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3,022,611

CONTOUR GRINDING MACHINE

Filed March 11, 1959

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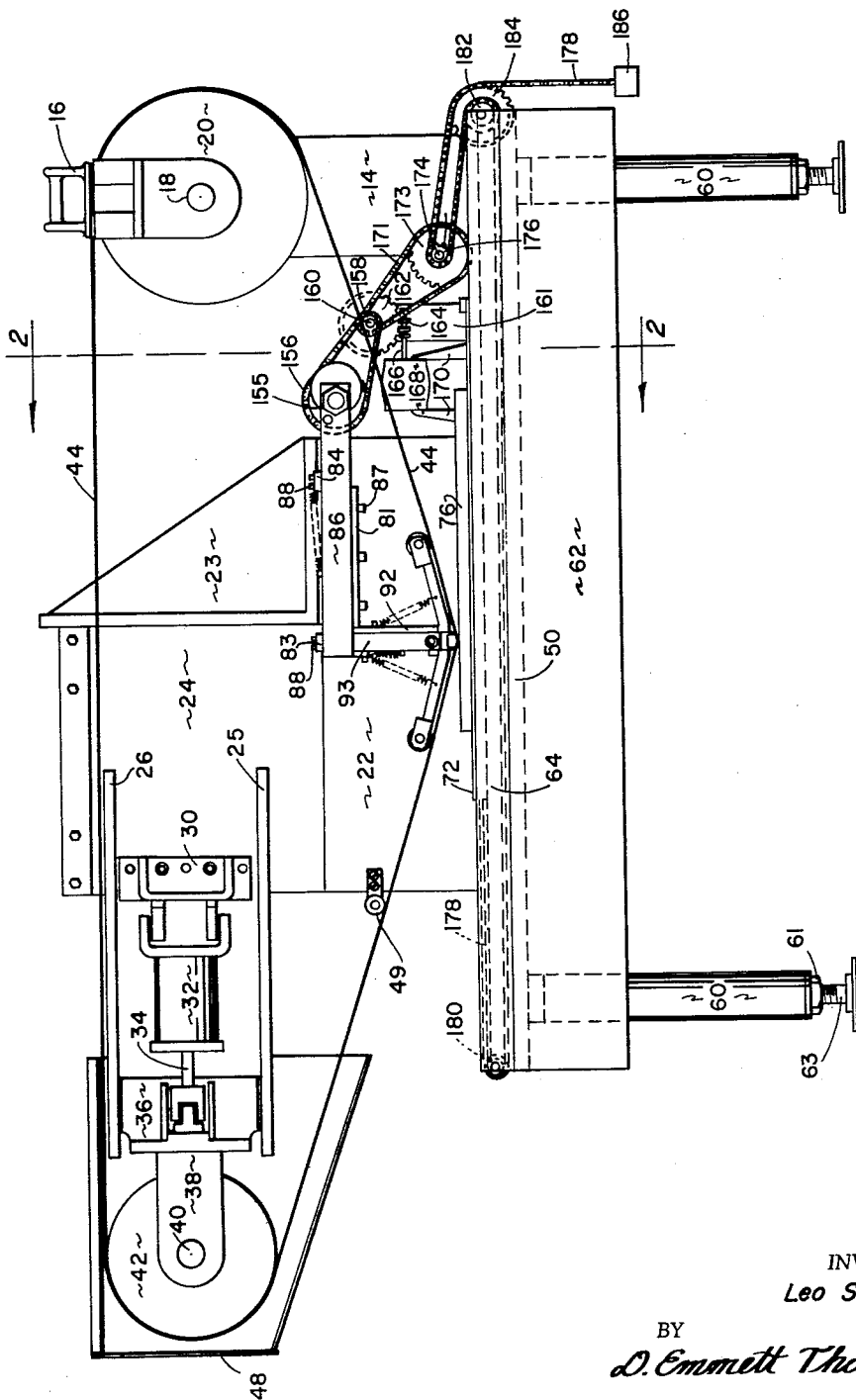


