Sept. 30, 1941. W. H. NICKERSON, JR 2,257,305

ABRADING MACHINE

Filed Oct. 25, 1939 3 Sheets-Sheet 1

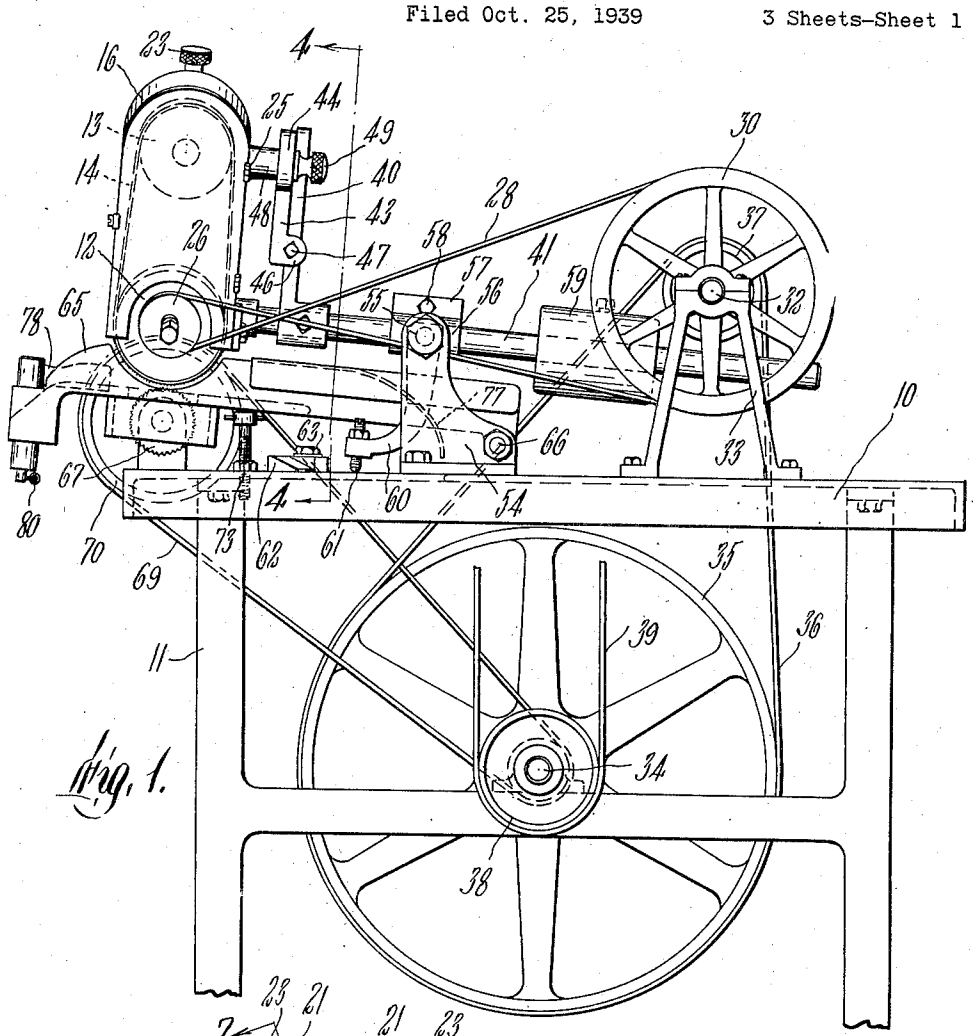


Fig. 1.

