

Feb. 23, 1943.

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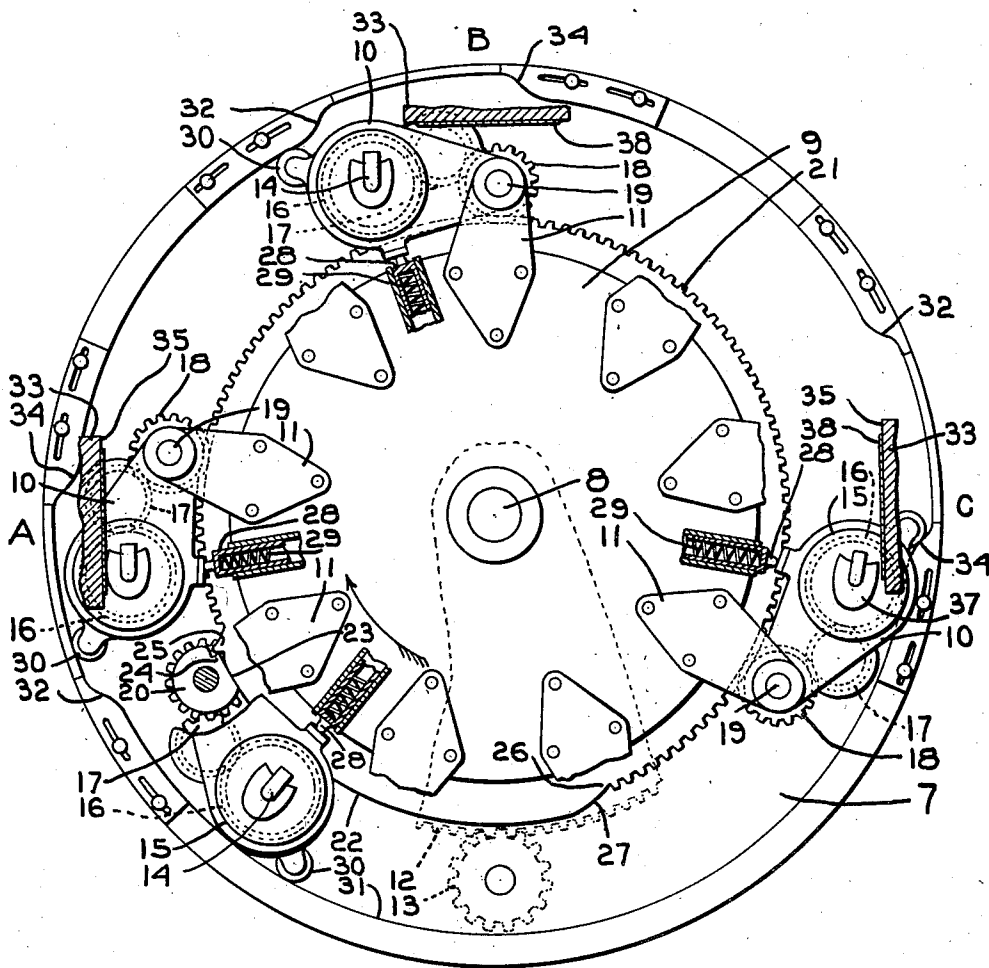
2,312,028

METHOD OF SMOOTHING SURFACES

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3 Sheets-Sheet 1

Fig. 1.