FIG. 1

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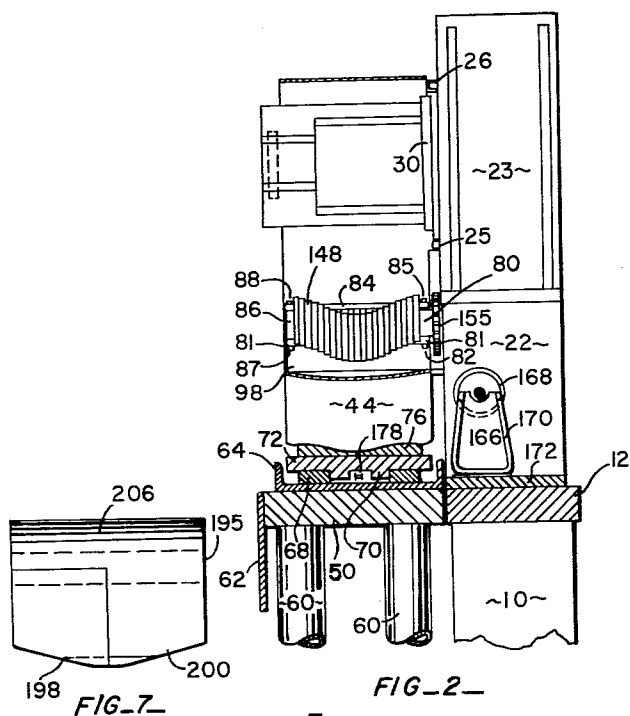
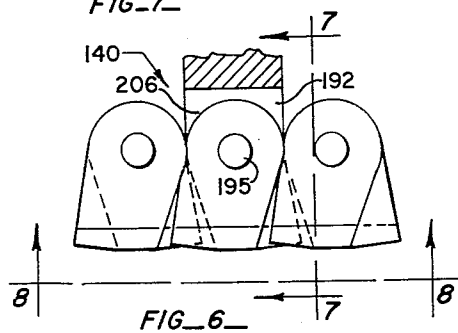
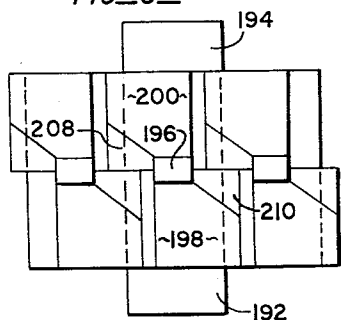
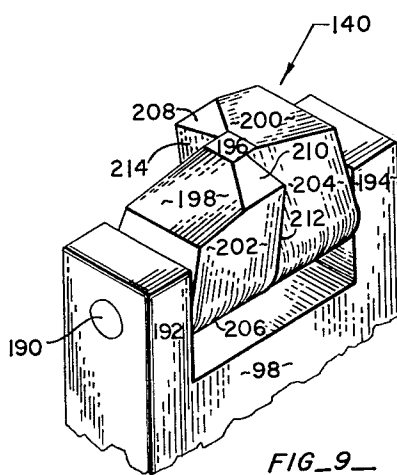
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3 Sheets-Sheet 2



