Feb. 8, 1955 E. T. LORIG 2,701,430

ROLL ASSEMBLY FOR AUTOMATICALLY CENTERING A MOVING STRIP

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FIG. 1

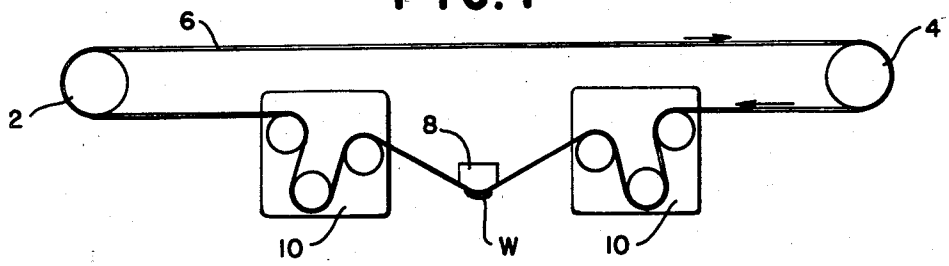

FIG. 2

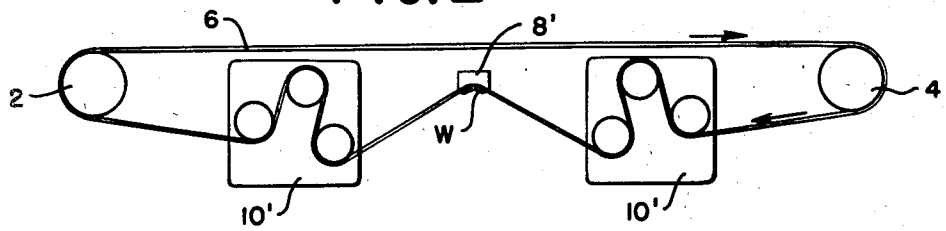

FIG. 5

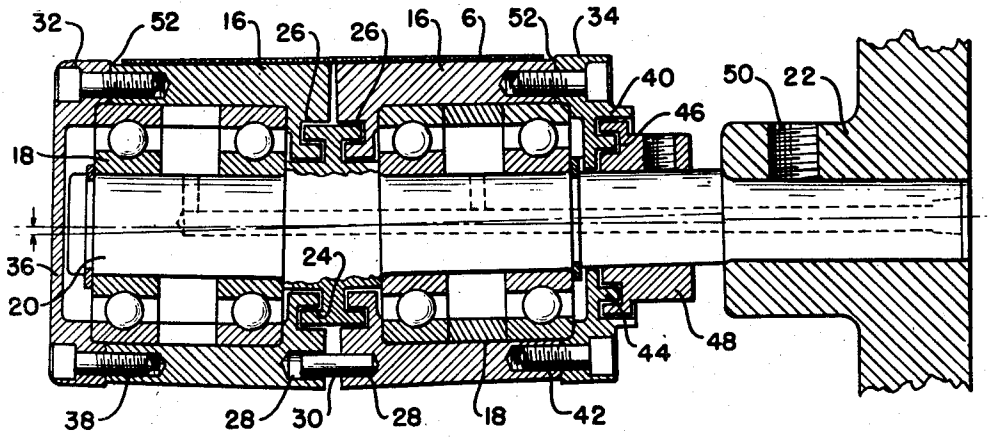

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FIG. 3

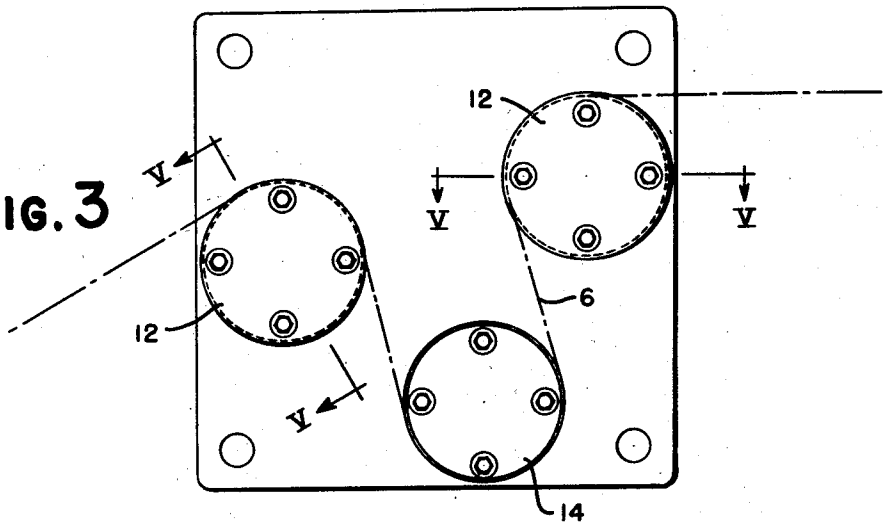
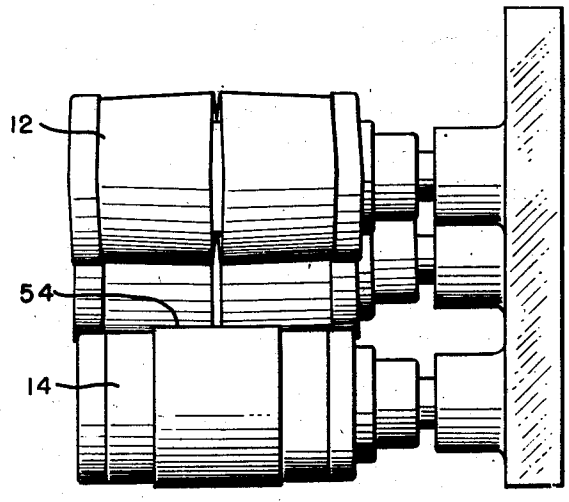


FIG. 4



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ROLL ASSEMBLY FOR AUTOMATICALLY CENTERING A MOVING STRIP

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Application December 5, 1952, Serial No. 324,371

9 Claims. (Cl. 51—135)

This invention relates to a roll assembly for automatically centering a moving strip or strip like material and is particularly adapted for very difficult tracking problems such as the tracking of grinding belts traveling at high speeds under variable laterally applied grinding loads. Many abrasive belt grinding units are being used at present but are not entirely satisfactory because of lateral fleeting of the belts when subjected to the load at grinding contact with the shaping dies and the warped object being surfaced. This lateral movement is caused primarily by the application of variable intermittent tension across the full width of the belt under load. A contributing factor in this lateral movement is the fact that commercial belts have a certain amount of camber or crookedness which cannot be totally eliminated. This causes rhythmic cyclic lateral movement of the belts. By utilizing self-centering rolls such as shown in my prior Patents Nos. 2,593,157 and 2,593,158, the fleeting of the abrading belts is partially compensated for and satisfactory performance has been obtained in instances where the lateral distortion of the belt is not too great. I have also disclosed in my copending application, Serial No. 301,321, filed July 28, 1952, an improved centering apparatus which gives satisfactory results under somewhat more severe operating conditions, especially when used with narrow belts. However, when using wider abrasive belts, especially at high speeds, the problem is so severe that satisfactory results are not obtained. The same problem of tracking is present in other instances where a belt or strip is subjected to severe lateral distortion.