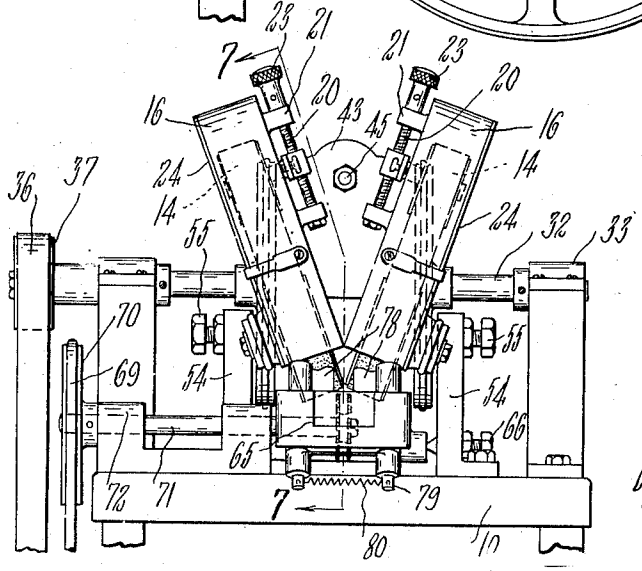


Fig. 2.

Inventor
William H. Nickerson, Jr.
by Wright, Brown, Quinby & May Attys.

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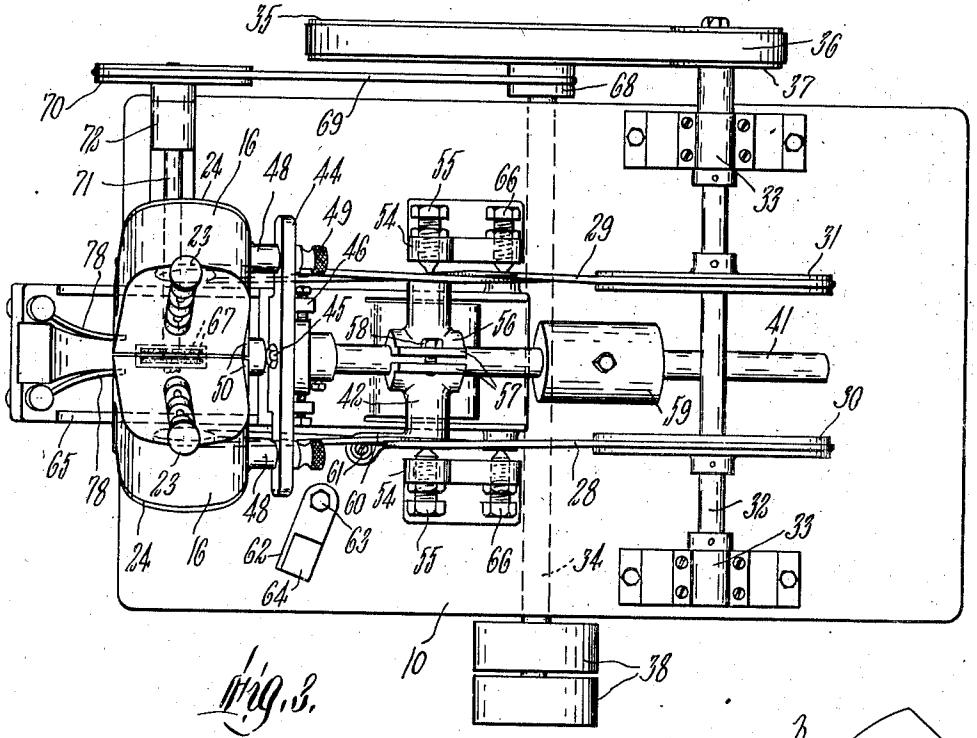


Fig. 3.