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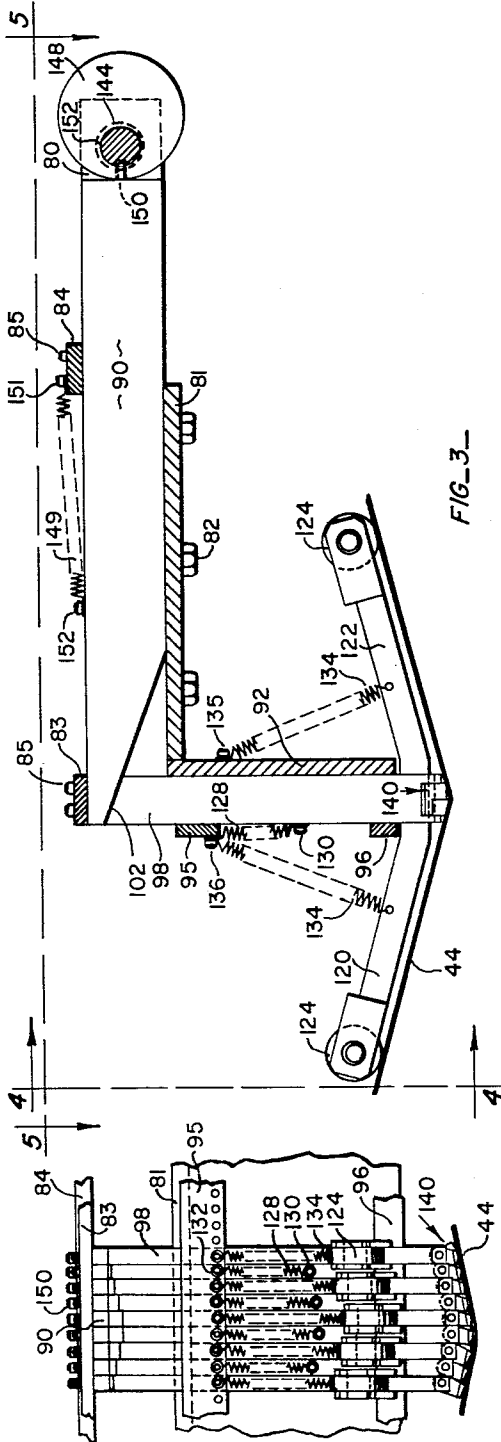
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3,022,611

CONTOUR GRINDING MACHINE

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This invention relates to and has as an object a new and improved apparatus for imparting a contoured backing surface to a belt grinding machine utilizing abrasive or other type belts.

More particularly, this invention has as an object new and improved apparatus for imparting a variable contour back-up surface for the belt of a belt grinding machine in order to grind a variable contour on the surface of a work piece passed through the belt grinding machine.

The invention consists in the novel features and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawings in which like characters designate corresponding parts in all the views.

In the drawings—

FIGURE 1 is a side elevational view of a machine embodying the invention.

FIGURE 2 is a cross-sectional view of a portion of the machine shown in FIGURE 1.

FIGURE 3 is a side elevational view of a portion of the machine shown in FIGURE 1.

FIGURE 4 is a view taken looking in the direction of the arrows of line 4-4 in FIGURE 3.

FIGURE 5 is a view taken looking in the direction of the arrows of line 5-5 in FIGURE 3.

FIGURE 6 is a side elevational view of a detail of the invention.

FIGURE 7 is a view taken looking in the direction of the arrows of line 7-7 in FIGURE 6.

FIGURE 8 is a view taken looking in the direction of the arrows of line 8-8 in FIGURE 6, and

FIGURE 9 is a fragmentary perspective view of a portion of the invention.

In the embodiment shown in the drawings, the grinding machine comprises a stand 10, see FIGURE 2, on which a top plate 12 is mounted. At one end of the top plate 12, an upstanding arm 14 is mounted and has a bracket 16 mounted at its upper end which carries the shaft 18 of the driving roll 20. Suitable means (not shown) for driving the roll 20 may be mounted on the outer side of the upstanding arm 14.

Mounted centrally of the plate 12 is an upstanding box-like column or base 22 on which there is secured an angle plate bracket 23. A vertically disposed support plate 24 is positioned on the column 22 and affixed to the angle bracket 23. A pair of rails 25, 26 are fixed to the support plate 24 and extend outwardly therefrom. Adjacent the end of the plate 24 is a bracket 30 carrying a cylinder 32. The outer end of the rod 34 of the cylinder 32 is provided with a slide member 36 which moves between the rails 25 and 26 and carries a yoke member 38. The outer ends of the arms of the yoke member 38 are apertured to receive the shaft 40 of the idler roll 42. The cylinder 32 may be controlled by any suitable means whereby to move the idler roll 42 toward or from the roll 20 in order to adjust the tension of the abrasive belt 44 carried by the drive roll 20 and the idler roll 42. A dust guard 48 has been shown as being mounted on the outer ends of the rails 25 and 26. As best seen in FIGURE 1, a conventional belt spreader roll 49 is mounted by means of a bracket, or the like, on the base 22 in engagement with the lower run of the belt 44. It

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is understood that a spreader bar may be used in place of the spreader roll if desired.

