

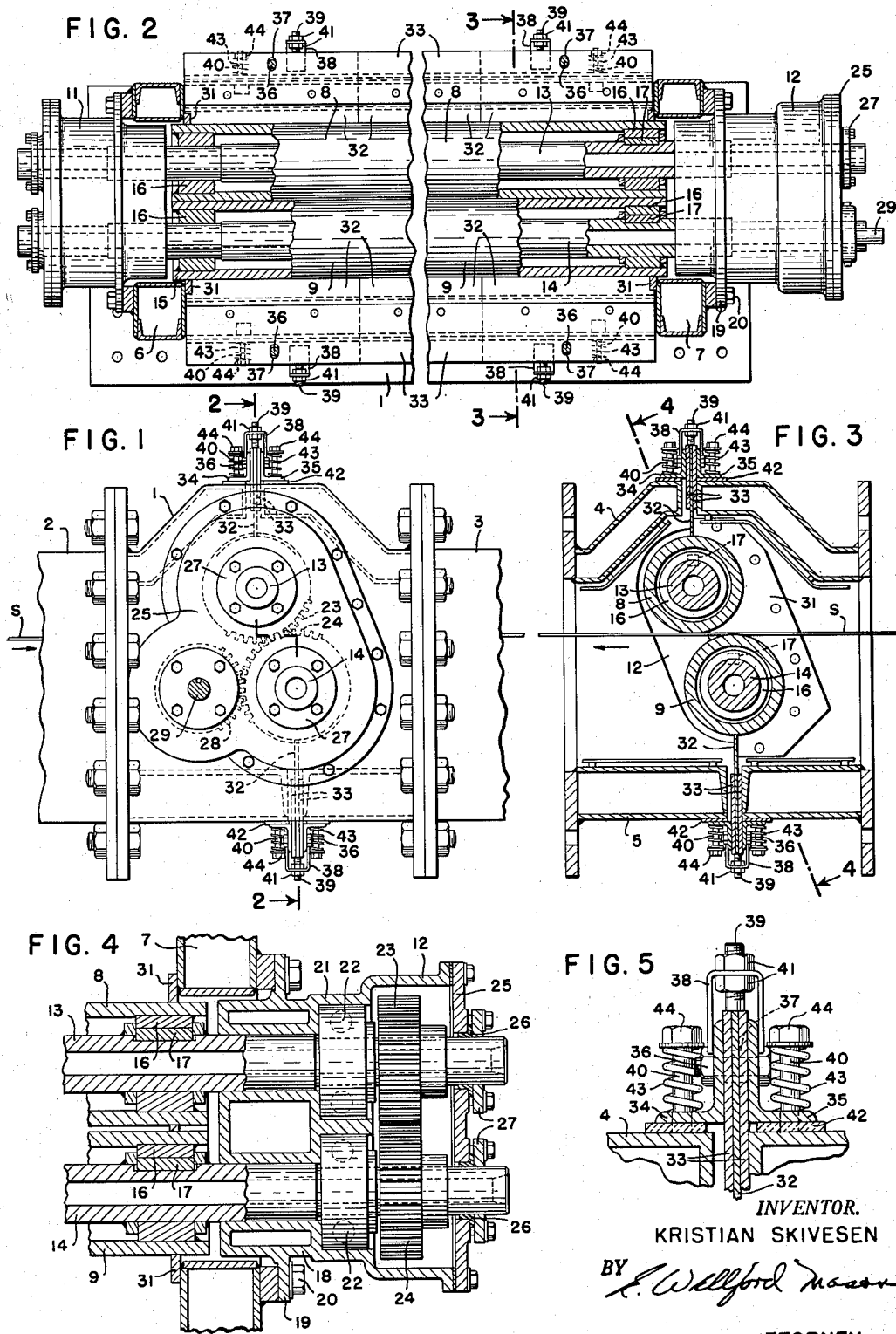
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ROLL SEAL

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ROLL SEAL

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The present invention relates to roll seals, and more particularly to a roll seal of the type that is used between the heating and cooling chambers of a continuous heat treating apparatus for strip material, for example.

In the continuous heat treatment of strip material, such as the continuous annealing of steel, it is customary to provide a seal at the entrance and exit of the cooling chamber to keep the special cooling atmosphere in that chamber. As far as I am aware, all previous roll seals used for this purpose had one or both of the rolls that engage the opposite sides of the strip movable. Usually these rolls are spring biased toward each other so that they can move apart when thick portions of a strip or lapped ends of two strips pass between them. These movable rolls have the disadvantage that the inertia of the rolls prevents them from moving apart instantaneously when the strip changes in thickness abruptly. This is particularly objectionable where the strip has a double thickness such as where the trailing end of one strip is joined to the leading end of the next. There is always an added strain placed on the strip at this point by the roll seal and not infrequently the strip is broken. The momentary holding back of a fast moving strip by the rolls of the seal before they separate is often sufficient to pull the strip apart, particularly if the trailing end of one strip has been improperly welded to the leading end of the next.