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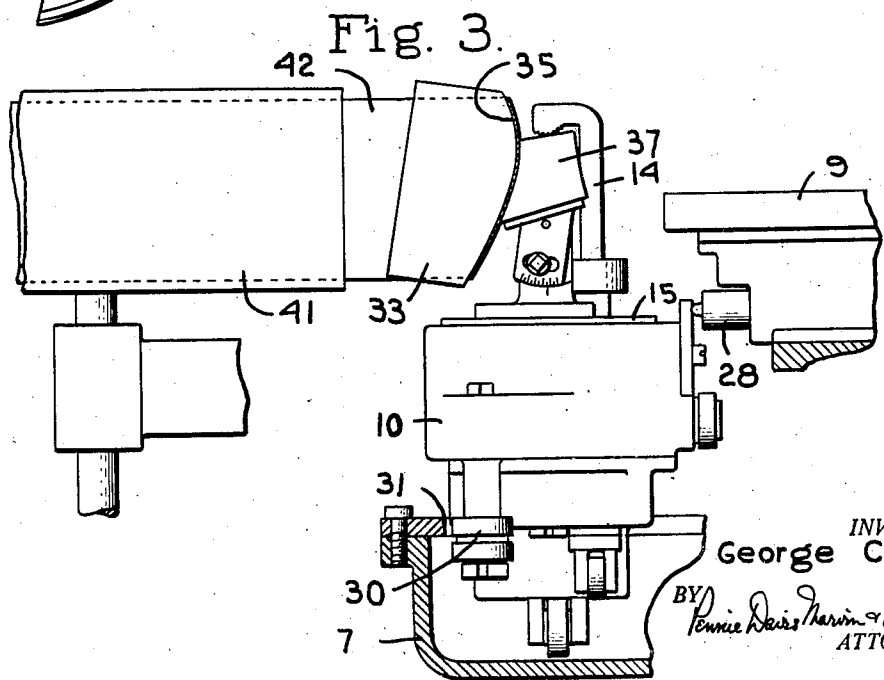
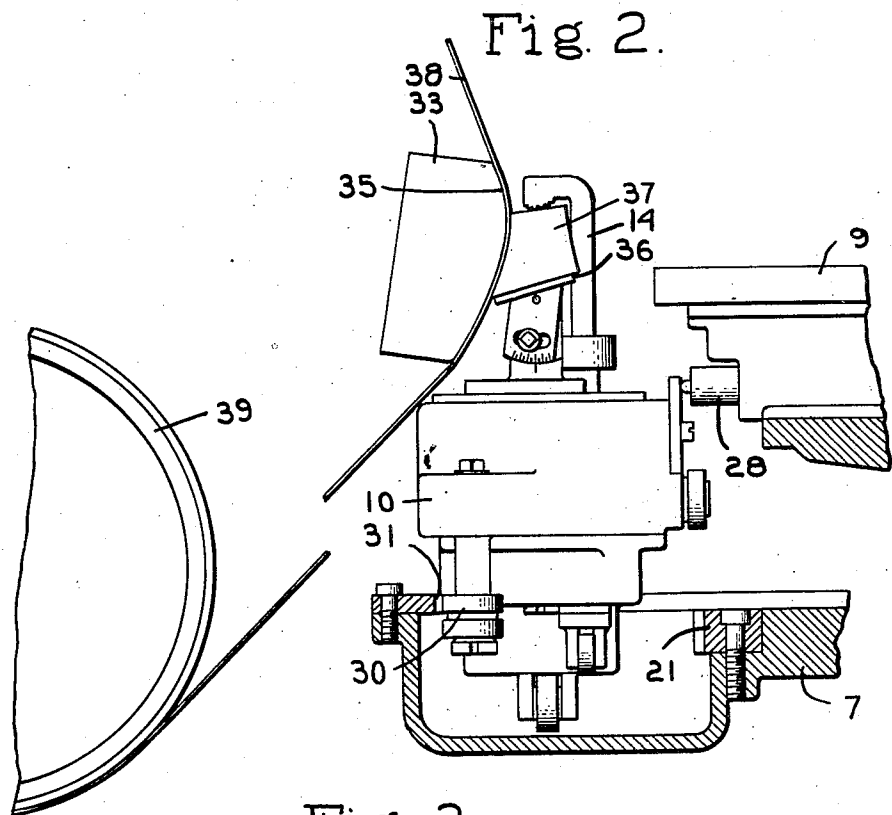
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3 Sheets-Sheet 2