Adjacent the stand 10 is a work supporting table 50 mounted on a plurality of upstanding legs 60 (see FIGURES 1 and 2). The outer end or side of the table 50 is provided with a depending guard plate 62. A channel-shaped bed 64 is mounted on the top of table 50. A pair of rails 68 are mounted in the bed 64 and cooperate with a pair of depending lugs 70 formed on a work supporting table 72 to guide table 72 for movement forwardly and rearwardly on the bed 64.

As shown in FIGURE 2, a work piece 76 is supported on the table 72 and engages the lower run of the belt 44. Referring to FIGURE 1, it will be seen that the lower ends of the legs 60 are mounted by means of a nut 61 on threaded feet 63 whereby the entire bed 64 and work supporting table 72 may be adjusted vertically to receive work pieces 76 of varying thickness. The machine thus far described is conventional and comprises no part of the invention.

Applicant's invention is directed to the apparatus for imparting a variable contour back-up surface to the lower run of the grinding belt 44. Referring to FIGURES 2 and 3, the means for imparting the variable contour backing surface to the belt includes a bar 80 fixedly secured to the face side of the column 22 and extending toward the forward side of the machine intermediate the upper and lower runs of the belt 44. A plate 81 is attached to the lower edge of the bar 80, as by screws 82, and a pair of plates 83, 84 are attached at their inner ends to the upper edge of the bar 80, as by screws 85. An outer bar 86 is mounted between the outer edge of the lower plate 81, as by screws 87, and the outer ends of the bars 83, 84, as by screws 88.

A plurality of cam bars 90 are supported between the bottom plate 81 and the upper plates 83, 84 and are slidably mounted for individual movement in a direction lengthwise of the belt 44, the series of cam bars 90 being confined between the bars 80 and 86. The lower plate 81 is formed with a depending flange plate 92. Each of the bars 80, 86 is formed with a depending portion 93 positioned along the end portions of the flange 92 to which they are affixed. Guide plates 95, 96 are secured at their ends to the depending portions 93 of the bars 80, 86 and form in conjunction with the flange plate 92, means for guiding a plurality of contour forming members or fingers 98. The upper ends of the fingers 98 are positioned below the ends of the cam bars 90 and the contacting surfaces of the bars and fingers are formed with complementary inclined cam surfaces, as shown at 102, FIGURE 3, whereby upon movement to the left, FIGURE 3, of the bars 90 the fingers 102 are urged downwardly.

As best seen in FIGURES 3, 4 and 5, alternate ones of the fingers 98 have affixed to the forward and rearward edges of their lower ends outwardly extending belt guiding members 120 and 122. Mounted on the outer ends of the members 120 and 122 are belt engaging and guiding rollers 124 which serve to guide the belt 44 to and past the lower ends of the fingers 98.

The fingers 98 are normally yieldably urged to an upward position in the following manner. Tension springs 128 are affixed at like ends to alternate ones of the fingers 98 by means of bolts 130 and are affixed at their opposite ends to plate 95 by means of bolts 132. The remaining alternate fingers 98, on which the members 120 and 122 are fixedly mounted, are connected to the plate 95 by means of tension springs 134 connected at like ends to the members 120 and 122 and at their opposite ends to the plate 95 by bolts 135 and 136 whereby the springs 134 and 128 serve to urge the fingers 98 toward an upward position. As will be obvious, other suitable means

may be utilized to effect return of the fingers 98 to an upward position in engagement with the sloping surface of the bars 90, and in a like manner other suitable means may be utilized to urge the bars 90 rearwardly.

Mounted at the lower end of each of the fingers 98 is a belt engaging member 140, to be hereafter described. As will be obvious, the belt 44 passes over the idler roll 42 from the drive roll 20 and is guided to and past the belt engaging members 140 by means of the rollers 124. The contour of the back-up surface provided by the belt engaging members 140 is varied in the manner to be next described.

A shaft 144 is journaled in the rear end portions of the bars 80, 86. A plurality of cams 148 are mounted on the shaft 144 there being a cam for engagement with each of the cam bars 90. The cams 148 are mounted on the shaft for circumferential adjustment by means of set screws 150. The relative position of the cams 148 determines the relative position of the cam bars 90 which, in turn, determines the relative position of the series of contour forming members 98. By means of the set screws 150, the cams 148 may be assembled on the shaft 144 to effect a desired configuration or contour across the lower ends of the members 98 at any given position of the shaft 144 and as the shaft is rotated the contour established by the members 98 changes to effect a change in the configuration of the abrasive belt 44.