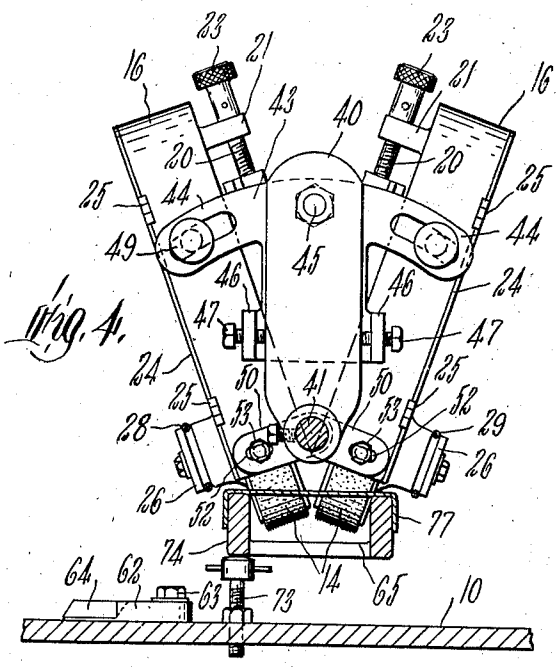


Fig. 4.

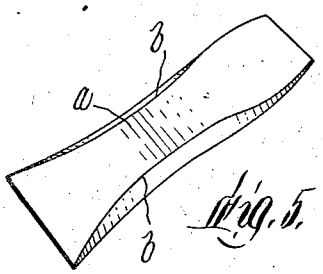


Fig. 5.

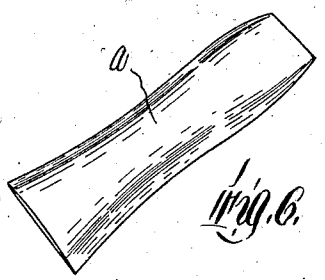


Fig. 6.

Inventor
William H. Nickerson, Jr.
by Wright, Brown, Quinby & May
Attys.

Sept. 30, 1941. W. H. NICKERSON, JR 2,257,305

ABRADING MACHINE

Filed Oct. 25, 1939 3 Sheets-Sheet 3

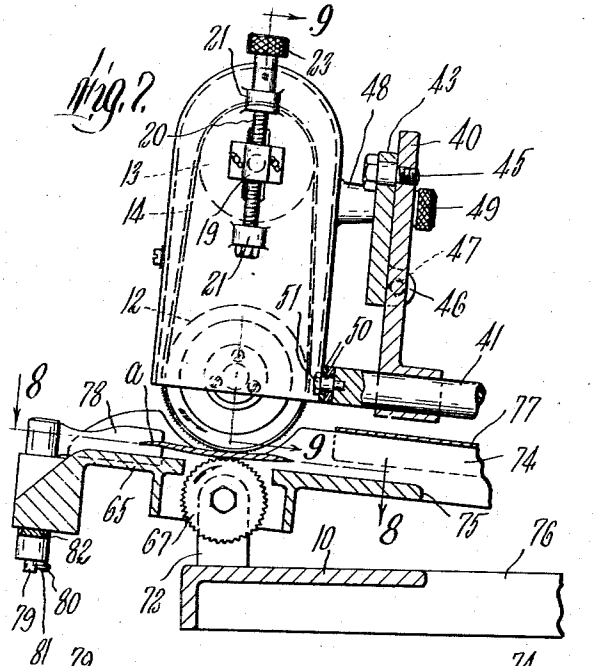


Fig. 7.

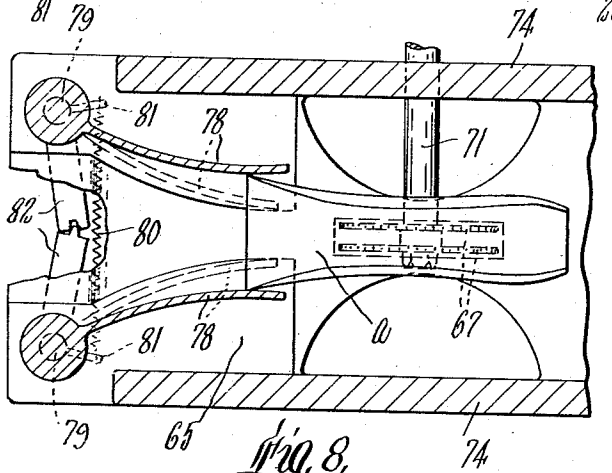


Fig. 8.