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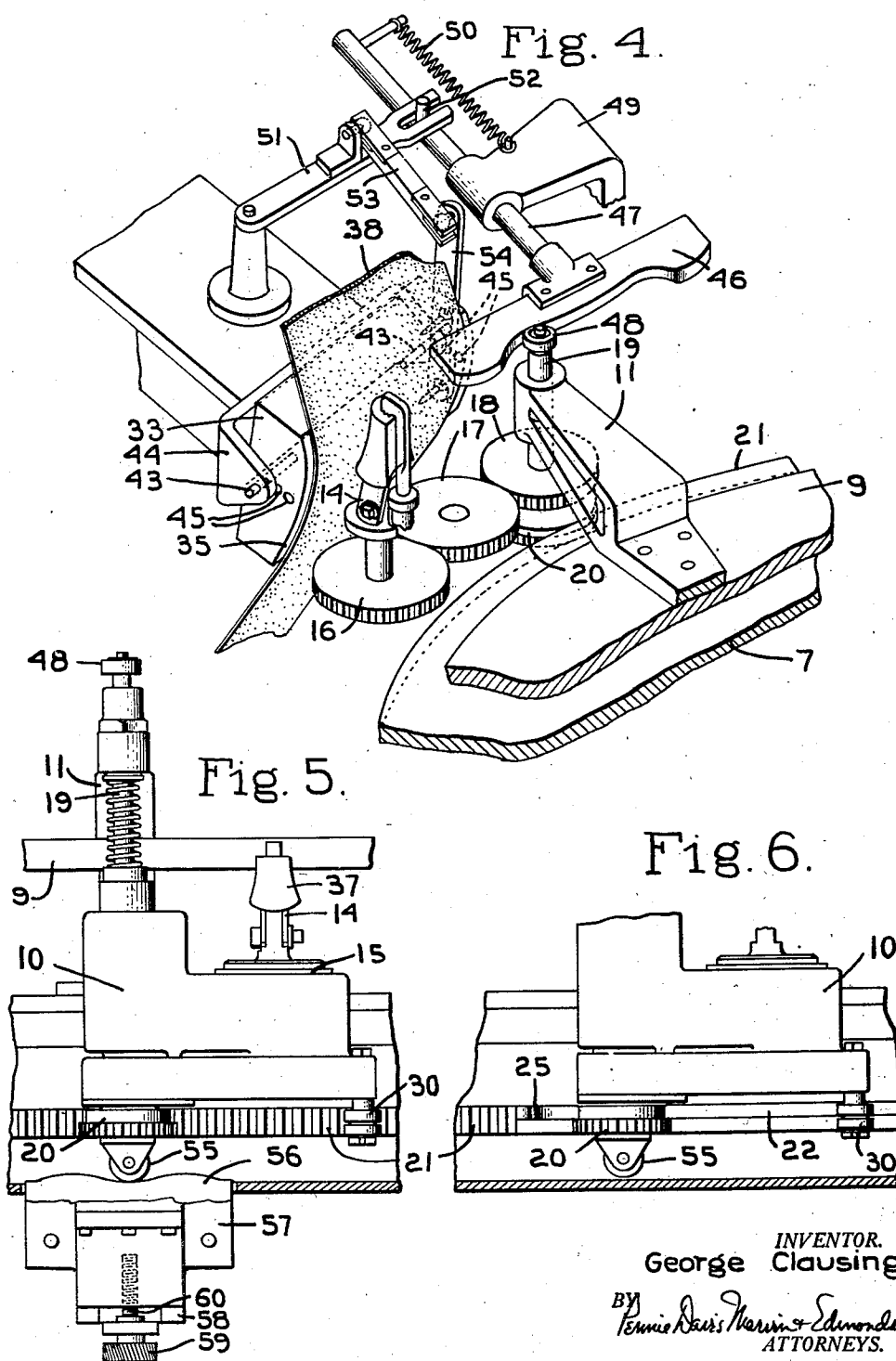
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3 Sheets-Sheet 3.



UNITED STATES PATENT OFFICE

2,312,028

METHOD OF SMOOTHING SURFACES

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1 Claim. (Cl. 51—145)

This invention relates to a method of abrading, buffing, waxing or otherwise surface treating shoe heels subsequently to the turning or shaping operation. The invention relates particularly to the surface smoothing operation upon the side and back faces of a shoe heel. The heel to be treated may consist of any of the commonly employed materials, such as wood, leather or molded plastic composition.

In the manufacture of shoe heels it is necessary to smooth the side and back faces of the heels subsequently to the execution of the turning or shaping operation. The turning operation results in an accurately shaped heel, but despite the perfection of the cutting knives and the efficiency of the operation of the shaping machine, the heel surface contains a series of knife marks and exhibits roughness due to raised wood fiber and other causes.

Before the heel can be placed on the market or before it can be surface coated—either by covering with sheet material, such as Celluloid, or covered with liquid coating, this surface must be smooth. This smoothing operation is highly critical for the reason that the final appearance of the heel depends directly upon the qualities of this smoothing operation.

The present invention deals with a procedure for producing the required high quality surface finish upon the heel.

