May 31, 1932. W. N. SAWYER 1,860,789

WOOD HEEL GROOVING MACHINE

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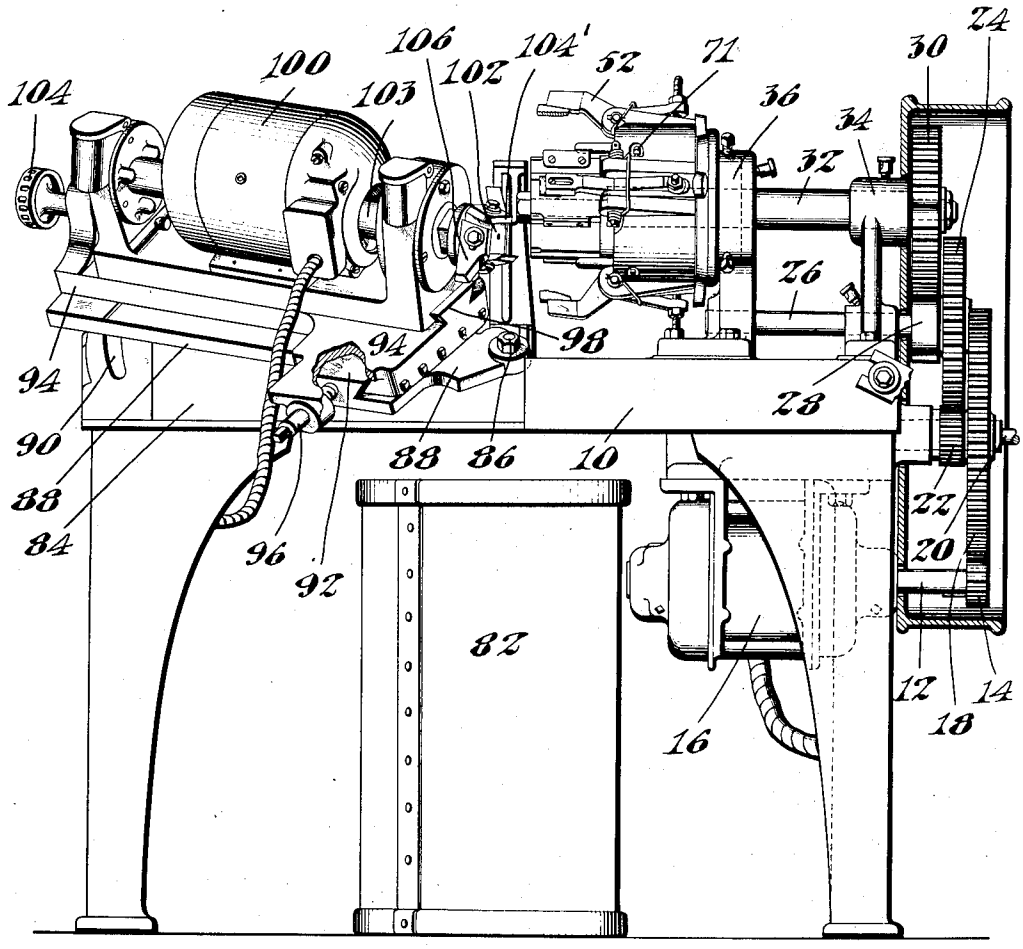
Fig. 1.



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By his Attorney

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WOOD HEEL GROOVING MACHINE

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Fig. 2.

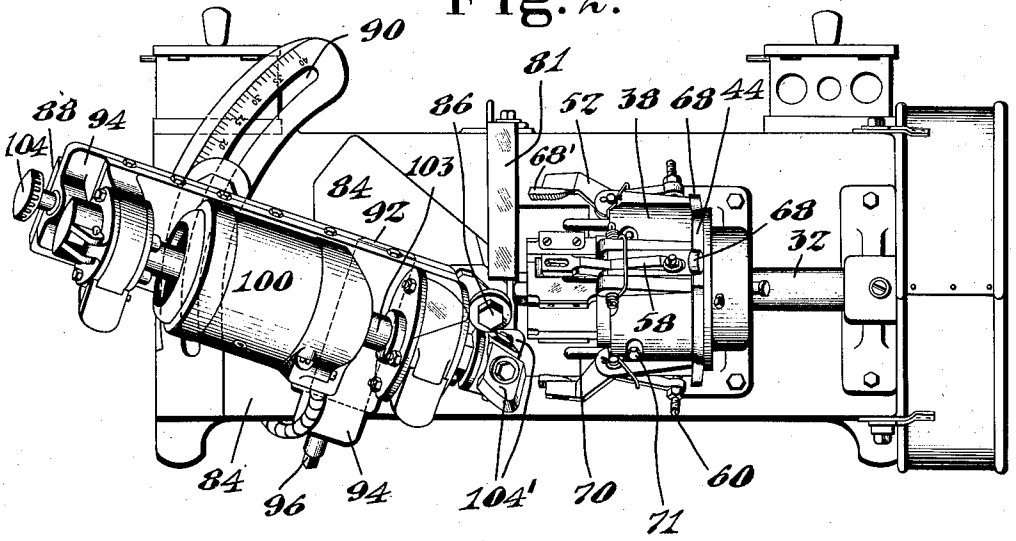


Fig. 15.

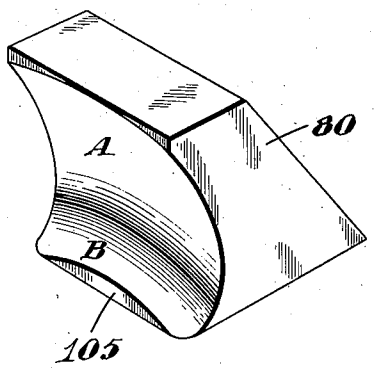


Fig. 5.

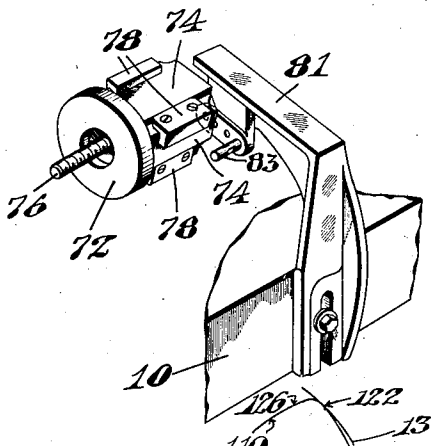
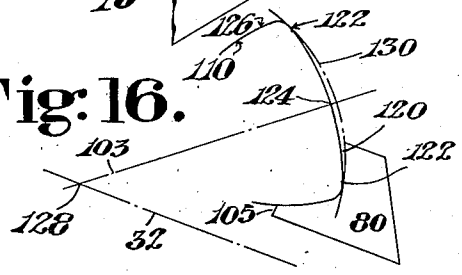


Fig. 16.



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WOOD HEEL GROOVING MACHINE

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Fig. 3.