It is therefore an object of my invention to provide a roll assembly for automatically centering a moving strip under severe tracking conditions.

Another object is to provide an abrading machine in which the grinding belt will remain centered under severe conditions.

These and other objects will become more apparent after referring to the following specification and attached drawings, in which:

Figure 1 is a schematic view showing my invention as applied to an abrading machine;

Figure 2 is a view similar to Figure 1 showing a slight modification thereof;

Figure 3 is an enlarged end view of the roll assembly;

Figure 4 is a side view of the roll assembly; and

Figure 5 is a sectional view taken on the line V—V of Figure 3.

Referring more particularly to Figure 1 of the drawings, reference numeral 2 indicates a drive pulley which may be rotated by any suitable means such as an electric motor (not shown). Spaced from the pulley 2 is a tail or tension take-up pulley 4 which is preferably a self-centering roll of the general type shown in my above mentioned Patent No. 2,593,157. An abrasive belt 6 passes around the pulleys 2 and 4 and over a die 8. A pair of roll assemblies 10 are arranged adjacent the die 8, one on each side thereof. The belt 6 passes at a high speed around the rolls 2 and 4, through the roll assemblies 10 and over the surface of the die 8. A workpiece W, such as a jet turbine blade, may be ground by placing the concave surface thereof against the convex surface of the die 8. The die 8 may be moved to force the abrasive side of the belt 6 against the blade W. Due to the speed of the belt and the forces applied thereto the tendency for the belt to move sideways off

the supporting pulleys and rolls is very great but the use of my roll assemblies 10 permits the belt to track properly under the most adverse conditions. In many instances it is only necessary to have one roll assembly 10 located on the entry side of the die 8.