The principles of the invention are practiced to the best advantage by the use of a suitably constructed mechanism. Such a mechanism desirably is provided with a heel holding jack which grips the heels to be processed during the complete processing operation. The jack is provided with means for rotating it about an axis passing through and extending substantially vertically of the heel. The jack desirably is mounted in a unit which will hereinafter be called the carrier or carriage. Desirably, there are a plurality of these heel holder units which are given bodily movement and by such movement, carry the heel along the face of an abrading device. The path of the carriers may be straight or may move concentrically about an axis. The means for imparting movement to the carriers herein illustrated, cause them to travel in a closed circular path. The heel and a holding jack are mounted at one end of the carrier unit, while the other end of the carrier is pivoted upon a supporting turret to permit the heel and jack to swing transversely of its path of travel, thus to present the heel to an abrading tool and retract it therefrom, in a manner to be described.

As above suggested, a plurality of heel carriers are mounted upon a rotating turret, which is constantly driven. During the cycle of operation of the mechanism, the heel and its jack are rotated on its axis by a train of gears, one of which engages a fixed, circular rack mounted upon the machine frame. This rack is interrupted for a portion of its circumference by a smooth concentric portion having no teeth. The gear, which engages the circular rack and serves to drive the heel jack, is so constructed that when it traverses the smooth, concentric portion of the rack, the heel jack is held against rotation to permit ejection of a completely processed heel and the insertion of an unprocessed heel.

Arranged adjacent the path of the heel are one or more processing stations. Three such stations are illustrated in the drawings, one of which may perform a coarse abrading operation, another of which may perform a fine abrading operation and the third, a buffing or polishing operation. The function of each station may be varied, however.

To obtain maximum production speed, the turret is driven continuously. As above pointed out, at the loading station, the heel jack ceases to rotate about its axis, but continues to have bodily motion. This gives the operator or an automatic ejector an opportunity to eject a processed heel and insert an unprocessed heel. The unprocessed heel is carried to the initial processing station and during such movement, the axis of the heel jack remains concentric with the axis of the turret. The processing station desirably is provided with an abrading tool, such as a sand belt, which is driven over and maintained in close engagement with a form block. The form block has a longitudinally uniform profile, which is complementary to the master curve to which the sides of the heel are shaped upon the heel turning or forming machine. As the heel approaches the sand belt, it is resiliently pressed into contact therewith and by reason of the rotation of the heel about its height-wise axis as it is fed along the surface of the abrading tool, the sides of the heel are smoothed. Before the heel reaches the end of its traverse across the form block, it is retracted from engagement therewith and continues to travel along its circular path until it reaches the next processing station, which, for example, may be designed to execute another abrading operation similar to that executed at the first station or the heel may there receive a buffing or polishing treatment. Whatever treatment it receives, the operation of the

elements at the second or at any other station, will be the same as that described in connection with the first station. After the heel has been presented for processing at each station, it arrives again at the ejecting and feeding portion of its cycle, where its axial rotation is again discontinued and where the processed heel is ejected and an unprocessed heel is inserted in the jack.

Certain heels can be successfully processed by the straight-forward execution of the above described processing steps. However, other types of heels are more perfectly smoothed by imparting compensatory motion to the heel, the form block or both of these elements during the passage of the heel along the block. To accomplish the desired results with the latter type of heel, the form block is rocked about a longitudinal axis to present different portions of the master profile curve as progressively different portions of the heel surface are presented to the processing tool, thereby to more perfectly match the curve of the form block to that of the heel sides. To accomplish a similar result, the heel may be bodily raised or lowered while the form block remains fixed or a combination of movement of both form block and heel may be effected while the heel traverses the block.

To present a better understanding of the invention, a particular embodiment thereof will be described in connection with a suitable mechanism for executing the steps which constitute the method of the invention.

Fig. 1 is a plan view presented partially diagrammatically of a preferred mechanism for executing the steps of the invention.

Fig. 2 is a view of the heel holding element of the mechanism together with an illustrative showing of the elements comprising a processing station.

Fig. 3 is a view similar to Fig. 2 presenting another form of processing station.

Fig. 4 is a perspective diagrammatic view illustrating a mechanism for matching the contour of the abrading or buffing tool to that of the heel contour during the treatment of the heel.

Fig. 5 is a partial sectional view illustrating another mechanism for matching contours between the abrading tool and the sides of the heel.

Fig. 6 is a detail view showing a desirable means for starting and stopping the rotation of the heel holding jack during the machine cycle.

