a pair of elongated rolls mounted across the end of the chamber, and between which the strip passes; means for supporting each of said rolls in substantially parallel relation and in rolling contact with the strip passing therethrough; one of said rolls being an articulated assembly of roll segments maintained in substantially axial alignment as the strip passes between the rolls; and one of said rolls comprising a shaft supported on the support means; pivot support ring means mounted on the shaft near the respective ends thereof; a right, circular, roll face tube disposed around the shaft and extending between said pivot support ring means whereby said roll face tube is supported substantially by line contact around the shaft only at each of said ring means and is independent of flexing of the shaft therebetween or therebeyond; a pair of washers on either end of said roll face tube, each washer having a central hole substantially larger than the diameter of the shaft therethrough and having a face perpendicular to the end of the roll face tube thereagainst and an opposite spherically shaped face; a roll end member at each end of the roll having a conical face contacting the spherical face of the washers; and spring means acting on said roll end members tending to force them together.

11. A roll seal assembly for sealing the end of a chamber through which strip passes, the assembly comprising, in combination: a pair of elongated rolls mounted across the end of the chamber and between which the strip passes; and means for supporting each of said rolls in substantially parallel relation and in rolling contact with the strip passing therethrough; one of said rolls being an articulated roll comprising a shaft extending axially through apertures in a plurality of roll segments mounted thereon and in driving relation to at least one of said segments, the shaft being substantially smaller than the apertures in the segments whereby to allow relative lateral movement of each of the segments independently with respect to the shaft yet insure the shaft will drive the roll segments in driving relation therewith when such segments tend to turn at a different rotational speed than the shaft.

12. A roll seal assembly for sealing the end of a chamber through which strip passes, the assembly comprising, in combination: a pair of elongated rolls mounted across the end of the chamber and between which the strip passes, one of said rolls being an articulated assembly of roll segments having holes therethrough and mounted upon a shaft whose size is sufficiently smaller than said holes to allow relative lateral movement of the segments with respect to the shaft; independent means acting upon each of the several segments tending to force each of the several segments toward the other roll of the pair; and means for supporting each of said rolls in substantially parallel relation and in rolling contact with the strip passing therebetween, said supporting means comprising resilient means maintaining an axial compressive force on said segments maintaining them in contact with each other yet allowing relative lateral movement therebetween.

13. A roll seal assembly according to claim 12 wherein said shaft is in driving relation to at least one of said segments whereby to maintain the rotational speeds of the shaft and the segments in driving relation therewith substantially equal within the tolerance of play between the shaft and the segments.

14. A roll seal assembly for sealing the end of a chamber through which strip passes, the assembly comprising, in combination: a pair of elongated rolls mounted across the end of the chamber and between which the strip passes, one of said rolls being an articulated assembly of roll segments having holes therethrough and mounted upon a shaft whose size is sufficiently smaller than said holes to allow relative lateral movement of the segments with respect to the shaft; means for supporting said rolls in substantially parallel relation and in rolling contact with the strip passing therebetween; and independent means acting upon each of the several segments tending to force each of the several segments toward the other roll of said pair.

15. A roll seal assembly according to claim 14 wherein said shaft is in driving relation to at least one of said segments whereby to maintain the rotational speeds of the shafts and the segments substantially equal within the tolerance of play between the shaft and the segments.

16. A roll seal assembly according to claim 15 and comprising means for maintaining an axial compression force on said segments sufficient to maintain them in contact with each other yet allowing relative lateral movement therebetween.

17. A roll seal assembly for sealing the end of a chamber through which strip passes, the assembly comprising, in combination: a pair of elongated rolls mounted across the end of the chamber and between which the strip passes, one of said rolls being an articulated assembly of roll segments having holes therethrough and mounted on a shaft whose size is sufficiently smaller than said holes to allow independent relative lateral movement of the segments with respect to the shaft; and means for supporting said rolls in substantially parallel relation and in rolling contact with the strip passing therebetween.

References Cited in the file of this patent

UNITED STATES PATENTS

936,250	McDonough	Oct. 5, 1909
1,191,386	Battle	July 18, 1916
1,576,163	Voelker	Mar. 9, 1926
1,737,117	Morton	Nov. 26, 1929
1,833,132	Shoffstall et al.	Nov. 24, 1931
2,080,027	Allsop et al.	May 11, 1937
2,135,175	Fallon	Nov. 1, 1938
2,603,578	Ornitz	July 15, 1952
2,654,587	Skivesen	Oct. 6, 1953