Aug. 11, 1936. F. C. LOVEJOY 2,050,348

METHOD AND APPARATUS FOR MAKING A HEEL

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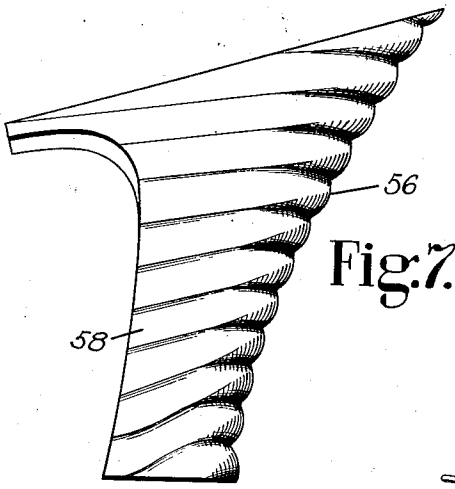


Fig. 7.

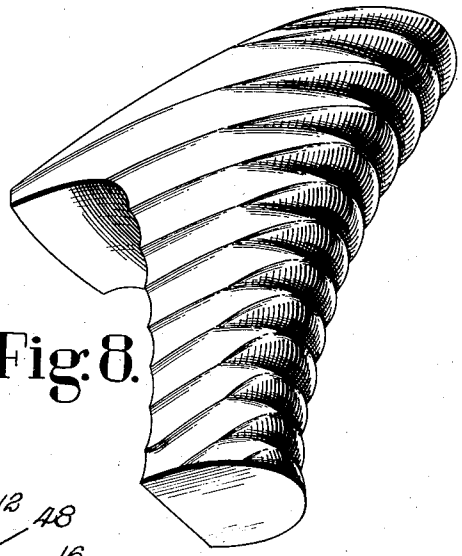


Fig. 8.

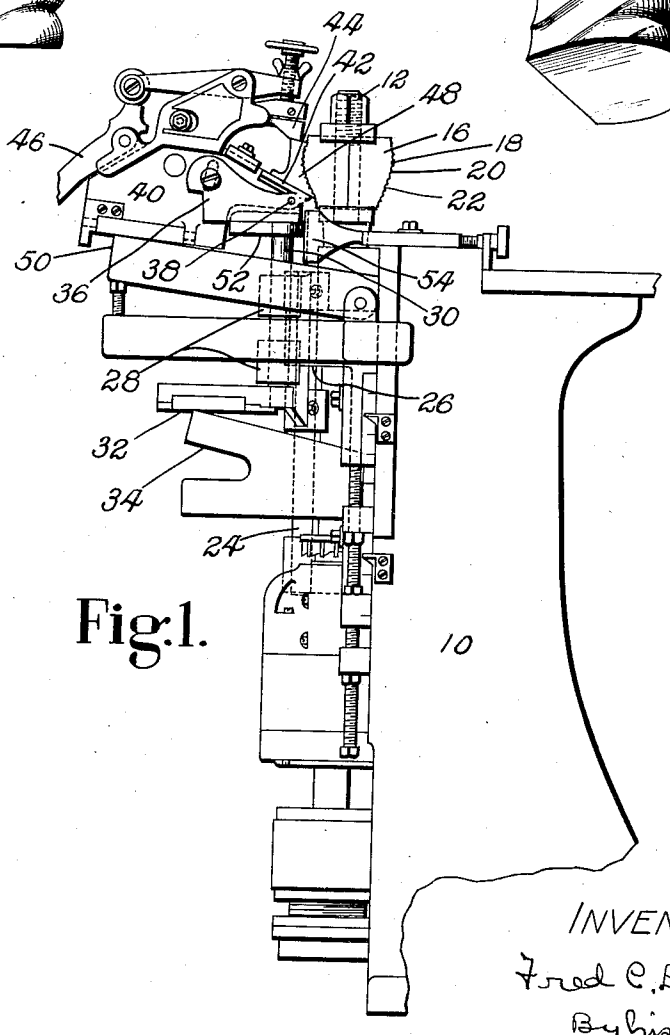


Fig. 1.