The mechanism illustrated in the drawings comprises a main frame or pedestal member 7, which desirably presents a circular upper portion. The frame is provided with a central vertical shaft 8, upon which is pivotally mounted a turret member 9. Upon the turret are mounted a plurality of heel carriers 10, only 4 of which are illustrated. A greater or less number of carriers may be mounted upon the turret.

The carrier units 10 are pivotally mounted to swing in a horizontal plane in brackets 11 secured upon the peripheral edge of the turret 9. The turret 9 is mounted upon the vertical shaft 8 situated at the center of and rotatable in the frame 7. Below the turret, the shaft 8 has fixed thereon a driving gear 12 shown in dotted lines in Fig. 1. A pinion 13 meshes with and rotates the gear 12, which, through the shaft 8, rotates the turret 9. The pinion may be driven in any suitable manner, as by means of an electric motor and speed reducing gear, not illustrated.

The heel carriers 10 are provided with means

for rotating the heel about a vertical axis. This is accomplished by mounting a heel holding jack 14 upon a supporting member 15, which is rotatably mounted in the carrier 10. The support 15 is provided with a driving gear 16, which meshes with an idler gear 17 mounted in the carrier. The gear 17 in turn meshes with and is driven by a gear 18, rotatably mounted upon the shaft 19 upon which the carrier is pivoted. Another gear 20 of special construction is secured to the gear 18 and rotates therewith upon the shaft 19. The gear 20 meshes with a circular rack 21 concentrically positioned with respect to the shaft 8 and fixed to the frame 7.

The rack 21 is interrupted for a portion of its periphery and in its place a smooth track 22 presents a concentric edge face against which the portion 23 of the special gear 20 rides. The portion 23 of the gear 20 has a curvature complementary to the curve of the smooth track and the position of the respective inter-engaging faces with respect to the shaft 8 is such that the gear 20 is held against rotation while it traverses the track 22. It will be observed by examining Figs. 5 and 6 that the gear 20 is composed of two portions—the lower portion being provided with gear teeth, while the upper portion is of special construction. The track 22 is narrow in width and engages only the upper portion of the gear 20. The upper portion of the gear, therefore, functions alone to control the movement thereof during its passage along the track. The upper portion of the gear 20 has, in addition to the portion 23, a specially designed tooth 24, situated adjacent the portion 23. As the turret moves in the direction of the arrow and the gear 20 reaches the end of the track 22, the tooth 24 engages a tooth 25 projecting slightly outward from the cam face. The shape of the two teeth 24 and 25 is such that when they engage, the gear will begin to rotate and the timing of this motion is so calculated that as the turret continues to rotate, the teeth of the lower portion of the gear 20 will smoothly mesh with the teeth on the rack 21 and the gear will continue to be driven by the circular rack until it arrives at the point 26 of the track 22, at which point the rack 21 is discontinued. The timing of the rotation of the gear 20 is so calculated that when it arrives at the point 26, the portion 23 will engage a curved portion 27 of the track 22 and ride smoothly over this curved portion and thence into engagement with the concentric portion of the cam.

During the portion of the machine cycle, when the gear 20 is traversing the track 22, the clamping pressure of the heel holding jack is released and the completely treated heel ejected. Directly thereafter, an untreated heel is placed therein, after which the clamping pressure is again exerted upon the new heel, which is clamped in an accurately predetermined position in the jack.

The manipulation of the heel during its passage through a processing station will now be described. Each of the heel carriers 10 are yieldingly urged outward away from the axis of the turret. The carriers may be urged outwardly in any convenient manner; for example, by means of a plunger 28 mounted upon the turret, which is pressed against the carrier by a spring 29. The spring pressed plunger 28 engages the carrier adjacent its outer or free end. The swinging movement of the carriage is effected by its rotation about the pivot shaft 19.