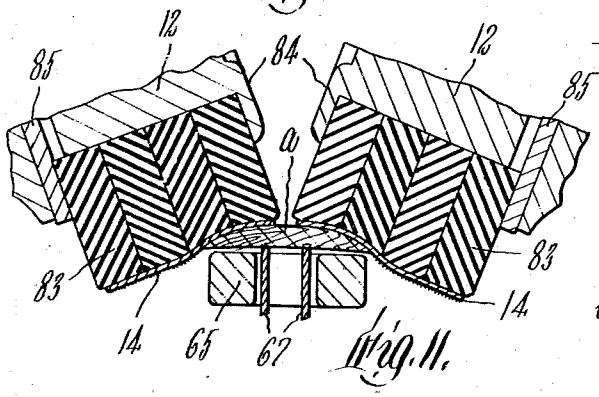


Fig. 11.

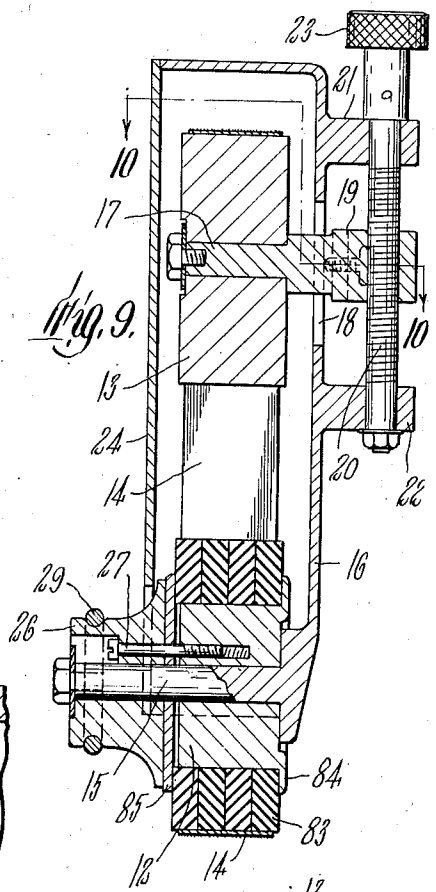


Fig. 9.

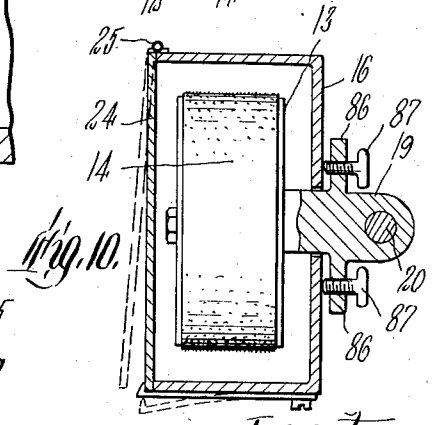


Fig. 10.

Inventor
William H. Nickerson, Jr.
by Wright, Brown, Quinby & May
Attys

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UNITED STATES PATENT OFFICE

2,257,305

ABRADING MACHINE

William H. Nickerson, Jr., Newton, Mass.

Application October 25, 1939, Serial No. 301,117

8 Claims. (Cl. 51—139)

The subject matter of the present invention is a machine for smoothing articles by the abrasive action of sandpaper or similar instrumentalities. In the embodiment herein illustrated the machine is designed for sanding wooden shank stiffeners for shoes. As organized for this purpose the abrasive tools consist of endless bands of sandpaper or the like, each of which is carried around a driving wheel or roll and an adjustable idle or tension roll. There are two such tools which together are adapted to act over substantially the entire outer face of such a shank stiffener, in a manner to round off the sharp angles left in the original manufacture between the outer face and lateral bevels of the article, and also to smooth the entire face.

Important features of the machine are constructions by which the abrasive tools may be adjusted to different angles of bevel in the work pieces, and adjusted otherwise for different longitudinal and transverse curvatures and contours of the work piece; means for adjusting the work supporting table and abrading tools with respect to the feed control means; provisions for easy renewal of sandpaper bands; and other features which will appear from the following detailed description.