It is an object of the invention to provide a roll seal to be used with strip material in which the rolls are mounted on centers that are fixed with respect to each other, and spaced slightly apart at an angle to the path of strip travel. It is a further object of the invention to provide a roll seal having a pair of rolls between which the strip can pass with a minimum of disturbance to the strip. It is a further object of the invention to provide a roll seal which will not become clogged with scale or other dirt.

According to the present invention, there is provided a housing in which there are journaled two rolls. These rolls are displaced with respect to each other along the path of travel of the strip so that there is a space between them at an angle to the strip travel. As the strip moves between the rolls, it engages each of them, but because of their displaced positions, the strip can flex slightly around them when there are irregularities in thickness, without placing any strain on the strip. Sealing means are provided between the rolls and the housing in which they are located to prevent any undue passage of gas from one side to the other thereof. The seal is described as being used in connection with apparatus for the continuous annealing of metal. It is apparent, however, that it may be used in connection with any apparatus in which such a roll seal is necessary or desirable.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its ad-

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vantages and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

In the drawings:

Figure 1 is a side view of the housing in which the roll seal is located;

Figure 2 is a view taken on line 2—2 of Figure 1;

Figure 3 is a view taken on line 3—3 of Figure 2;

Figure 4 is a view taken on line 4—4 of Figure 3; and Figure 5 is an enlarged view of the sealing strip holding means.

Referring to Figure 1 of the drawing, there is shown a housing 1 in which the roll seal of the present invention is located. This housing is fastened between two compartments which may include a duct 2 leading from the heating unit and a duct 3 leading to a cooling tower. The apparatus is used to seal off the atmosphere in the cooling tower from that in the heating unit so that a strip of material S moving from the heating unit through the seal into the cooling tower will be subjected to proper atmosphere in each of the units. As shown best in Figures 2 and 3, the housing is substantially rectangular in shape and includes an upper water cooled wall 4 and lower water cooled wall 5. Walls 6 and 7, that are also water cooled, form the ends of the housing. The rolls forming the seal are indicated at 8 and 9 and are located in the housing and journaled for rotation in castings 11 and 12, respectively, that are fastened in openings formed in walls 6 and 7.

The rolls 8 and 9 are duplicates of each other and include hollow shafts 13 and 14 respectively through which a cooling fluid can be circulated. Each shaft has spacing members 16 suitably fastened to it upon which is mounted a cylindrical member forming the surface of the roll. At least one end of each shaft is provided with a key indicated at 17 which engages a keyway in the spacing member 16 to insure that the roll surface rotates with the shaft.

The casting 12, which is shown in outline in Figure 2 and in section in Figure 4, consists of a water cooled portion 18 that is received in a suitable opening formed in the end wall 7 of the housing. The casting 12 is held in position in the housing wall by means of a flange 19 formed thereon and bolts 20 which extend through the flange and into the end wall. To the right of the water cooled section 18 as shown in Figure 4 are provided enlarged recesses 21 in which are received suitable ball or roller bearings 22 that receive the ends of the shaft. To the right of these bearings, the shafts are provided with meshing gears 23 and 24, respectively, by means of which the rolls can be rotated. In view of the fact that the shafts 13 and 14 are adapted to have water circulate through them, the ends of these shafts extend through a plate 25 closing the end of the casting and are surrounded by seals 26 that are held in place by small plates 27 bolted to the end plate 25. It will be seen that the water cooled portion 18 of the casting has openings that are slightly larger in diameter than the shafts that extend through it and that the ball bearings 22 are so located in the recesses 21 that they can move slightly in an axial direction. These provisions permit expansion of the rolls and shafts during operation.

The gear 24 meshes with a third gear 28 (Figure 1) that is attached to a shaft 29 journaled in casting 12. This shaft extends from the casting and is adapted to be driven by a motor, not shown. It will be obvious from the gearing arrangements that the rolls 8 and 9 will be driven in opposite directions to move a strip passing between them.

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The casting 11 which supports the left end of the shafts 13 and 14 is shown in Figure 2 and is identical with the casting 12, except that there is no provision made for driving gears 23 and 24 since it is only necessary to drive these shafts from one end.