In other words, due to the engagement between the sloping cam surfaces 102 on the bars 90 and the fingers 98, the movement imparted to the bars 90 by the cams 148 is translated to move the fingers 98 transversely to the movement of the bars 90. Consequently, a contour, as for example as seen in FIGURES 2 and 4, is imparted to the fingers 98 and the belt engaging members 140 to provide a countoured back-up surface to the belt 44. The cam bars 90 are maintained against the periphery of the cams 148 by tension springs 149, like ends of which are affixed to the cam bars 90 by screws 152, the opposite ends being secured to the cross bar 84, as by bolts 151. The contour fingers 98 are urged upwardly against the inclined cam end surfaces of the bars 90 by the springs 128 and 134 as previously described, whereby the contour backing for the belt 44 is maintained as determined by the cam group 148.

While in the embodiment shown in the drawings the means for effecting and varying the contour back-up surface for the belt 44 is shown to be a plurality of cams 148, it is to be understood that this means may take any suitable form such as hydraulic or pneumatic cylinder connections, or so-called tape operated tracer controls. Also, it is to be understood that by means of any of such controls any desired contour may be imparted to the belt engaging surface of the work piece. For example, with the cam control shown in the drawings, for each revolution of the shaft 144, a repeating contour will be imparted to the belt 44. However, by means of dissimilar cams 148 or hydraulic or pneumatic cylinders, or tracer controls, a single non-repeating contour may be imparted to the work piece.

In the finishing of certain work pieces which have a non-planar surface in a direction lengthwise of the work piece, as well as transversely thereof, it is necessary to change the contour of the abrading belt during advancement of the work piece under the belt. This is accomplished in my machine by rotating the cam shaft 144 during the advancement of the work piece beneath the contour members 98 and in timed relation with the movement of the work piece. To accomplish this feature, a sprocket 155 is affixed to the inner end of the cam shaft 144. A chain 156 is trained over the sprocket and a sprocket 158 mounted on a shaft 160 journaled in suitable bearings in a bracket 161 mounted on a plate 172. A worm gear 162 is secured to the shaft 160 and arranged in mesh with a worm 164 mounted on the output shaft 166 of a motor 168 carried by a bracket 170 also sup-

ported by the plate 172. As will be obvious, when the motor 168 is energized to rotate the shaft 166, the shaft 144 will be rotated by virtue of the worm 164, gear 162, shaft 160, chain 156 and sprocket 155.

A second sprocket, not shown, is mounted on the shaft 160 between the sprocket 158 and gear 162, and is connected by means of an endless chain 171 to a sprocket 173. The sprocket 173 is mounted on a shaft 174 supported at its inner end on the upstanding arm 14, and a second sprocket 176 is supported on the outer end of the shaft 174. Chain 178 is connected at one end to the forward end of table 72, and is trained over an idler sprocket 180 mounted at the forward end of the platform 50. The chain 178 passes between the underside of the table 72 and the channel bed 64 between the lugs 70 and the rails 68 and is trained over an idler sprocket 182 mounted at the rearward end of the platform 50. The chain 178 passes from the idler sprocket 182 over the sprocket 176 and from thence outwardly over a second idler sprocket 184 also mounted on the end of the platform 50. A weight 186 is connected to the end of the chain 178 and serves to urge the chain downwardly and maintain tension in the chain 178 over the sprockets 184, 176, 182 and 180. By reason of the connections just described, as the motor 168 is energized to rotate the cams 148 in the manner previously described, the table 72 is advanced along the bed 64 in timed relation to the rotation of cams 148 so as to move the work piece 76 under the belt 44 and the variable contour back-up surface provided by the fingers 98 and belt engaging members 140, in order to grind the surface of the work piece 76 with the variable contour selected by the predetermined setting of the cams 148 on the shaft 144.