It is to be understood that, although the illustrated embodiment of the invention is designed for the particular class of work above mentioned, the principles of the invention are not so limited, and that the scope in which I claim protection for this invention includes all equivalent constructions and combinations adapted for any similar or analogous purpose, whether the articles operated on are wooden shank stiffeners or some specifically different articles. However, for convenience and in the interests of definiteness I will explain the principles of the invention as embodied in the specific machine here shown and applied for the specific purpose of smoothing wooden shank stiffeners.

In the drawings herewith—

Fig. 1 is a side elevation of a shoe shank sanding machine embodying the invention;

Fig. 2 is a front elevation of the machine;

Fig. 3 is a plan view;

Fig. 4 is a sectional elevation taken on line 4—4 of Fig. 1;

Figs. 5 and 6 are perspective views of a wooden shank stiffener for shoes before and after treatment by the machine;

Fig. 7 is a longitudinal section taken on line 7—7 of Fig. 2;

Fig. 8 is a substantially horizontal section taken on line 8—8 of Fig. 7;

Fig. 9 is a vertical section on a larger scale taken on line 9—9 of Fig. 7;

Fig. 10 is a cross section taken on line 10—10 of Fig. 9;

Fig. 11 is a fragmentary vertical section through the tools and work piece at the point of engagement.

Like reference characters designate the same parts wherever they occur in all the figures.

Referring first to Fig. 5, a sample of the type of work piece on which the machine is designed to operate is shown. This is a wooden piece *a* cut with the proper outline and substantially correct thickness for use as a shank stiffener in a shoe. Such shank stiffeners are commonly called "shanks" simply, by their producers and by shoe makers, wherefore that term will be used generally in the further description herein. Such shanks before the final operation of sanding have the correct longitudinal curvature for the type of shoe for which they are designed, have their greatest thickness in mid length, are beveled or chamfered with diminishing thickness at both ends, and their sides are beveled. The manner in which they are cut causes distinct angles, indicated by the reference letter *b*, to be left between the bevels and the middle zone of the shank, the outer surface of which is substantially straight transversely. It is necessary to remove these sharp angles and give a smoothly rounded convex transverse curvature in order to make the shanks suitable to meet the requirements of shoe makers. This finishing effect is the result performed by the machine herein illustrated.

The operating parts of the machine are mounted on a base or frame, here shown as a table 10 having supporting legs or frames 11. The operating tools or units, of which there are two, consist each of two parallel separated rolls 12 and 13 and an endless band 14 of sandpaper or equivalent flexible material having an abrasive outer surface or covering, passed around them. The roll 12 is mounted rotatably on a pivot stud 15 which projects from the rear wall of a tool housing 16, and the roll 13 turns upon a stud 17 which projects through a slot 18 in said wall, from a carrier 19. Such carrier is a nut in threaded engagement with an adjusting screw 20 mounted rotatably in bearing lugs 21 and 22 on the outer side of the back wall. By rotation of the screw, which has a crown or nob 23 on its outer end for that purpose, the idle roll 13

may be shifted so as to adjust the tension of the band.

The back and side walls of the housing embrace all of the abrasive tool except approximately the lower half of the roll 12 and so much of the band as passes around that part of the roll. The housing is completed by a front wall 24 hinged at one edge to one of the side walls, as indicated at 25 in Figs. 1 and 4, so that it serves as a door capable of being opened to permit easy removal of worn bands and substitution of new ones when required. Such housing serves as a holder for the tool.

The roll 12 of each tool is the driving roll and a belt pulley 26 is secured to its outer face by screws 27. Belts 28 and 29 pass around the pulleys of the two tools and also around pulleys 30 and 31 on a countershaft 32 which is supported by bearings 33 on the table. Shaft 32 is rotated from the main shaft 34 by a pulley 35, belt 36 and pulley 37. The main shaft carries a pulley 38 driven by a belt 39 from any suitable source of power.