Sealing means are provided between the rolls and the housing in order to prevent the passage of any substantial amount of gas from one of the ducts to the other past the rolls. For this purpose, there are provided end seals, one of which is shown in detail at 31 in Figure 3 of the drawing. This seal consists of a plate of metal which is carefully machined so that it surrounds closely substantially half of each roll. This plate is bolted to the inside face of the wall 7. Referring to Figure 2, it will be seen that the rolls are of such a length that they extend slightly into the hollow wall 7 so that the seal will effectively prevent passage of atmosphere from the cooling chamber around the ends of the rolls. A similar seal, also indicated at 31, is provided on the left end of the rolls in Figure 2 of the drawing so that passage of the gas is also prevented around that end of the rolls.

A sealing assembly is also provided between the upper wall 4 and the surface of the top roll, and between the lower wall 5 and the surface of the bottom roll. These sealing assemblies are identical so that a description of one will be sufficient. The upper assembly, for example, includes a thin plate 32 which extends through a slot in the wall 4 toward the surface of the roll 8. This plate is re-enforced on each side by heavier plates 33, each of which extends the full length of the rolls between the seals 31. On each side of the re-enforcing members 33, there is an angle member 34 and 35 respectively, the horizontal portions of which rest upon the outer surface of the wall 4 to limit downward movement of the seal plate assembly 32, 33. The angle members and the seal plate assembly are held in adjusted position with respect to each other by means of bolts 36 that extend through the angles and through slots 37 formed in the members 32 and 33. The assembly 32 and 33 is adjusted with respect to the angles so that it is just out of engagement with the surface of the roll when the angles are resting upon the outer surface of the wall, as is shown best in Figure 3 of the drawing. Means is provided to adjust the seal assembly with respect to the angles 34 and 35 which includes a pair of yokes 38 that are fastened to the angles. Extending upwardly from the seal assembly and through each yoke is a bolt 39 that can be adjusted relative to the yoke by means of nuts 41. It is noted that an asbestos gasket 42 is placed between the wall 4 of the housing and each of the angle members 34 and 35 respectively in order to seal more effectively the joint between these parts.

In the adjustment of the seals, the bolts 36 are loosened and nuts 41 are adjusted along bolt 39 until the proper clearance is obtained between the seal plates 32 and the roll. Allowance must be made for expansion which will take place as the rolls and seals are heated due to engagement with a heated strip. After the seal assembly is adjusted with respect to the angles 34 and 35, the bolts 36 are tightened. The upper seal will normally be held in place against the outer surface of wall 4 by the action of gravity. It is best, however, to provide some means to hold this assembly in place positively. To this end, pairs of bolts 40 are provided which extend upwardly from the top of the housing wall through openings in the horizontal side of the angles. Springs 43 are placed around these bolts and they are held in position by nuts 44. Therefore, the seal will be held in position, but it can be moved upwardly against the force of the springs 43 if for some reason the rolls or the seals should expand or warp. It is noted that the plates 32 are made in sections in order to prevent buckling as a result of thermal expansion of the same when the device is in operation.

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The lower seal assembly extending between wall 5 of the housing and bottom of roll 9 is exactly the same as the upper seal assembly. In this case, however, the assembly must be held in place by springs. Therefore, a larger number of bolts 40 and springs 43 are provided to support resiliently this assembly in engagement with the outer surface of wall 5 and in proximity to the surface of the roll.

In the operation of a roll seal of the type described herein, the strip S can move in either direction. As shown herein, however, it is moving toward the right in Figure 1 and toward the left in Figure 3. It will be seen that the strip passes over and engages the surface of the lower roll 9 and passes under and engages the surface of the upper roll 8. These rolls are offset horizontally with respect to each other so that there is a small space between them which is shown best in Figures 3 and 4 of the drawing. Vertically, the rolls appear to engage each other as shown in Figure 2. This arrangement permits the strip to pass between the rolls even though there may be irregularities in its thickness as would be encountered, for example, when the trailing end of one strip is fastened to the leading end of the next in order to make the operation continuous. The movement of the strip that is occasioned by unevenness in its thickness will not cause the same to be jammed between the rolls and will quickly be dampened out due to the position of the rolls with respect to the strip. The rolls and the various seal plates 31 and 32 can be so machined and adjusted that the spacing between them is negligible. Therefore, any leakage that would take place between the rolls and the seal plates is too slight to be of any consequence. Normally, the rolls will be slightly longer than the width of the strip, so that there will be a small amount of leakage between the edges of the strip and the side seals 31. This leakage is negligible, and as a matter of fact, is frequently desired in order that proper purging of the atmosphere in the cooling chamber can take place. The area through which this leakage can occur is only equal to the perpendicular distance between the surfaces of the rolls times the distance between the edges of the strip and the seals 31.