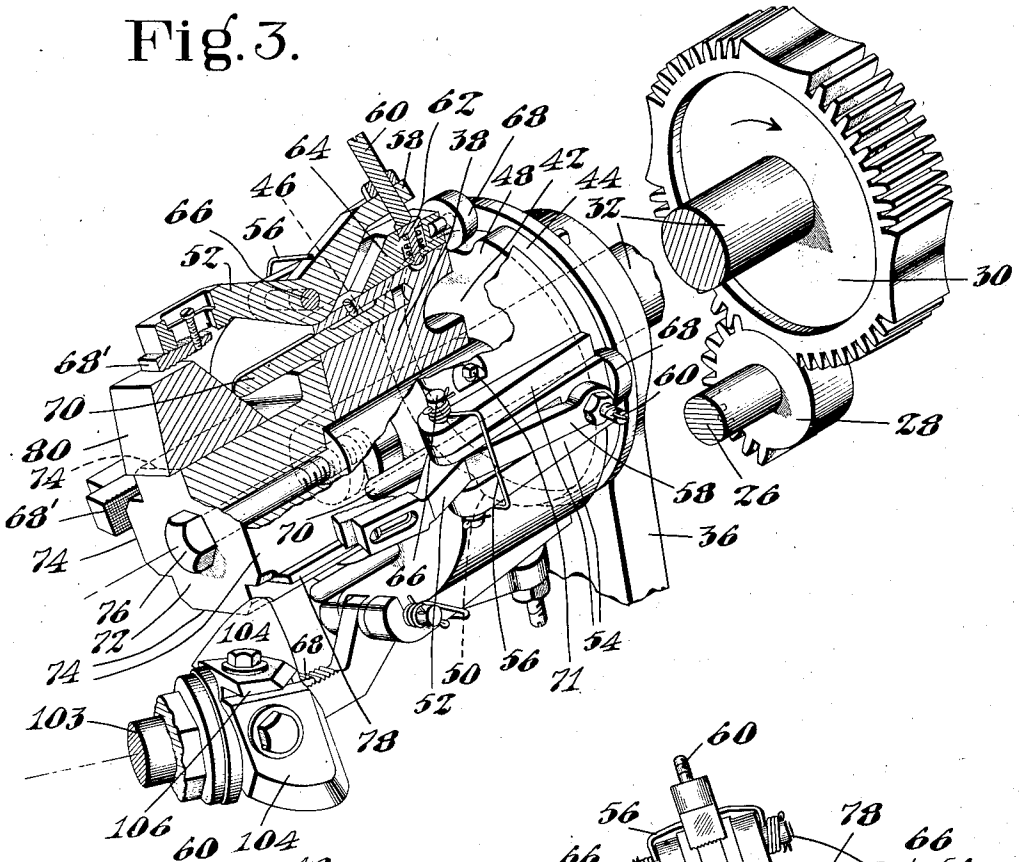
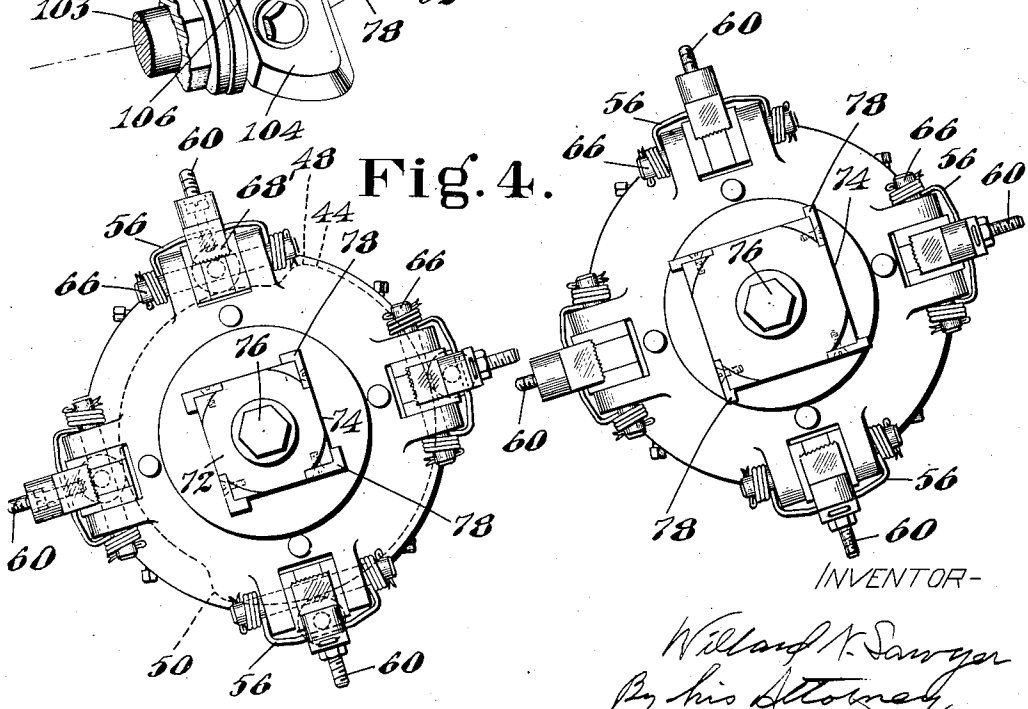


Fig. 4.



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WOOD HEEL GROOVING MACHINE

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Fig.6.

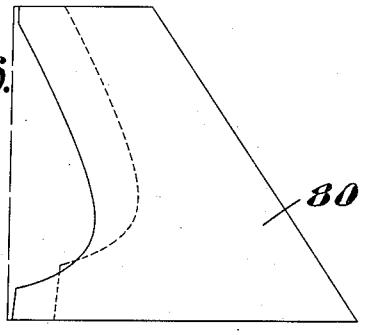


Fig.7.

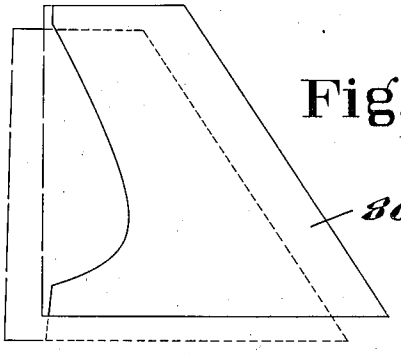


Fig.8.

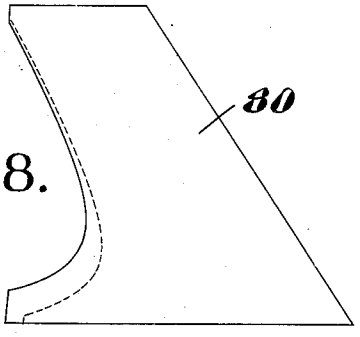


Fig.9.

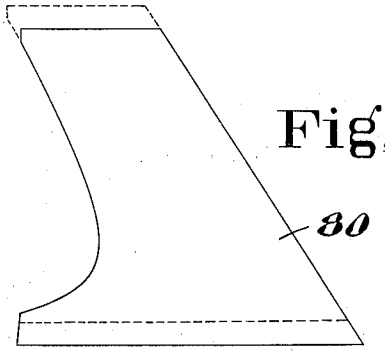


Fig.10.