The two tools or units are assembled with other parts to form a tool head, in an arrangement which enables the portions of the sanding bands passing under the drive rolls 12 to bear on the angles *b, b* of the work piece. The other parts constituting the tool head include a plate 40, a bar 41 (hereinafter referred to as a longitudinal member, and also as a carrier for the tools and tool holders) to which such plate is secured, a swivel 42 holding the bar, and certain connections from the plate and bar to the tool housings, which will now be described in detail. A plate 43 having two oppositely extending slotted arms 44 is connected to the plate 43 by a pivot 45 and provided with lugs 46 loosely embracing the plate 40, in which are mounted set screws 47 arranged to bear on opposite edges of the latter plate. Each of the tool housings 16 has a shouldered stud 48 passing through the slot in one of the arms 44 and carrying a clamp nut 49. The lower part of each housing is connected by a strap link 50 with the bar 41, the two strap links being coupled to the bar by a pivot 51 (Fig. 7) and each strap link being connected to one of the housings by a shouldered stud on the housing passing through a slot 52 in the link and a clamp screw 53 on the stud. By these means the tools are supported with provision for angular adjustment independently of one another. The arms 44 support the weight of the tool units, while the strap links 50 control the location of the working parts of the tool, enabling these parts to be brought together or separated more or less, within limits, according to the width of the work pieces, and to avoid interference when the tools are adjusted with a wide angle between them, or prevent too great separation when brought more nearly to parallelism. Such angular adjustments occur about the axis of the rod 41, thus causing a separation or approach of the working parts of the tools to one another, which can be compensated for by the connections with the strap links 50. In addition, by withdrawing one of the screws 47 and advancing the other, the plate 43 can be turned about its pivot 45, thereby raising one of the tools and simultaneously lowering the other.

The swivel 42 is located between brackets 54 on the main table and pivotally supported thereon by cone pointed screws 55 which may be adjusted to shift the whole assemblage laterally. The middle part of the swivel has a split sleeve portion 56 through which the bar 41 passes and in which it is both rotatable and movable endwise. The sleeve 56 is equipped with flanges 57 and a screw 58 by which it may be contracted to grip the rod in a well known way. Freedom for adjustment permitted by this clamping means enables the whole tool head to be adjusted angularly about the axis of the bar and also to be moved bodily forward and back to accommodate work pieces of different characters. A counterweight 59 is adjustably mounted on a rear extension of the bar 41, such extension being long enough, and the counterweight being heavy enough, to balance any desired proportion of the weight of the tool head. The tool head overhangs the working location and presses by gravity on the work. Any desired pressure therefore may be obtained by suitable adjusting the counterweight. Limitation of the depth of cutting is afforded by an arm 60 in rigid connection with the swivel 42 which carries an adjustable stop screw 61 adapted to bear on the supporting table. By suitable setting of this screw the limit of descent of the tools may be established within a wide range.

A stop abutment 62 is pivoted at 63 to the table, in a position such that it rests on the table top and is movable to bring its beveled top surface 64 beneath the screw 61. This abutment may be used to hold the tool head in a raised position clear of other parts of the machine to facilitate opening the doors of the tool housings and renewing worn abrasive bands. Its beveled face may also be used in conjunction with the screw 61, or in substitution for it, to adjust the lower limit of movement of the tool head.