From the above, it will be seen that I have provided a roll seal for use in the continuous treatment of strip material. This seal can be used to close off portions of any apparatus in which strip is treated. The seal does not require that the rolls be mounted for movement relative to each other, therefore the construction required for mounting the rolls rigidly and driving them is considerably simplified over the construction required when one or both of the rolls is bodily movable with respect to the other. The resilient mounting of the vertical seal members is such that they will give in the event of undue expansion or warping of either the rolls or the seal members. While the present seal has been shown as mounted in a horizontal position, it will be obvious that the housing could be rotated through 90° so that the strip is traveling in a vertical direction. The operation in each case would be the same. If the strip is traveling in a vertical direction, and scale or other dirt should fall on the rolls, the slight space between the two will permit the strip to flex sufficiently for the dirt to pass along to a lower chamber where it can be collected.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit and scope of the invention as set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What is claimed is:

1. A seal for use between two compartments through which a strip of material passes comprising in combina-

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tion a housing through which the strip passes, a pair of rolls on opposite sides of the strip, first means to mount one of said rolls for rotation around a fixed axis in said housing, second means on opposite sides to mount the other of said rolls for rotation around a fixed axis in said housing, said first and second means being so positioned relative to each other that the peripheries of said rolls are tangent to a plane and the axes of said rolls are parallel and laterally displaced along said plane, the displacement being such that the surfaces of the rolls do not engage each other.

2. A seal to be placed between two compartments through which a continuously moving strip passes comprising in combination a housing having end walls, a top wall and a bottom wall, an opening in each of said end walls, a pair of rolls, an end of each roll projecting through each opening, means to mount each roll for rotation, means to attach said mounting means to the outside of the ends of said housing to cover the openings therein, each of the walls of said housing and said mounting means being water cooled.

3. A seal to be placed between two compartments through which a continuously moving strip passes comprising in combination a housing substantially rectangular in cross section through which the strip passes, said housing having ends and opposed walls, a pair of rolls, means to mount one of said rolls in said end walls and on a fixed axis on one side of said strip with the periphery of the roll engaging the strip, and means to mount the other of said rolls in said end walls and on a fixed axis on the other side of said strip with the periphery of the roll engaging said strip, the axes of said roll being displaced in the direction of strip travel, the displacement being such that the surfaces of the rolls do not engage each other.

4. The combination of claim 3 including means forming seals between the ends of said housing and said rolls, a seal extending axially of one roll between the surface of said roll and a wall of said housing, and a seal extending axially of said other roll and between the surface thereof and the other wall of said housing.

5. In a roll seal, the combination of a rectangular housing having end walls, and a pair of connecting walls, a pair of rolls, means to journal said rolls for rotation in said end walls, one above the other, one of said connecting walls having a slot formed therein parallel to the roll adjacent thereto, a sealing member extending through said slot between said connecting wall and roll, means engaging the outer surface of said connecting wall to support said seal, means to adjust the position of said seal relative to said supporting means, and means to hold said supporting means in engagement with the outer surface of said connecting wall.

6. In a roll seal to be located between two compartments, the combination of a housing rectangular in section through which a strip passes, a pair of rolls, means

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to mount each of said rolls in the ends of said housing for rotation around a fixed axis perpendicular to the direction of strip travel, one of said rolls being on one side of said strip and in engagement with the surface thereof and the other of said rolls being on the other side of said strip and engaging its surface, said rolls being displaced relative to each other in the direction of strip travel, so that the surfaces of the rolls do not engage each other, a seal extending between each end of said housing and the surfaces of the rolls adjacent to the ends thereof, and a seal extending between each side of said housing and the surface of the roll adjacent thereto, said last mentioned seals extending axially of the rolls.

7. In a roll seal, the combination of a rectangular housing having top, bottom and end walls, a pair of rolls, means to journal said rolls one above the other in said end walls for rotation around fixed axes, the surfaces of said rolls being tangent to opposite sides of a plane and the axes of said rolls being parallel to the plane and displaced laterally with respect to each other, the displacement being such that the surfaces of the rolls do not engage each other, a seal attached to each end wall and substantially in engagement with the surface of each roll adjacent to the end thereof, a seal parallel to the axis of the upper roll between the surface of said roll and the top of said housing, a seal parallel to the axis of the lower roll between the surface of said lower roll and the bottom of said housing, and means to hold said last two mentioned seals in engagement with the top and bottom of said housing respectively and substantially in engagement with the surfaces of the top and bottom rolls respectively.

8. In a roll seal, the combination of a housing having top, bottom and end walls, a pair of rolls, means to journal said rolls in said end walls one above the other, each of said top and bottom walls having a slot therein parallel to said rolls, a seal extending between the top wall and the surface of the top roll, a seal extending between the bottom wall and the surface of the bottom roll, each of said seals extending through the slot in its respective wall, resilient means for holding said seals in position in said slots with a portion thereof in engagement with the outer surface of the wall through which it extends, and means to adjust said seals in said slots toward and from the rolls.

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