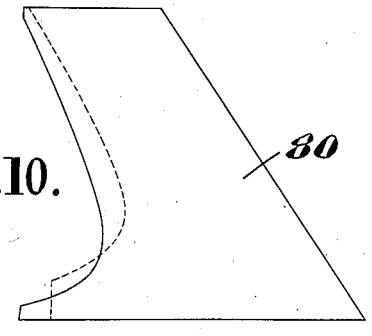
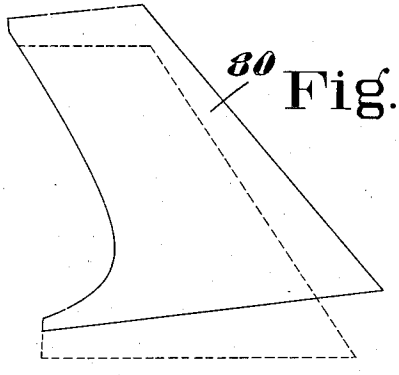


Fig.11.



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WOOD HEEL GROOVING MACHINE

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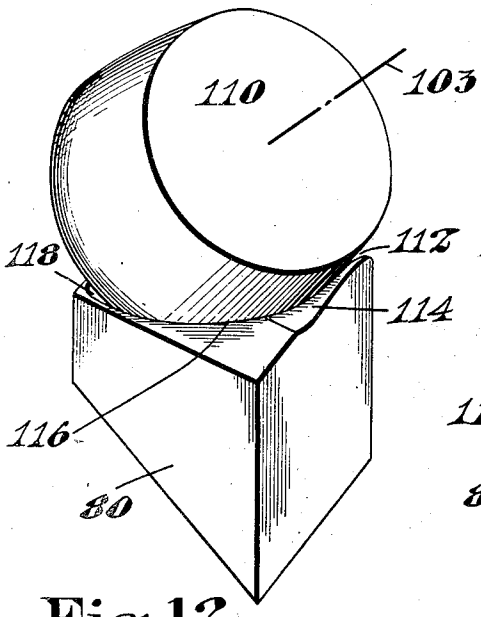

Fig.12.

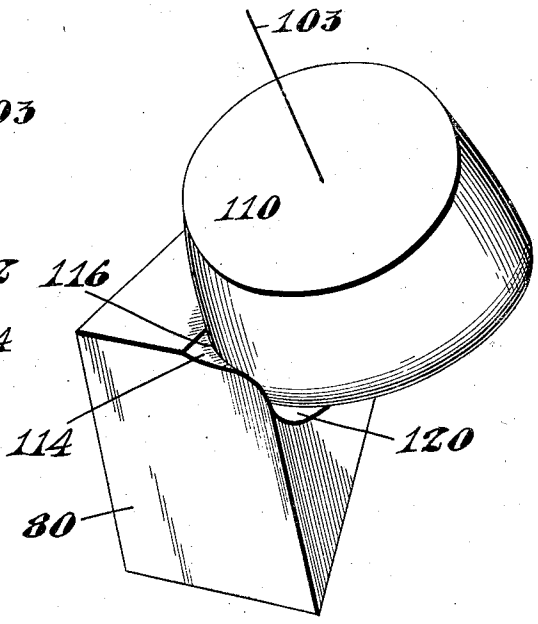

Fig.13.

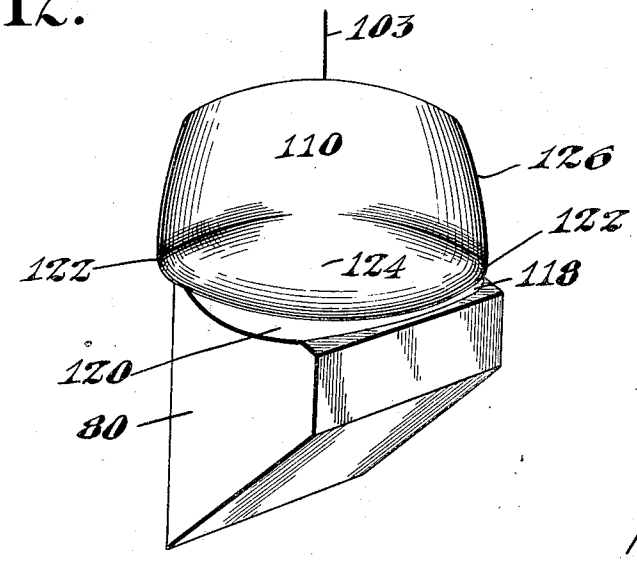

Fig.14.

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UNITED STATES PATENT OFFICE

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WOOD HEEL GROOVING MACHINE

Application filed January 12, 1927. Serial No. 160,622.

This invention relates to machines for use in and methods of making wood heels and, in its machine aspect, is illustrated as embodied in a wood heel grooving machine by means of which the novel method of the invention may advantageously be practised.

In making wood heels of the Louis type the first operation on the wood heel blank has been grooving, by which is meant the cutting of a horizontal cylindrical groove across the breast surface of the blank, corresponding in its major part to the breast surface of the finished heel. Prior to the invention of Harley W. Russ, described in his application Serial No. 587,893, filed Sept. 13, 1922, the surface formed by the grooving operation was merely such a cylindrical surface composed of an aggregate of horizontal straight lines, and included a straight horizontal lip portion where the heel merged into the shank of the shoe. This lip had to be rounded by hand in a second operation to bring it to the transverse curvature of the shank.

The invention referred to provided a machine for forming both the breast surface and the curved lip surface simultaneously as a single compound surface, by the relative revolution of a tool and a heel blank about an axis lying on the heel seat side of the blank, the tool being a cutter rotating about an axis parallel to, and in the machine illustrated in the above mentioned application coincident with, the axis of relative revolution first mentioned.

I have found that the advantages of the invention referred to above can be retained, and additional advantages (including better work and increased production) secured, by placing the axis of rotation of the cutter at an oblique angle to the axis of relative revolution of the cutter and heel blank. In the particular embodiment of the invention shown herein, these axes intersect, so that the cutter axis passes around the axis of relative revolution in a conical surface.

By virtue of this arrangement the cutter blades are enabled to cut across the wood fibers at an acute angle, whereas heretofore the cut has been straight across, or perpendicular to, the fibers. This arrangement produces much smoother work than has heretofore been obtainable.

Accordingly, a principal feature of the invention consists in an organization such as described, comprising a work holder and a cutter arranged for relative revolution about an axis, the cutter axis being not parallel and preferably oblique to the axis of relative revolution.