Outward swinging movement of the carrier is

prevented at all times excepting when the heel is being processed. Any convenient means may be employed for controlling the swinging movement of the carrier. As illustrated in the drawings, each carrier is provided with a roll 30, which engages an abutment 31 having a cam face concentric with the axis of the turret. This concentric cam face, however, is interrupted at the heel treating station. Assuming the heel has been placed in the jack 14 at the loading station, it is carried to the first station rotating as it travels. As the heel approaches the first station, which will be designated as station A, the roll 30 follows an outwardly sloping cam face 32, thus permitting the carrier to swing outward under the action of the spring 29 until the heel in the jack engages an abrasive tool in the form of a sand belt, which is driven over the face of a form block 33. The heel, therefore, is now pressed against the abrasive tool with the full pressure of the spring 29. Simultaneously with the engagement of the heel with the abrasive tool, the roll 30 moves out of engagement with the cam 32. The position of the cam 32 is adjustable and its shape is so determined that the rotation of the heel jack 14 may be so coordinated that the heel will engage the abrasive tool exactly at the instant the heel assumes its position presenting one of its side faces at the breast corner and tangentially to the surface of the tool. The heel then rotates as it traverses the face of the form block, thereby scouring the sides of the heel and at the instant the other side face arrives at a position where it is tangent to the face of the abrasive tool at the breast corner, the roll 30 engages the cam 34 which immediately re-tracks the heel from engagement with the abrasive tool. The same sequence of operations is repeated at the remaining stations, wherein the heel may, for example, at station B receive another abrasive treatment and at station C a polishing or buffing treatment.

The transverse or cross-sectional shape of the contoured face 35 of the form block 33, as illustrated, for example, in Fig. 2, conforms to the master curve, which corresponds to the peripheral or generated contour of the cutter blades which were used to shape the heel sides. To provide for correctly positioning the heel with respect to the form block, the heel jack 14 is provided with a base plate 36 upon which the seat of the heel 37 is positioned. The base plate 36 is angularly adjustable to permit the heel to be positioned at a predetermined angle with respect to the block face 35. Many heels may be satisfactorily processed by determining the proper angular disposition of the heel with respect to the block and adjusting the base plate 36 to establish that angle. When the proper adjustment of the heel is secured, they are fed across the face of the form block without shifting the position of the block or the axial position of the heel. Some types of heels, however, are processed more accurately by introducing certain compensatory motion to the form block, while other heels may be processed more accurately by combining motion of both of these elements, as will be pointed out hereinafter.

The abrading of the heel surface is effected by a driven abrasion tool, such as the sand belt 38, which presents an abrading surface to the heel. The belt 38 may desirably be supported upon a pair of pulleys and at a point situated between the pulleys, the belt runs over the face of the form block 33. Sufficient tension is in-

troduced into the belt to draw it firmly against the face 35 thereof and thus cause it to accurately conform to its contour. Only one of the pulleys 39 is shown in the drawings. This pulley may be connected to a suitable source of power, which serves to drive the belt. The other pulley not shown, is situated above the block and serves as a guide regulating pulley.

In the construction illustrated in Fig. 2, the abrasive belt 38 moves in a substantially vertical path as it passes over the form block 33 and its path is substantially parallel to the height-wise axis of the heel. Another means for supporting and driving an abrasive belt is shown in Fig. 3, wherein the belt is supported horizontally upon a pair of pulleys, only one of which is illustrated. The pulley 41, which is shown, may serve as the driving pulley, while the other pulley not shown acts to support and guide the abrasive belt 42. The pulleys are mounted upon vertical axes and act to drive the abrasive belt 42 across the face 35 of the block 33 in a direction at substantially 90° to the height-wise axis of the heel. Sufficient tension is maintained in the belt to insure firm contact of the belt with the face 35 throughout its whole area. One of the processing stations, for example, station C may employ a leather or fabric belt instead of an abrasive belt, to which a wax or other suitable compound may be applied.

As above pointed out, it is desirable in surface finishing some types of heels to co-ordinate the position of the form block and the heel according to a predetermined relationship in timed relation to the progress of the heel along the form block. In this manner, the contour of the heel is matched to the contour of the form block throughout the progress of the treating operation.

In connection with the above, it will be noted that the curve of the face of the form block is not circular, but presents a constantly changing radius. As the block is moved with respect to the heel, it presents a changing curved contour and by properly forming the curve and by manipulation of the block with respect to the heel, the heel contour can be accurately matched.

Suitable mechanism for establishing relative movement between the form block and heel is illustrated in Figs. 4 and 5. In Fig. 4, the form block 33 is pivoted upon a pair of pins 43 rotatably mounted in a yoke-shaped support 44 rigidly fixed upon the main frame of the machine. The axis of the pin extends lengthwise of the block and means desirably are provided for shifting the position of the pivot pins in the block 33. This may be accomplished by providing a plurality of apertures 45, in which the pins may be received. By thus providing for shifting the fulcrum about which the block 33 is pivoted, the mechanism may be readily adapted to cover a wide range of operating conditions.