In the embodiment of my invention shown in Figure 2, the convex side of the blade W is being ground. In this embodiment the die 8 is replaced by a die 8' having a concave surface for supporting the belt 6. Also in this embodiment the roll assemblies 10' are shown in a somewhat different position but the operation of the machine is essentially the same as that of Figure 1.

As shown in Figures 3 to 5 each of the roll assemblies 10 and 10' consists of a pair of spaced apart self-centering rolls 12 and a narrow bodied cylindrical roll 14 located between the rolls 12. It will be noted that the belt 6 passes around a considerable arc of rolls 12 and as shown the wrap is approximately 90°. However, the amount of wrap may vary but is preferably between approximately 90° and 180°. The belt 6 is shown as passing around 180° of the periphery of roll 14 but this amount of wrap can also be varied between wide limits. It is desirable to place the roll 14 as close as possible to the rolls 12 but the spacing must be sufficient to permit the belt 6 to be placed around the rolls 12 and 14. The distance between the surface of the rolls 12 and 14 may vary considerably but for practical reasons this distance is preferably between one half inch and three inches. However, this distance may be increased or decreased depending upon the size of the rolls and the thickness of the belt or strip passing thereover.

As best shown in Figure 5, each of the self-centering rolls consists of a pair of opposed rotatable rollers 16. Each of the rollers 16 is mounted on ball bearings 18 which are held in place on a bent shaft 20. As shown, the shaft 20 is supported by a plate 22. The shaft 20 is provided with a peripheral tongue portion 24 located between the rollers 16 and received in complementary grooves 26 in the rollers 16. The adjacent ends of the rollers 16 are provided with openings 28 for receiving pins 30 which cause the rollers to rotate in the same direction and at the same angular velocity. The rollers 16 are provided with raised flanges 32 and 34. The flange 32 is provided by means of an end member 36 which is fastened to the adjacent roller 16 by means of cap screws 38. The member 36 also acts as a cap to retain the bearing 18 in position on the shaft 20. The flange 34 is provided by means of a somewhat similar cap 40 which is fastened to the other roller 16 by means of cap screws 42. The cap 40 retains the adjacent roller bearing 18 in position and has a tongue portion 44 which is received in a groove 46 of a collar 48 fastened to the shaft 20. The roll shaft 20 is rotated in the supporting plate 22 so the periphery of the rollers 16 of each roll will be closest together at about the point where the belt 6 leaves the roll. It is then locked in place by means of a screw 50. In this position the rollers 16 will rotate about the shaft 20 with their axes of rotation intersecting at a point between the rollers and diverging away from the direction of approach of the belt 6. Each of the rollers 16 increases in diameter from the flange 32 toward its inner end. The diameters of the inner ends of the rollers 16 are preferably at least as great and as shown are slightly greater than the outside diameter of the flanges 32. The height of the shoulder 52 between the main portion of roller 16 and the flange 32 is preferably approximately equal to the thickness of the abrasive belt 6. The distance between the flanges 34 is equal to or slightly greater than the width of the belt 6. The roll 14 is provided with a supporting surface 54 having a width less than the width of the belt 6. The self-centering rolls 12 need not have the exact construction shown but may be of the type shown in my above mentioned Patent No. 2,593,157 or in Figure 2 of my above mentioned copending application. Also for lower speeds the self-centering rolls 12 may be of the type shown in my above mentioned Patent No. 2,593,158. In the latter case flanges similar to the flanges 32 are provided on the rolls. In each of my above mentioned patents the automatic

centering roll includes a pair of axially opposed roll sections and means for causing each section to rotate at the same angular velocity, the peripheries of said sections being so arranged with respect to each other that forces exerted on the object being moved have a component from the object engaging surface of each section directed axially toward the adjacent ends of the sections.

The operation of the abrasive machine shown in Figures 1 and 2 is essentially the same as that shown in my above mentioned copending application except that the centering effect of the roll assembly 10 enables the machine to operate with greater accuracy under severe lateral distortion of the belt at the dies. The roll assembly can also be used to center strips or strip like material other than the abrasive belt shown in Figures 1 and 2.

While several embodiments of my invention have been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. A roll assembly for automatically centering a moving strip comprising a pair of spaced apart self-centering rolls around a substantial arc of which the strip passes, each of said self-centering rolls including a pair of axially opposed roll sections and means for causing said sections to rotate at the same angular velocity, the peripheries of said sections being so arranged with respect to each other that forces exerted on the object being moved have a component from the object engaging surface of each section directed axially toward the adjacent ends of the sections, each of said self-centering rolls having a raised flange thereon adjacent each of its ends, the distance between the flanges on each roll being at least as great as the width of the strip, and a roll mounted between said self-centering rolls with its axis substantially parallel to the axes of said self-centering rolls, the strip supporting surface of said last named roll being of less width than the width of the strip passing thereover.