Another important feature of the invention resides in the shape of the cutter used. The illustrated cutter blade is so shaped that the surface of revolution generated by it is flatter at the place where it is intersected by its axis of revolution, than at points remote from the axis, the curvature being such that those points of the cutter axis and of the axis of relative revolution above mentioned where these axes are nearest each other (in the machine illustrated these points are merely the single point of intersection of these axes) are farther from the above-mentioned more remote points of the surface than from the point of intersection of the surface and its axis. This results, as will be shown, in a much smoother cutting action at those parts of the work which correspond to the flattened portion of the surface. Preferably the cutter blade is so shaped that these remote points of the surface correspond to the junction of the breast and lip surfaces to be formed on the work.

The invention also includes novel means for effecting various adjustments between the work holder and the revolving cutter, to alter and control the style of the heel and the position of the cut in the heel blank.

In accordance with another feature of the invention, the cutter head is provided with a blade arranged to trim the end of the shank lip in proper relation to the surface just discussed.

In the machine shown the heel blank, in addition to being supported on its heel seat surface, is gaged by a rod engaging its rear lateral face and a plate which engages one of the side lateral faces. Thus the heel blanks are located with absolute accuracy and uniformity in the machine and can be similarly

located in machines for performing subsequent operations, with the assurance that the surfaces formed by these operations will be properly related.

Accordingly, reverting to its machine aspect, the invention comprises, as an important feature, a gaging mechanism such as that just outlined.

These and other features and characteristics of the invention comprising certain combinations and arrangements of parts will be apparent from the following description of the novel method of the invention and of a preferred embodiment of the invention shown in the drawings, in which

Fig. 1 is a front elevation;

Fig. 2 is a plan;

Fig. 3 is a detailed perspective of the jack and turret mechanism;

Fig. 4 shows two of the base blocks and side gages;

Fig. 5 is a detail of the blank inserting mechanism;

Figs. 6–11 illustrate the different adjustments;

Figs. 12–14 illustrate the nature of the cutting operation performed on the heel blank;

Fig. 15 shows a grooved heel blank; and

Fig. 16 shows diagrammatically the relation between the cutter, cutter shaft, and the work holder axis while a heel is being cut.

The main frame 10 carries a shaft 12 with a small pinion 14 arranged to be driven by a source of power, as by a motor 16. The pinion 14 drives a large pinion 18 on a shaft 20, to which a handle may be attached to turn the machine over by hand. The shaft 20 carries a small pinion 22 which drives a larger one 24, on a shaft 26. The shaft 26 carries the smaller pinion 28 of a Geneva stop motion 28, 30, having, in the machine shown, four dwells. The pinion 30 will thus drive its shaft 32 in successive cycles of 90° each.

The shaft 32 is mounted in bearings 34, 36 carried by the frame, and carries the jack, or work carrying mechanism, which is of turret form and which will now be described (see particularly Fig. 3). This mechanism comprises a head 38 mounted fixedly on the shaft 32, on the inside of the bearing 36. This head 38 fits against a cam plate 42 mounted fixedly on the bearing 36 and of generally circular formation. The cam plate has two circular arcs 44, 46, the former of greater radius than the latter, and each extending about half way round the cam plate. The circular arcs are joined by cam surfaces 48, 50. Mounted on the head 38 are four jack levers 52, each pivoted in a pair of ears 54 on the head and resiliently held in open position by a spring 56, that is with their right-hand ends 58 (Fig. 3) forced toward the head 38. These ends carry adjustable screws 60, resting on spring plungers 62 in blocks 64 which are pivoted on the jack lever pivots 66, and are bifurcated to embrace the jack arms 52. Each block carries at its outside end a cam roll 68 which runs on the cam plate 42. When the head 38 is rotated by the shaft 32 the upper jack arm (Fig. 3) will be forced counterclockwise (Fig. 3) as the roll 68 rides up the cam 48 on to the arc 44, and will be held that way through approximately two cycles of 90° each when the roll rolls down the cam 50 and the spring 56 forces the jack arm back into the position shown at the top of Fig. 3. The jack arm carries at its inner end an adjustable clamping plate 68′ to engage the toplift portion of the heel blank and the head 38 has four adjustable gage bars 70, one for each jack, mounted in holes, and held in adjusted position by set screws 71. The bars 70 are arranged to engage one of the lateral (as distinguished from the upper and lower) faces of the heel blank 80, herein shown as the rear lateral face.

A base block 72, having four faces 74, is bolted to the head 38 by a bolt 76 threaded into the end of the shaft 32. A set of several of these base blocks 72 is provided, of varying diameters between opposite faces 74, for a purpose explained below. Mounted on the leading side of each face 74 is a gage plate 78, projecting upwardly beside and overhanging the face 74, and arranged to engage a side lateral face of the heel blank. Eleven sets of these plates 78 are preferably provided, of different effective thicknesses (varying by $\frac{1}{32}''$) in that part which extends above the face 74 in order to center properly blanks of different lateral thicknesses, as will be explained. Fig. 4 illustrates two sizes of base blocks 72 and gages 78.

The operator stands behind the machine as shown in Figs. 1, 2 and 3. To facilitate the insertion of the work during the time the base block is at rest the work blank 80 is placed by the operator on a vertically adjustable platform 81, Figs. 2 and 5, which is mounted on the machine frame, which can be set to aline with the position of the upper face 74 of the base block when the machine is at rest, and is then slid over on the face 74 with one side against the gage plate 78 and its rear side face against the gage rod 70 and held there by the operator until the machine has started on a cycle and the plate 68′ has been forced down on the top of the blank. The blank is held thus clamped during approximately two cycles, or 180° rotation of the shaft 32, when the cam roll 68 drops on to the arc 46, and the blank is then released and knocked out by a pin 83 (Fig. 5) if it adheres to the plate 68′, and drops into a barrel 82 (Fig. 1). During this 180° of clamped rotation it will have been carried past a cutter and grooved.

The cutting instrumentality is mounted on the left end of the frame 10. Built integrally

into the frame 10 is a sloping plane surface 84 (Fig. 1), making an angle, in the disclosed machine, of 25° with a horizontal plane. As constructed, the vertex of the dihedral angle of 25° above mentioned is parallel to the axis of the shaft 32. In other words, the normal to this sloping surface 84 as seen in Fig. 1, which is a rear elevation, is in a plane perpendicular to the paper. This angular location of the surface 84 puts the operating parts of the machine into a convenient situation for the operator. At the inner end of this surface 84 is a pivot stud 86 inserted perpendicularly to the surface 84. A cross slide plate 88 is pivotally mounted on the stud 86 to swing around on the surface 84, being held in any desired position by a clamping mechanism, not shown, which may be of any desired type, running in a slot 90, graduated in degrees to show the angular setting of the cross slide plate. The cross slide plate 88 has an upwardly projecting dovetail rib 92 extending straight across it, on which is mounted, to slide back and forth on the plate, a cross slide 94 adjustable along the dovetail by a screw 96 threaded in the dovetail rib 92 and collared in the cross slide. The cross slide has an upwardly projecting dovetail rib 98 at right angles to the rib 92, on which is slidably mounted a motor 100 having a cutter head 102 at the inner end of its shaft 103. The shaft 103 is parallel to the rib 98. A screw 104 adjusts the motor back and forth on the rib 98. All these adjustments will be discussed below.