The required movement of the form block 33 may be effected in any desirable manner. A suitable method for doing this is illustrated in Fig. 4 wherein a pattern means, such as a cam 46 is provided, the contour of which determines the movement of the block. The cam 46 is secured upon the end of a push rod 47 preferably disposed radially from the center of the turret 9. The working face of the cam is held in engagement with a co-acting cam roll 48 mounted upon a suitable location upon the turret, such as the upper end of the vertical shaft 19. A roll 48 is

mounted on each of the heel carrier units. As the roll traverses the cam 46, motion is transmitted to the rod 47 in response to the shape of the cam. The rod 47 is supported and guided in its axial movement in a bracket 49 rigidly fixed to the machine frame. The cam is held against the roll 48 by a spring 50 anchored at one end upon the bracket 49 and at its other end to the other end of the rod 47. Motion of the rod 47 is transmitted to the lever 51 having a bifurcated outer end within which a pin 52 is received. The pin 52 is secured upon the rod 47 and acts to transmit motion thereof to the lever 51. The other end of the lever 51 is fulcrumed upon the machine frame. Intermediate its end, a link 53 is universally pivoted thereto. The other end of the link is universally pivoted upon a form block actuating lever 54. The lever 54 is secured to the block 33 and acts to rock the block about the pivot pins 43.

A suitable procedure for determining the shape of the cam 46 is as follows. The turret 9 is moved into a plurality of positions including the total length of travel of the turret in which a heel remains in engagement with the sand belt. At each position, the form block is tilted until its contour matches the heel contour. The resulting series of positions of a cam blank with respect to the roll 48 is noted. From these positions the curve of the cam is plotted. A cam thus computed will function to accurately match contours on a wide variety of heels. If necessary, one or more additional cams may be supplied, which are designed to permit accurate treatment of heels of unusual design.

Another control which may be introduced to co-ordinate relative motion of the heel with respect to the block is illustrated in Fig. 5. The carriers 10 are arranged to be raised and lowered desirably by movement along the axis of the pivot shaft 19. By thus raising the carriers, the heel is also raised or lowered with respect to the form block. This motion is imparted to the heel during its traverse of the form block. Any suitable means may be employed to develop such movement. As herein illustrated, the lower end of the pivot shaft is provided with a roll 55. The roll engages a cam 56 which is formed in a manner to impart the desired movement to the heel. The cam is removably secured in a cam holder 57, which in turn is slidable vertically upon a bracket 58 rigidly secured upon the machine frame. Vertical adjustment is imparted to the cam by means of an adjusting knob 59 secured upon the end of an elevating screw 60.

It is within the scope of the present invention to combine the vertical motion of the heel established by the above described mechanism with

the motion imparted to the block 33 by the cam 46. Such a combination of movement may be desirable to be employed to fulfill certain requirements. Obviously, either of these motions may be employed independently in the operation of the machine.

Prior to the development of the present invention, most of the surface treating operations upon shoe heels had been accomplished by hand operations. Such hand finishing of the heels is noticeably rough, exhibits lack of uniformity and is generally unsatisfactory as well as being one of the most costly operations in manufacturing a heel. The present invention provides a method of rapidly finishing heels with great accuracy and uniformity, as has heretofore been unattainable. In addition to the accuracy, uniformity and speed resulting from the practice of the invention, the quality of the treatment is of the highest order. In fact, heels treated by the method of the invention can be coated by spraying or dipping with a minimum quantity of coating material, and due to the high quality surface, fail to show the marks of the abrading operation and thus produce an article of high quality at a greatly reduced cost.

A further very important result is effected by the method of sanding herein presented. This advantage applies to the surface treatment of natural wood heels wherein the wood fibers extend from front to back thereof. In the method which employs a vertically moving scouring tool traversing the heel substantially parallel to its vertical axis, it will be noted that the tool moves across the wood grain at an obtuse angle throughout the smoothing operation. The tool also travels away from the apex of the angle of its contact with the heel, thereby avoiding the tendency to roughen the heel surface by abrading against the wood grain.

I claim:

In the treatment of shoe heels with a surface treating tool having a curved working face, the method which comprises operating the tool face along the side and back of the heel, simultaneously varying independently of movement of the heel the curvature relative to the heel of the part of said face acting on the heel to cause the tool face contour to match the heel contour during the tool operation, and simultaneously pressing the heel against the tool face with a yielding force while maintaining said face against yielding under the pressure of the heel and maintaining positive predetermined timed relation between the movement of the heel and the variation in the curvature of the tool face.

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