The work to be sanded is supported when approaching and after leaving the abrading tools by a support 65 which is pivoted to the bracket 54 by cone pointed screws 66 and extends forwardly under and beyond the abrading tool. This support has a table portion on which the work pieces may rest, and in which there is an opening to admit the feed controlling wheels 67. The latter are thin disks provided with sharp edged serrations at their peripheries somewhat similar to saw teeth. For that reason the feed disks are commonly called saws, although their function is not to cut the work pieces but merely to control their rate of travel past the abrading tools. Their serrations are necessarily sharp enough to indent the work pieces in order to overcome the driving force of the abrading tools. The parts of the abrading tools and feed disks which simultaneously engage the work travel in the same direction, as indicated by the arrows in Fig. 7, (although if desired the abrading tools may travel oppositely to the feeding direction), and the feeding disks are controlled by a pulley 68 on the main shaft, a belt 69, and a pulley 70 on shaft 71 which carries the disks. Bearings 72 on the table support the shaft 71.

The work support 65 may be raised and lowered to bring its supporting upper surface into proper relation with the feed disks and abrading tools. For thus adjusting it a screw 73 is mounted on the base table, the head of which screw underlies one of the side bars 74 of the support. The bottom of the work support is interrupted at 75 (Fig. 7) over an opening 76 in the base table, and a deflector 77 is secured to the side bars of the support and inclined downwardly at its rear end, as shown dotted in Fig. 1, so as to

direct the finished article through the opening 76 into a receptacle beneath.

Guides 78 for centering the work pieces in approaching the abrading tools are mounted by pivots 79 in the forward end of the work support and extend rearwardly substantially as shown by Fig. 8. A spring 80 is connected to arms or pins 81 on the pivots to draw the guides together more closely than the width of the work pieces, as shown by dotted lines in Fig. 8. The movements of the two guides are correlated by arms 82 carried by the pivots and each extending to approximately the middle of the space between them. One of the arms 82 has a projection and the other a notch receiving such projection. In effect the arms are gear segments of equal radius.

Figs. 9 and 11 show a preferred form of driving roll for the abrader bands adapted to yield so as to permit extended contact of the flexible bands over transversely curved surfaces on the work pieces. Such roll is made of a solid core, of wood, metal or other suitable material, and disks 83 of yieldable material such as flexible rubber or felt placed on the core and confined between a flange 84 on one end of the core, and a washer 85 backed up by the pulley 26 and pressed tightly against the disks by the screws 27. Owing to the yielding character of such disks, the abrasive bands 14 may conform to changing convex or concave contours of different work pieces. It is within my contemplation, however, to make the drive roll of any other suitable material and construction, and make the guide roll 13 of like or different construction.

The tools are driven with great rapidity. The high speed of their travel has raised problems in alining the rolls 12 and 13 to prevent the endless bands from running off in one direction or the other. One of the features of the invention is a means for adjusting the guide roll, while running, if desired, to insure proper guidance of the band. An embodiment of such means is shown in Figs. 9 and 10, consisting of lugs 86 projecting to opposite sides from the pivot holder 19 and carrying adjusting screws 87 bearing on the rear wall of the housing. By advancing one screw while retracting the other, the pivot 17 may be turned angularly around the tension screw 20 in either direction enough to correct any tendency of the band to creep over one end or the other of the roll.

Many of the principles contained in the machine herein disclosed are applicable in different forms for accomplishing similar effects on shoe shanks and other articles. These principles include a single tool or a combination of two tools adjustable to vary the inclination of the plane of travel with respect to the work, either independently or simultaneously. They include also adjustments of the tool or tools forward and back with respect to the point at which the feed controller engages the work, and adjustment of both the tool or tools and the supporting surface of the work support toward and away from the engaging point of the feed controller. The abrading tools may be furnished with sand or other abrasive of any degree of coarseness or fineness or provided with a surface suitable for polishing rather than cutting. While the construction of the tools of two rolls and an endless band is a valuable feature of the invention, yet other features are not limited to use or combination with tools of this particular construction, and so far as such features are concerned, the driving roll of either tool may be used as, or supplanted by, an abrading or polishing wheel, with or without a covering of sandpaper or the like.