While in the embodiment just described and shown in the drawings, chain drive means have been illustrated to interconnect the work table 72 with the timing means for imparting the variable contour back-up surface to the belt 44, it is to be understood that any suitable means may be utilized to advance the table 72 and work piece 76 under the belt 44 in timed relation to the means for imparting the variable contour back-up surface to the belt 44.

Referring now to FIGURES 6, 7 and 8 and 9, the belt engaging members, generally indicated at 140, will now be described in detail. Referring to FIGURE 9, the lower end of each of the fingers 98 is bifurcated and the belt engaging members 140 are mounted between the leg portions 192, 194 of the bifurcated end portion on a pin 190, the members 140 being free for limited rotation about the axis of pins 190. The members 140 are formed with apertures 195 to receive the pins 190. The pins 190 extend in a direction lengthwise of the belt 44. The members 140 are formed with a flat belt engaging surface 196 formed at the apex of a pair of sloping convergent surfaces 198 and 200. The surface 196 extends in a direction normal to pin 190 or transversely of the belt 44. The surfaces 198 and 200 are formed on the ends of a pair of angularly offset portions 202 and 204 which merge into a semi-cylindrical portion 206, which is provided with the aperture 195 to receive the pin 190. The edge portions of the convergent surfaces 198 and 200 are formed with a slope 208 and 210 which converge into the flat surface 196.

The offset between the portions 202 and 204 forms overlapping surfaces 212 and 214 which serve to interlock the member 140 with the next adjacent member 140. FIGURE 7 is an orthographic view of a single belt engaging member 140 as described in connection with FIGURE 9, and in FIGURES 6 and 8 three members 140 are shown in interfitting or interlocking position. As best seen in FIGURE 8, the surfaces 196, 208 and 210 serve to provide a continuous back-up surface which extends transversely across the belt 44 which is guided to and past the surfaces 196, 208 and 210 by the convergent surfaces 198 and 200. As the fingers 98 are reciprocated,

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the members 140 will also be moved but the overlapping surfaces 212 and 214 on the members 140 are interlocked with the adjacent members 140 so as to maintain a continuous surface, provided by the surfaces 196, 208 and 210, extending transversely across the belt 44 to the direction of travel of the belt. Thus, it will be seen that, while the contour back-up surface provided by the members 140 may be varied, the surface will be continuous by reason of the novel formation of the belt engaging members 140. Further, by reason of the tapered or sloped surface 208 and 210 and the inner lock between adjacent ones of the member 140, a smooth continuous surface will engage the belt 44 thereby eliminating any sharp corners or edges which would cause destruction of the belt 44.

What I claim is:

1. A contour grinding machine, comprising, a drive roll, an idler roll, an abrasive belt mounted on said rolls, means for imparting a variable transverse contour to the grinding surface of said belt, at a work station including a plurality of individually selectively movable belt engaging members arranged transversely of the belt adjacent to the work station, and means separate from any work-piece in the machine for moving said members individually selective distances toward the grinding run of the belt and holding the members in engagement with the grinding run of said belt to provide a variable contour back-up surface imparting a comparable variable transverse contour to the belt.

2. A machine as defined in claim 1, wherein said members are arranged transversely of the belt with adjacent members overlapping fashion transversely of the belt in order to provide a substantially continuous smooth backup surface extending transversely across the reverse side of the grinding run of said belt.

3. In a contour grinding machine having an abrasive belt, an idler roll and a drive roll, means for imparting a variable contour to the grinding surface of said belt, said means comprising a frame, a plurality of fingers carried by said frame, between the runs of said belt and mounted for reciprocation in said frame, said fingers carrying inter-fitting belt engaging members, a plurality of actuating arms mounted for reciprocation in said frame, said arms being transversely disposed to said fingers and being formed at their ends with angular surfaces, the upper ends of said fingers being formed with complementary angular surfaces abutting said angular surfaces on said arms whereby movement imparted to said arms is translated to said fingers, adjustable means for moving said arms to impart a contour to said belt engaging members and means interconnecting said adjustable means and a movable table supporting a work piece whereby to contour grind said work piece as said work piece is advanced under said belt and belt engaging members.