The cutter head 102 is rectangular-frusto-wedge shaped and carries a knife on each of its four faces. Two of these knives 104′, on opposite faces are grooving cutters and the other two, 106, are lip trimming cutters.

The knives 104′ as they revolve about the motor shaft 103 generate a surface of revolution shaped like a flat oblate ellipsoid 110 (Figs. 12 to 14), and the cross-section of this ellipsoid corresponds to the combined breast and shank lip profile desired. The angle between the cutter axis and the shaft 32 brings the cutter axis approximately perpendicular to the breast surface A of the blank, and should be sufficient to enable a convex-ended cutter head to be used without danger of fouling. (See 120 in Fig. 14.) The heel blank produced by the machine is shown in Fig. 15. Its breast surface is indicated at A and its lip surface at B.

The cutter axis 103, in whatever position it is placed by the three adjustments mentioned, lies in a plane parallel to the sloping surface 84 on the frame 10, and, in the illustrated machine, this plane passes through the axis of the shaft 32, with the result that this axis and the cutter axis 103, always intersect at an oblique angle, which can be varied by the adjustment 86—90, within wide limits. The term "angle" as used herein is not to be understood as limited to the plane angle concept, but is used in the solid analytic geometrical sense, in which any two lines, however situated, make a definite and ascertainable angle with each other. The operation of the machine can perhaps be best understood by regarding the shaft 32 as fixed, and the frame of the machine and the motor 100 as revolving about it. In this case the cutter axis may be considered as traveling around the axis 32 as the machine revolves, in a cone, which is a limiting form of the hyperboloid of revolution of one nappe. The edge of the ellipsoid which is toward the axis 32 will cut through the breast of the heel blank in a circular path about the axis 32.

Owing to the fact that the ellipsoid sweeps through the blank in a circular path about the axis of the shaft 32, the surface cut on the blank will be composed of an aggregate of circular arcs all having their centers in the axis 32, and their planes perpendicular to the axis 32. This gives the desired curvature to the lip 105 of the heel blank to cause it to conform to the transverse curvature of the shoe to which the heel is to be attached. The sharpness of this curvature is dependent on the distance of the lip 105 from the axis 32—76, and accordingly, as above stated, the machine is provided with seven base blocks 72, two of which are shown in Fig. 4, with the radii to the centers of the flat faces 74 varying by 1/4 inch from $1\frac{1}{16}''$ to $2\frac{9}{16}''$. These seven base blocks enable the machine to curve the lips on radii varying from about $1\frac{1}{4}''$ to $2\frac{3}{4}''$.

As the ellipsoid is carried through the heel blank, owing to the angle between its axis, that is, the axis of the shaft 103, and the axis of the shaft 32, it moves through the blank in a slanting position, and only the leading side of it cuts. The cut is progressively finished as it travels across the blank and the leading side of the blank is finished and left by the leading side of the ellipsoid before the following side of the blank is finished. The ellipsoid is in contact with only a part of the breast surface at once, thereby relieving the duty on the knives which thus do not have to cut through the whole width of the blank each time they come around. The knives also cut at all times through the blank at a substantially acute angle to all the wood fibers (which run horizontally in the heel from front to rear), and therefore the knives make a shearing cut instead of a scraping or plowing cut. This construction and arrangement insures very smooth work. It has always been necessary, in previous grooving of wood heels, to support the blank at the following edge to prevent the knives from tearing out large chips as they leave, but this is unnecessary in the use of the present machine.

The nature of the cut is illustrated in Figs.

12, 13 and 14. The "ellipsoid" is shown at 110, as above stated, and the figures referred to illustrate the heel blank at the same instant of partial completion. The leading side of the heel blank has been finished, at 112, 120, and the leading end of the lip has been trimmed (114). The cutter head is cutting at 116, on its leading side. The portion 118 has just been cut by the leading "corner" 122 of the ellipsoid 110, and the clearance 120 back of the cutter head, which is in effect the clearance of the cutter blades themselves, is due to the somewhat flattened shape of the end of the ellipsoid. That is, the distance from the center 124 of the ellipsoid to the intersection of the axes 103, 32 is less than the distance of the "corners" 122 from this intersection.

In other words the cutter blades are so shaped that they each have a point at or near the point 122 (Fig. 14), this point being at the maximum distance from the intersection 128 of the axes of the shafts 103 and 32. From this structure results an important advantage. Consider this point of maximum distance (which will be called 122 for the purposes of this discussion, its location varying slightly with the shifting of the above-mentioned intersection of the axes by the different adjustments which are to be discussed below), as a single cutting point rotating about the axis 103 as this axis swings about the axis 32. It is clear that it will cut a spherical zone 130 (Fig. 16) about the axis 32, the radius of the sphere being the distance from 122 to the intersection mentioned. All points of the cutter blade between 122 and the center 124 are closer to the intersection mentioned than is the point 122, and always lie inside the spherical surface. In other words they do no cutting. Those points of the cutter blades which lie beyond 122 on that part of the blade which is more nearly parallel to the axis 103, indicated at 126 in Fig. 14, do the rough cutting for the entire work piece, and also finish the curved lip portion, which corresponds to the portion 126. The point 122 finishes all the rest of the block, that is the entire breast surface, and does no other work. This results in a very superior and smooth finish on the breast portion of the cut, as the point 122 has only an infinitesimal amount of material to remove and finishes three-quarters or more of the entire surface cut. This part of the surface is, of course, spherical. The point 122 corresponds to the junction of the lip surface and the breast surface of the heel blank.

The lip trimming knives 106, which have a straight cutting edge, cut straight across the lip, the cut being formed progressively, with the direction of cut at an acute angle to the direction of the wood fibers.

The sets of gage plates 78 provide for accurate centering of the wood heel blank on the faces 74. If a wide blank 80 is being breasted a plate 78 with a thin top or gage portion will be used, and if a narrow blank is being treated, a plate 78 with a thick top, overhanging the leading edge of the surface 74 to a considerable degree, will be used. With the disclosed machine, as above stated, eleven sets of plates are provided varying in top thickness by $\frac{1}{32}$ inch, two different plates being shown in Fig. 4.

The various adjustments of the cutter head, around the stud 86, and along the dovetail ribs 92, 98 permit a considerable latitude in altering the slope and the location of the breast groove in the blank without changing the cutters or the base block 72.