What I claim and desire to protect by Letters Patent is:

1. In a machine of the character set forth, a tool head structure comprising a longitudinal member, a swivel mounted to swing on a substantially horizontal axis transverse to the length of said member, the longitudinal member being connected with the swivel with provision for adjustment relatively thereto in the direction of its length, and also angularly about an axis in the direction of its length, two tool holders supported by said longitudinal member and each including a tool supporting pivot extending transversely to the longitudinal member and at the opposite side thereof from the tool supporting pivot of the other holder, and means for adjusting the tool holders angularly with respect to the longitudinal member about axes extending in the general direction of the length of the latter.

2. A machine for the purpose set forth and analogous purposes comprising a supporting structure, bearings rising from said structure, a swivel pivoted between said bearings on a substantially horizontal axis, a bar passing through said swivel with provision for lengthwise and angular adjustment therein, tool units supported on said bar at opposite sides thereof and including tools having working surfaces arranged to travel in orbits of which the planes are substantially parallel to the length of the bar, and means for adjusting said tool units to vary the angle between the planes of their orbits.

3. In a machine of the character set forth, a supporting structure, a feed disk rotatably supported on said structure to rotate about a substantially horizontal axis, a work support having an opening through which said feed disk extends and having supporting portions in front and rear of the feed disk, mounted on the supporting structure with provisions for adjustment to raise and lower its supporting surface with respect to the circumference of the feed disk, an abrading tool supported over the work support and feed disk with provisions for movement toward and away from the latter adapted to engage the upper surface of a work piece when the under surface thereof is engaged with the feed disk; the work-engaging portion of said tool being of cylindrical formation with the axis of such formation transverse to the direction in which the work is constrained to travel, and means whereby the tool may be adjusted to vary the angle between such axis and the horizontal.

4. In a machine of the character set forth, a supporting structure, a feed disk rotatably supported on said structure to rotate about a substantially horizontal axis, a work support having an opening through which said feed disk extends and having supporting portions in front and rear of the feed disk, mounted on the supporting structure with provisions for adjustment to raise and lower its supporting surface with respect to the circumference of the feed disk, two abrading tools mounted side by side over said work support in position to engage simultaneously the upper side of a work piece when passing over the feed disk, the engaging portions of the tools being of cylindrical formation with their axes of curvature transverse to the prescribed path of travel of the work and inclined to the horizontal, the inclination of one tool axis being

of opposite hand to the inclination of the axis of the other tool.

5. An abrading tool as set forth in claim 4, including means whereby the tools may be adjusted to alter the inclinations of their respective axes relative to the horizontal.

6. In a machine of the character described, a tool assemblage consisting of a bar, a plate secured to said bar, a second plate connected to the first named plate and having slotted arms extending to opposite sides of its connection with the first plate, housings connected pivotally to the bar and each having a stud adjustably clamped in one of said slotted arms, whereby the housings may be adjusted to make different inclinations with one another, and abrading tools contained in the respective housings and each including a rotatable member mounted to turn about an axis transverse to the axis of adjustment of the housing in which it is contained.

7. In a machine of the character described, a tool holder carrier, a swivel adapted to be mounted pivotally to swing about an axis, to which said carrier is secured with provision for adjustment in a line transverse to said axis, a plurality of tool holders mounted on said carrier side by side with provision for adjustment angularly about an axis extending in the line of adjustment of the carrier, whereby said holders may be located nearly parallel to one another or at acute angles of greater and less magnitude, and tools mounted in said holders having abrasive surfaces arranged to travel in orbits of which the planes are substantially parallel to the axis around which the holders are so adjustable.

8. A machine of the character described comprising a supporting structure, a tool head carrier including a swivel supported by said structure to turn about a substantially horizontal axis, said carrier extending in a generally horizontal direction from the swivel transversely to the axis thereof, a tool unit mounted on the carrier at a distance from the swivel axis, an arm extending from the swivel toward the supporting structure, and a shiftable abutment provided with a wedge portion placeable and insertable to a greater or less degree between the foot portion of said arm and the supporting structure whereby to regulate the height of the tool unit.

WILLIAM H. NICKERSON, JR.