2. An abrading machine comprising an endless abrasive belt, pulleys for supporting and rotating said belt, a die bearing against said belt at the position where an object is being ground, and a roll assembly adjacent said die on the entry side thereof; said roll assembly comprising a pair of spaced apart self-centering rolls around a substantial arc of which the belt passes, each of said self-centering rolls having a raised flange thereon adjacent each of its ends, the distance between the flanges on each roll being at least as great as the width of the belt, and a roll mounted between said self-centering rolls with its axis substantially parallel to the axes of said self-centering rolls, the belt supporting surface of said last named roll being of less width than the width of the belt passing thereover.

3. An abrading machine according to claim 2 in which each of said self-centering rolls comprises a pair of opposed rotatable rollers, the axes of rotation of said rollers under load intersecting at a point between the rollers and diverging away from the direction of approach of the belt, each of said rollers increasing in diameter from the flange thereon toward its inner end, and means for positively causing said rollers to rotate in the same direction and at the same angular velocity.

4. An abrading machine according to claim 2 in which each of said self-centering rolls comprises a pair of opposed rotatable rollers, a bent shaft for rotatably supporting said rollers, the axes of rotation of said rollers on said shaft intersecting at a point between the rollers and diverging away from the direction of approach of the belt, each of said rollers increasing in diameter from the flange thereon toward its inner end, and means for positively causing said rollers to rotate in the same direction and at the same angular velocity.

5. An abrading machine comprising an endless abrasive belt, pulleys for supporting and rotating said belt, a die bearing against said belt at the position where an object is being ground, and a pair of roll assemblies adjacent said die one on each side thereof; each of said

roll assemblies comprising a pair of spaced apart self-centering rolls around a substantial arc of which the belt passes, each of said self-centering rolls having a raised flange thereon adjacent each of its ends, the distance between the flanges on each roll being at least as great as the width of the belt, and a roll mounted between said self-centering rolls with its axis substantially parallel to the axes of said self-centering rolls, the belt supporting surface of said last named roll being of less width than the width of the belt passing thereover.

6. An abrading machine according to claim 5 in which each of said self-centering rolls comprises a pair of opposed rotatable rollers, the axes of rotation of said rollers under load intersecting at a point between the rollers and diverging away from the direction of approach of the belt, each of said rollers increasing in diameter from the flange thereon toward its inner end, and means for positively causing said rollers to rotate in the same direction and at the same angular velocity.

7. An abrading machine according to claim 5 in which each of said self-centering rolls comprises a pair of opposed rotatable rollers, a bent shaft for rotatably supporting said rollers, the axes of rotation of said rollers on said shaft intersecting at a point between the rollers and diverging away from the direction of approach of the belt, each of said rollers increasing in diameter from the flange thereon toward its inner end, and means for positively causing said rollers to rotate in the same direction and at the same angular velocity.

8. A roll assembly for automatically centering a moving strip comprising a pair of spaced apart self-centering rolls around a substantial arc of which the strip passes, each of said self-centering rolls having a raised flange thereon adjacent each of its ends, the distance between the flanges on each roll being at least as great as the width of the strip, and a roll mounted between said self-centering rolls with its axis substantially parallel to the axes of said self-centering rolls, the strip supporting surface of said last named roll being of less width than the width of the strip passing thereover; each of said self-centering rolls including a pair of opposed rotatable rollers, the axes of rotation of said rollers under load intersecting at a point between the rollers and diverging away from the direction of approach of the strip, each of said rollers increasing in diameter from the flange thereon toward its inner end, and means for positively causing said rollers to rotate in the same direction and at the same angular velocity.

9. A roll assembly for automatically centering a moving strip comprising a pair of spaced apart self-centering rolls around a substantial arc of which the strip passes, each of said self-centering rolls having a raised flange thereon adjacent each of its ends, the distance between the flanges on each roll being at least as great as the width of the strip, and a roll mounted between said self-centering rolls with its axis substantially parallel to the axes of said self-centering rolls, the strip supporting surface of said last named roll being of less width than the width of the strip passing thereover; each of said self-centering rolls including a pair of opposed rotatable rollers, a bent shaft for rotatably supporting said rollers, the axes of rotation of said rollers on said shaft intersecting at a point between the rollers and diverging away from the direction of approach of the strip, each of said rollers increasing in diameter from the flange thereon toward its inner end, and means for positively causing said rollers to rotate in the same direction and at the same angular velocity.

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