Starting from a "standard" condition of all three adjustments, sliding the cutter head in toward the work on the rib 98 moves the toplift portion of the cut backward and the lip portion of the cut toward the toplift portion so as to thicken the lip and vice versa. Fig. 6 shows the profiles of two heel blanks in the treatment of which this adjustment, only, has been changed. The full lines in so far as the outlines are different show the effect of the farther position of the cutter from the work. Fig. 7 shows the same blanks placed so that their grooved profiles coincide. Moving the cutter head down on the rib 92 moves the cut nearly vertically toward the toplift portion, thickening the lip, and vice versa. Fig. 8 shows the profiles of two heel blanks in the treatment of which this adjustment, only, has been changed. The full lines show the effect of the lower position of the cutter on the rib 92. Fig. 9 shows the same two blanks with their grooved profiles in coincidence. It should be observed that changes in the thickness of the lip also change its curvature slightly, since the distance of the lip surface from the axis 32 is thereby altered. Swinging the motor down around the stud 86 throws the cutter head toward the blank and also rotates its effective position around an axis perpendicular to the side faces of the blank and in front of the breast surface of the blank about an inch from the front corner of the toplift portion of the blank so as to throw the lip portion of the cut toward the heel seat portion of the blank and to thin the lip portion, and vice versa. Fig. 10 shows the profiles of two heels grooved with different angular adjustments of the motor and cutter axis, all other adjustments being the same. The full lines show the lower position of the motor on the plane 84. Fig. 11 shows the same blanks placed so that their grooved profiles coincide.

Heretofore, in wood heel making, the blank has been placed with one of its flat sides supported on a surface, or the equivalent thereof, and has then been brought up against a single gage bar which contacts with another surface of the blank. This offers no security

against the translatory or rotary displacement of the blank in various ways, on the first named surface and it has proved impossible to make the results of the grooving, turning and concaving operations appear in proper relationship, since there has been no assurance that any one of these operations will be performed in any definite relationship to the original surfaces of the heel blank. By the use of the two gages 70, 78 shown, engaging the blank on two of its lateral surfaces (as distinguished from its upper and lower faces), illustrated as the rear and one side of the blank, the blank is located on the table 74 which supports its heel seat surface. These surfaces are non-parallel, so that the heel blank is positioned with entire definiteness. The gage plate 78 contacts with the heel blank along a substantial extent of its depth, thus preventing any possibility of failure in orientation on the table 74. By the use of these same three surfaces in subsequent operations, an exact correspondence in the results of these operations can be secured, resulting in a perfectly formed heel.

In using the machine the operator places a heel blank 80 on the support 81 and pushes it over on the uppermost table 74 against the gages 70, 78 during an interval when the block 72 is motionless. He holds it there until the block 72 has rotated slightly, when the clamping plate 68′ comes down on the block and holds it until it has passed over the cutter head, after which it is released by the plate 68′ and drops out of the machine. Meanwhile the operator loads each table 74 as it comes around in the same way. Except for the insertion of the blank by the operator the operation of the illustrated machine is entirely automatic.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a wood heel machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section corresponding in part to a profile of a heel surface, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about an axis which is oblique to the axis of rotation of the tool and which is substantially parallel to the attaching face of a heel blank in the holder.

2. In a wood heel cutting machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section corresponding in part to a profile of a heel surface, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about an axis intersecting the axis of rotation of the tool at a point on the opposite side of the tool from the heel blank holder.

3. In a wood heel cutting machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section corresponding in part to a Louis heel lip profile, a heel blank holder, means for effecting a relative revolution of the heel blank holder and the tool about an axis which forms an angle with the axis of rotation of the tool, and means for adjusting the angle between the two said axes.

4. In a wood heel cutting machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section corresponding to a combined heel breast and shank lip profile, a heel blank holder, means for effecting a relative revolution of the heel blank holder and the tool about an axis which is oblique to the axis of rotation of the tool to carry the tool over the breast and shank lip portions of a heel blank in the holder, and means for adjusting the relative position of the two said axes to position the breasts and shank lip portions of the cut properly in respect to the heel blank.

5. In a wood heel cutting machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section corresponding to a combined heel breast and shank lip profile, a heel blank holder, means for effecting a relative revolution of the heel blank holder and the tool about an axis which is oblique to the axis of rotation of the tool to carry the tool over the heel breast and shank lip portions of a heel blank in the holder, and means for relatively adjusting the tool and the said axis of revolution in a direction parallel to the tool axis.

6. In a wood heel cutting machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section corresponding to a combined heel breast and shank lip profile, a heel blank holder, means for effecting a relative revolution of the heel blank holder and the tool about an axis which is oblique to the axis of rotation of the tool to carry the tool over the breast and shank lip portions of a heel blank in the holder, and means for relatively adjusting the tool axis and the said axis of revolution in a direction perpendicular to the tool axis.

7. In a heel breasting machine, a rotary tool constructed and arranged to form a curved shank lip surface in a heel blank, a heel blank holder, and means to swing the tool about a fixed axis relatively to a heel blank in the holder, to carry the tool relatively over the shank lip portions of the blank, the movement of the tool axis considered relatively to the work and the axis of swing generating a cone about the fixed axis, the axis of the cone being substantially parallel to the attaching face of the heel blank.

8. In a heel breasting machine, a rotary cutter having a blade arranged to pass over the breast and shank lip portions of a Louis heel blank to form a combined breast and

shank lip surface thereon, a heel blank holder, and means for rotating the work holder about an axis oblique to the tool axis to carry the cutter blade through the designated path relatively to a heel blank in the holder.

9. In a heel breasting machine, a rotary tool shaped to form a curved shank lip surface on a Louis heel blank, a heel blank holder, means for rotating the holder about an axis not parallel to the tool axis to carry a heel blank in the holder past the tool, and means for adjusting the distance from the said first named axis to the curved shank lip surface formed by the cutter, to control the curvature of said surface.

10. In a heel breasting machine, a rotary cutter shaped to form a curved breast surface on a heel blank, a heel blank holder, means for rotating the holder about an axis not parallel to the tool axis to carry a heel blank in the holder past the cutter, and means for adjusting the distance from the said first named axis to the curved breast surface formed by the cutter, to control the curvature of said surface.

11. In a heel cutting machine, a cutter constructed and arranged to form a compound breast and shank lip surface on a heel blank revolved past it, an intermittently rotating heel blank holder having a plurality of heel blank holding jacks and a corresponding number of cycles of movement, separated by resting positions, in each complete rotation, and means for automatically clamping a heel blank in a jack as it leaves a resting position, for holding it and revolving it past the cutter and for releasing it after it has passed the cutter.

12. In a heel cutting machine, a cutter constructed and arranged to form a compound breast and shank lip surface on a heel blank revolved past it, an intermittently rotating heel blank holder having a plurality of heel blank holding jacks and a corresponding number of cycles of movement in each complete rotation, between each two consecutive cycles of which it rests, and means for automatically clamping a heel blank in a jack as it leaves a resting position, for holding it and revolving it past the cutter to form the said compound breast and shank lip surface, about an axis oblique to the cutter axis, and for releasing it after it has passed the cutter.

13. In a heel cutting machine, a cutter constructed and arranged to form a compound heel breast and shank lip contour on a heel blank, a work carrying member arranged to carry a heel blank thereon past the cutter to form said surface, an adjustable back gage arranged to contact with the rear surface of the blank, and a side gage attached to a lateral edge of the work carrying member to support a lateral surface of the blank, said side gage being removable to substitute another gage having a different gaging characteristic.