4. A contour grinding machine, comprising, a drive roll, an idler roll, an abrasive belt passing around said rolls, means for imparting a variable transverse contour to the grinding surface of the belt at a work station including a plurality of belt engaging members arranged transversely of the belt between the runs thereof adjacent the work station, means mounting the belt engaging members for individual reciprocable movement toward and away from the grinding run of the belt, and individual cam means engageable with the belt engaging members for moving the latter individually selective distances toward the grinding run of the belt to provide a variable contour back-up surface imparting a comparable variable transverse contour to the belt.

5. A contour grinding machine as defined in claim 4, wherein the cam means comprises, cam surfaces on the belt engaging members, a plurality of individual cam bars slidable transversely of the belt engaging members and having cam surfaces engageable respectively with the cam surfaces on the belt engaging members to move

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the latter toward the grinding run of the belt, and separate means for actuating the cam bars selectively.

6. A contour grinding machine as defined in claim 5, wherein the last recited means comprises, a plurality of separate rotary cams engageable respectively with the cam bars for moving the latter selectively, and a single means for rotating the rotary cams.

7. A contour grinding machine, comprising, a drive roll, an idler roll, an abrasive belt passing around said rolls, a work support mounted beneath the lower run of the belt, means for moving the work support longitudinally of the belt, means mounted between the runs of the belt for imparting a variable transverse contour to the grinding surface of the belt adjacent the work support including a plurality of individually selectively movable belt engaging members arranged transversely of the belt adjacent the work station, separate means for moving said members individually selective distances into engagement with the lower run of the belt to provide a variable contour back-up surface imparting a comparable variable transverse contour to the belt, and means interconnecting the last recited means and the work support moving means to raise and lower the belt engaging members in timed relationship to movement of the work support.

8. A contour grinding machine, comprising, a drive roll, an idler roll, an abrasive belt passing around said rolls, a work support mounted beneath the lower run of the belt, means for moving the work support longitudinally of the belt, means for imparting a variable transverse contour to the grinding surface of the belt adjacent the work support including a plurality of belt engaging members arranged transversely of the belt between the runs thereof adjacent the work support, means mounting the belt engaging members for individual reciprocable movement toward and away from the grinding run of the belt, individual cam means engageable with the belt engaging members for moving the latter individually selective distances toward the grinding run of the belt to provide a variable contour back-up surface imparting a comparable variable transverse contour to the belt, a single means for actuating the cam means, and means interconnecting the last recited means and the work support moving means to vary the transverse contour of the belt adjacent the work support in timed relationship to the movement of the work support.

9. A contour grinding machine, comprising, a drive roll, an idler roll, an abrasive belt mounted on said rolls, means for imparting a variable transverse contour to the grinding surface of said belt at a work station including a plurality of individually selectively movable belt engaging members arranged transversely of the belt adjacent the work station, and means for moving said members individually selective distances into engagement with the grinding run of said belt to provide a variable contour back-up surface imparting a comparable variable transverse contour to the belt, each of said members having a compound belt engaging surface comprising a flat portion extending transversely of the length of the belt and portions extending transversely oppositely outwardly from the flat portion and inclined away from the belt.

10. A contour grinding machine as defined in claim 9, wherein the adjacent transversely outwardly extending portions of adjacent members overlap, thereby to provide a substantially continuous belt engaging surface regardless of the relative positions of adjacent members.

11. A contour grinding machine, comprising, a drive roll, an idler roll, an abrasive belt passing around said rolls, means providing a back-up surface for the grinding run of said belt at a work station spaced outwardly from a line extending between the rolls, said means including a plurality of belt engaging members, arranged transversely of the belt between the belt runs and movable toward and away from the grinding run of the belt, each of said members being formed with a compound belt engaging surface comprising a flat portion extending trans-

versely of the direction of belt travel and a pair of convergent portions extending longitudinally of the belt, merging with said flat portion and inclined relative thereto respectively toward the rolls to guide said belt to and from said flat portion.

12. A contour grinding machine as defined in claim 9, wherein each of said belt engaging surfaces also includes a pair of convergent portions extending longitudinally of the belt, merging with said flat portion and inclined respectively toward the rolls to guide said belt to and from said flat portion.

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