14. In a heel cutting machine, a cutter constructed and arranged to form a compound heel breast and shank lip contour on a heel blank, a work carrying member arranged to carry a heel blank thereon past the cutter to form said surface, and an adjustable back gage arranged to contact with the rear surface of the blank.

15. A work carrying member arranged to support the heel-seat surface of a heel blank, and an adjustable back gage arranged to contact with the rear surface of the blank, said work carrying member having an edge constructed and arranged to cooperate interchangeably with the members of a set of side gages arranged to limit its effective lateral extent to varying degrees to center properly a heel blank on the surface.

16. In a heel cutting machine, a cutter constructed and arranged to form a compound heel breast and shank lip contour on a heel blank, a work carrying member arranged to carry a heel blank thereon past the cutter to form said surface, and an adjustable back gage arranged to contact with the rear surface of the blank, a lateral edge of the work carrying member being arranged to carry any one of a set of interchangeable side gages for the blank whereby to cover varying amounts of the work carrying member to center heel blanks of varying widths.

17. A work holder for a wood heel grooving machine having a rotary head provided with a seat adapted to receive interchangeably, one at a time, the work carrying base blocks of a set, means for attaching a base block of the set to the seat, and means to rotate the base block so attached, said base blocks being of progressively varying diameters to position different heel blanks at different distances from the axis of rotation of the head.

18. In a heel breasting machine, a rotary cutter having a blade arranged to pass over the breast and shank lip portions of a Louis heel to form a compound breast and shank lip surface thereon, a heel blank holder, means for rotating the work holder about an axis oblique to the cutter axis to carry the cutter blade over the designated path relatively to a heel blank in the holder, and means for adjusting the relative location of the two axes.

19. In a heel breasting machine, a rotary cutter having a blade arranged to pass over the shank lip portion of a Louis heel to form a curved shank lip surface thereon, a heel blank holder, means for rotating the work holder about an axis oblique to the cutter axis to carry the cutter blade over the designated path relatively to a heel blank in the holder, and means for changing the angular relation between the said axes.

20. In a heel breasting machine, a rotary cutter having a blade arranged to pass over the breast portion of a Louis heel to form a breast surface thereon, a heel blank holder, means for rotating the work holder about an axis oblique to the tool axis to carry the cutter blade over the designated path relatively to a heel blank in the holder, and means for angularly adjusting the cutter axis in a plane passing approximately through the axis of rotation of the holder.

21. In a heel breasting machine, a rotary cutter having a blade arranged to pass over the breast and shank lip portions of a Louis heel to form a compound breast and shank lip surface thereon, a heel blank holder, means for rotating the work holder about an axis oblique to the tool axis to carry the cutter blade over the designated path relatively to a heel blank in the holder, and means for adjusting the cutter longitudinally of its axis.

22. In a heel breasting machine, a rotary cutter having a blade arranged to pass over the breast and shank lip portions of a Louis heel to form a compound breast and shank lip surface thereon, a heel blank holder, means for rotating the work holder about an axis oblique to the cutter axis to carry the cutter blade over the designated path relatively to a heel blank in the holder, and means for adjusting the cutter axis in a direction perpendicular to itself.

23. In a wood heel grooving machine, an angularly adjustable cross-slide plate, a cross slide arranged for adjustment back and forth across the cross-slide plate, a cutter arranged for adjustment on the cross slide in a direction transverse to the direction of adjustment of the cross slide, and a work holder arranged to rotate on an axis to carry a wood heel blank thereon past the cutter.

24. In a wood heel grooving machine, an angularly adjustable cross-slide plate, a cross slide arranged for adjustment back and forth across the cross-slide plate, a cutter arranged for adjustment on the cross slide in a direction transverse to the direction of adjustment of the cross slide, and a work holder arranged to carry a wood heel blank thereon past the cutter.

25. In a wood heel grooving machine, a rotary work support arranged to rotate intermittently on a horizontal axis, and having a plurality of work supporting surfaces, equal in number to the number of cycles of intermittent rotation in a complete revolution, and means for rotating said work support in such manner that at each cessation of rotation one of said work supporting surfaces reaches a loading position, a rotary cutter, shaped to generate a surface of revolution having a profile corresponding to the breast-shank lip profile of a Louis heel, mounted on a non-horizontal surface on the machine frame, and means for adjusting the position of the axis of said cutter angularly, longitudinally and laterally of itself while maintaining it parallel to the non-horizontal surface, the work support being constructed and arranged to carry a wood heel blank from the loading position past the cutter.

26. In a wood heel grooving machine, a rotary work holder arranged to support a wood heel blank with its heel-seat surface toward the axis of rotation of the holder and to revolve it about said axis, and a rotary cutter arranged to pass over the breast surface and the shank lip of the blank as it is revolved past the cutter, the cutter having its axis oblique to the axis of rotation of the work holder to bring the cutter axis approximately perpendicular to the heel breast.

27. In a heel cutting machine, a heel blank holder and a rotating cutter head, and means for relatively revolving the cutter head and the heel blank holder about an axis forming an acute angle with the cutter head axis to form a heel breast surface and a shank lip surface, and to trim the end of the shank lip of a heel blank in the holder.

28. In a heel cutting machine, a heel blank holder and a rotating cutter head, means for relatively revolving the cutter head and the heel blank holder about an axis oblique to the cutter head axis and parallel to the longitudinal horizontal axis of a heel blank in the holder to form the breast surface of the heel blank and to trim the end of the lip of the heel blank, and means for adusting the cutter head longitudinally of its axis.

29. In a heel cutting machine, a heel blank holder and a rotating cutter head, means for relatively revolving the cutter head and the heel blank holder about an axis oblique to the cutter head axis and parallel to the longitudinal horizontal axis of a heel blank in the holder to form the breast surface of the heel blank and to trim the end of the lip of the heel blank, and means for adjusting the cutter head axis in a direction parallel to itself.

30. In a heel cutting machine, a heel blank holder and a rotating cutter head, means for relatively revolving the cutter head and the heel blank holder about an axis oblique to the cutter head axis and parallel to the longitudinal horizontal axis of a heel blank in the holder to form the breast surface of the heel blank and to trim the end of the lip of the heel blank, and means for adjusting the cutter head axis angularly to alter the oblique angle between the said axis of revolution and the cutter head axis.

31. In a wood heel cutting machine, a rotary cutter having a cutting edge shaped correspondingly to a curved surface to be produced on the finished heel, a heel blank holder, and means for relatively revolving the holder and the cutter about an axis oblique to the cutter axis to carry the cutter over the

said surface, the movement of the cutter axis considered relatively to the work and to the said axis of revolution generating a form of hyperboloid of revolution about the said axis of revolution.

32. In a heel cutting machine, a cutter constructed and arranged to form a compound heel breast and shank lip contour on a heel blank, a work carrying member arranged to carry a heel blank thereon past the cutter to form said surface, and an adjustable back gage arranged to contact with the rear surface of the blank, said work carrying member having a lateral edge constructed and arranged to cooperate interchangeably with the members of a set of side gages arranged to project by different amounts over the said lateral edge to center heel blanks of different widths on said work carrying member.

33. In a wood heel cutting machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section composed of two relatively straight segments joined by a curve of substantially sharper curvature, corresponding to the breast and shank lip profiles of a Louis heel and the sharply curved angle between them, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about an axis which is oblique to the axis of rotation of the tool.

34. In a wood heel breasting machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section shaped to produce a cylindroidal profile on the breast and shank lip portion of a Louis heel blank, the profile comprising a comparatively long and straight portion extending from the toplift portion of the blank toward the heel seat portion, a shorter portion extending along the shank lip, and a more sharply curved portion joining them, and the axis of the cylindroid being transversely horizontal relatively to the heel blank, and means for effecting a relative revolution of the heel blank holder and the tool about an axis which is oblique to the axis of rotation of the tool.

35. In a wood heel cutting machine, a rotary tool constructed and arranged to generate about its axis of rotation a surface of revolution having a cross-section corresponding to a heel front profile, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about a second axis which is oblique to the axis of rotation of the tool, the said surface of revolution being so shaped in relation to the two said axes that those points of the said surface which lie most remote from those points of the two said axes where the said axes are closest to each other, are remote from the axis of the said surface of revolution.

36. In a wood heel cutting machine, a rotary tool constructed and arranged to generate about its axis of rotation a surface of revolution having a cross-section corresponding to a heel front profile, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about a second axis which is oblique to the axis of rotation of the tool, the said surface of revolution being so shaped in relation to the two said axes that those points of the said surface which lie most remote from those points of the two said axes where they are closest to each other, lie in the operative portion of the said surface of revolution and are remote from the axis of the said surface of revolution.

37. In a wood heel cutting machine, a rotary tool constructed and arranged to generate about its axis of rotation a surface of revolution having a cross-section corresponding in part to a portion of a heel front profile, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about a second axis obliquely intersecting the axis of rotation of the tool, the said surface of revolution being so shaped in relation to the two said axes that those points of the said surface which lie most remote from the intersection of the two said axes are remote from the axis of the said surface of revolution.

38. In a wood heel cutting machine, a rotary tool constructed and arranged to generate about its axis of rotation a surface of revolution having a cross-section corresponding to a heel breast profile, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about a second axis obliquely intersecting the axis of rotation of the tool at a point on the opposite side of the tool from the heel blank holder, the said surface of revolution being so shaped relatively to the two said axes that those points of the said surface which lie most remote from the intersection of the two said axes are remote from the axis of the said surface of revolution.

39. In a wood heel cutting machine, a rotary tool constructed and arranged to generate about its axis of rotation a surface of revolution having a cross-section corresponding in part to a Louis heel shank lip profile, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about a second axis which is oblique to the axis of rotation of the tool, the rotary tool being so constructed that the said surface of revolution is substantially flatter at the point where it is intersected by its own axis of revolution than it is at points remote from said axis so that its points of maximum distance from those points of the two said axes where they lie nearest each other, are remote from the said axis of revolution.

40. In a wood heel cutting machine, a ro-

tary tool constructed and arranged to generate about its axis of rotation a surface of revolution having a cross-section corresponding to a heel breast profile, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about a second axis obliquely intersecting the axis of rotation of the tool, the rotary tool being so shaped that the said surface of revolution has its flattest portion surrounding the point where its axis intersects it, and so that the radius of curvature of the surface at this point is greater than the distance from this point to the intersection of the two said axes whereby those points of the said surface which are most remote from the last said intersection are remote from the said intersection of the surface and its axis.

41. In a wood heel cutting machine, a rotary tool constructed and arranged to generate about its axis of rotation a surface of revolution having a cross-section corresponding to the front profile of a heel, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about a second axis obliquely intersecting the axis of rotation of the tool, the rotary tool being so shaped that the said surface of revolution has its flattest portion surrounding the point where its axis intersects it, and so that the radius of curvature of the surface at this point is greater than the distance from this point to the intersection of the two said axes whereby those points of the said surface which are most remote from the last said intersection are remote from the said intersection of the surface and its axis, and the tool being so shaped also that the said most remote points correspond to the junction of the lip surface and the breast surface of the heel blank being cut.

42. In a heel breasting machine, a rotary cutter having a cutting edge constructed and arranged to form a compound breast and curved shank lip surface in a heel blank, a heel blank holder, and means to swing the cutter about a fixed axis relatively to a heel blank in the holder, to carry the cutter over the breast and shank lip portions of the blank, the movement of the cutter axis considered relatively to the work and the axis of swing generating a cone about the fixed axis, the axis of the cone being substantially parallel to the attaching face of the heel blank.

In testimony whereof I have signed my name to this specification.

WILLARD N. SAWYER.

CERTIFICATE OF CORRECTION.

Patent No. 1,860,789. May 31, 1932.

WILLARD N. SAWYER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5 line 44, claim 1, after "heel" insert the word cutting; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 4th day of October, A. D. 1932.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

DISCLAIMER

1,860,789.—*Willard N. Sawyer*, Winchendon, Mass. WOOD HEEL GROOVING MACHINE. Patent dated May 31, 1932. Disclaimer filed June 10, 1935, by the assignee, *United Shoe Machinery Corporation.*

Hereby enters this disclaimer to said claims 1, 2, 3, 7 and 31 of said Letters Patent, which are in the following words, to wit:

"1. In a wood heel cutting machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section corresponding in part to a profile of a heel surface, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about an axis which is oblique to the axis of rotation of the tool and which is substantially parallel to the attaching face of a heel blank in the holder.

"2. In a wood heel cutting machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section corresponding in part to a profile of a heel surface, a heel blank holder, and means for effecting a relative revolution of the heel blank holder and the tool about an axis intersecting the axis of rotation of the tool at a point on the opposite side of the tool from the heel blank holder.

"3. In a wood heel cutting machine, a rotary tool constructed and arranged to generate a surface of revolution having a cross-section corresponding in part to a Louis heel lip profile, a heel blank holder, means for effecting a relative revolution of the heel blank holder and the tool about an axis which forms an angle with the axis of rotation of the tool, and means for adjusting the angle between the two said axes."

"7. In a heel breasting machine, a rotary tool constructed and arranged to form a curved shank lip surface in a heel blank, a heel blank holder, and means to swing the tool about a fixed axis relatively to a heel blank in the holder, to carry the tool relatively over the shank lip portions of the blank, the movement of the tool axis considered relatively to the work and the axis of swing generating a cone about the fixed axis, the axis of the cone being substantially parallel to the attaching face of the heel blank."

"31. In a wood heel cutting machine, a rotary cutter having a cutting edge shaped correspondingly to a curved surface to be produced on the finished heel a heel blank holder, and means for relatively revolving the holder and the cutter about an axis oblique to the cutter axis to carry the cutter over the said surface, the movement of the cutter axis considered relatively to the work and to the said axis of revolution generating a form of hyperboloid of revolution about the said axis of revolution."

[*Official Gazette July 2, 1935.*]