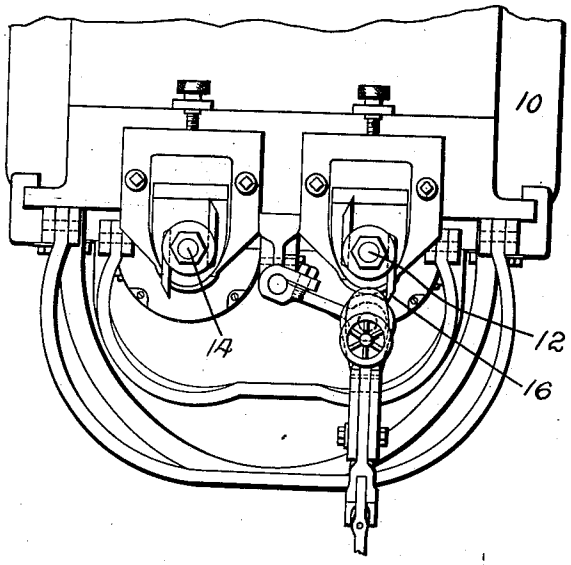
INVENTOR
Fred C. Lovejoy
By his Attorney
Harlow M. Davis

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Fig. 2.



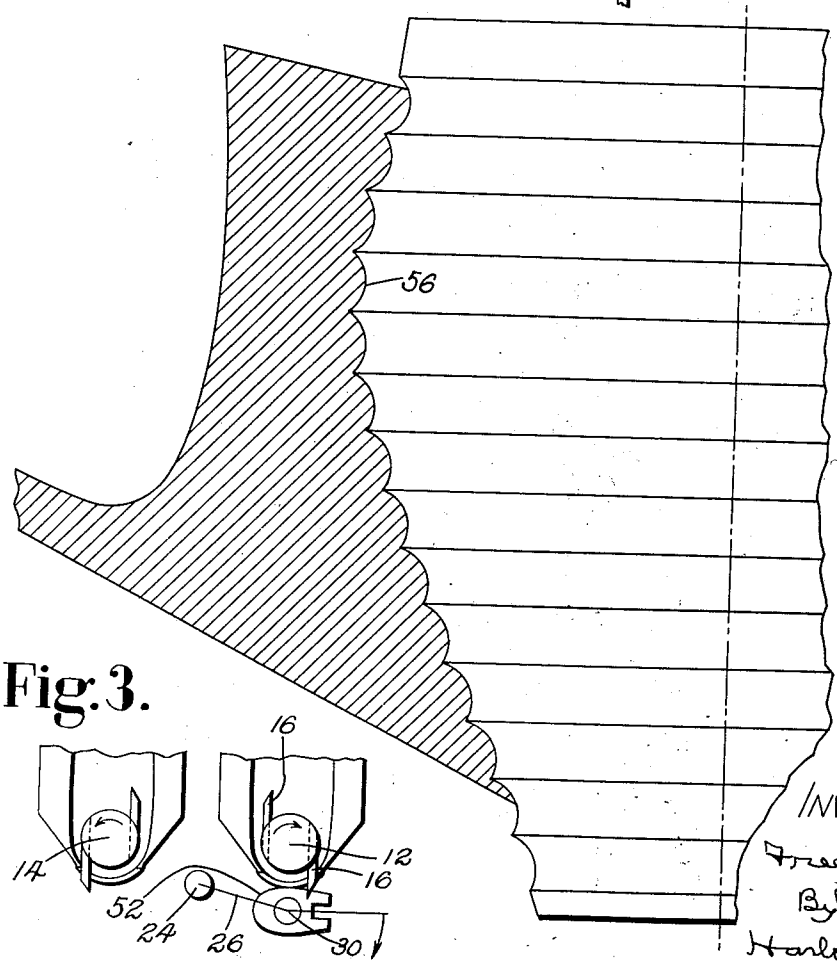


Fig. 4.

Fig. 3.

INVENTOR
Fred C. Lovejoy
By his Attorney
Harlow M. Sears

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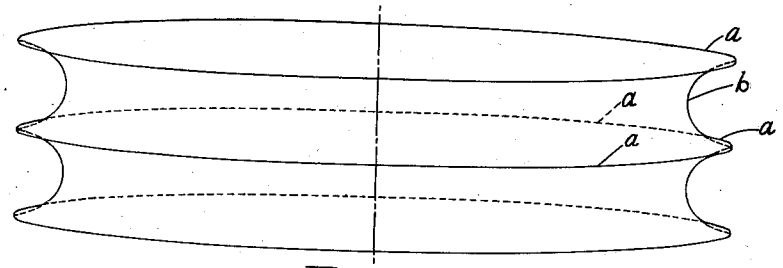


Fig. 5.

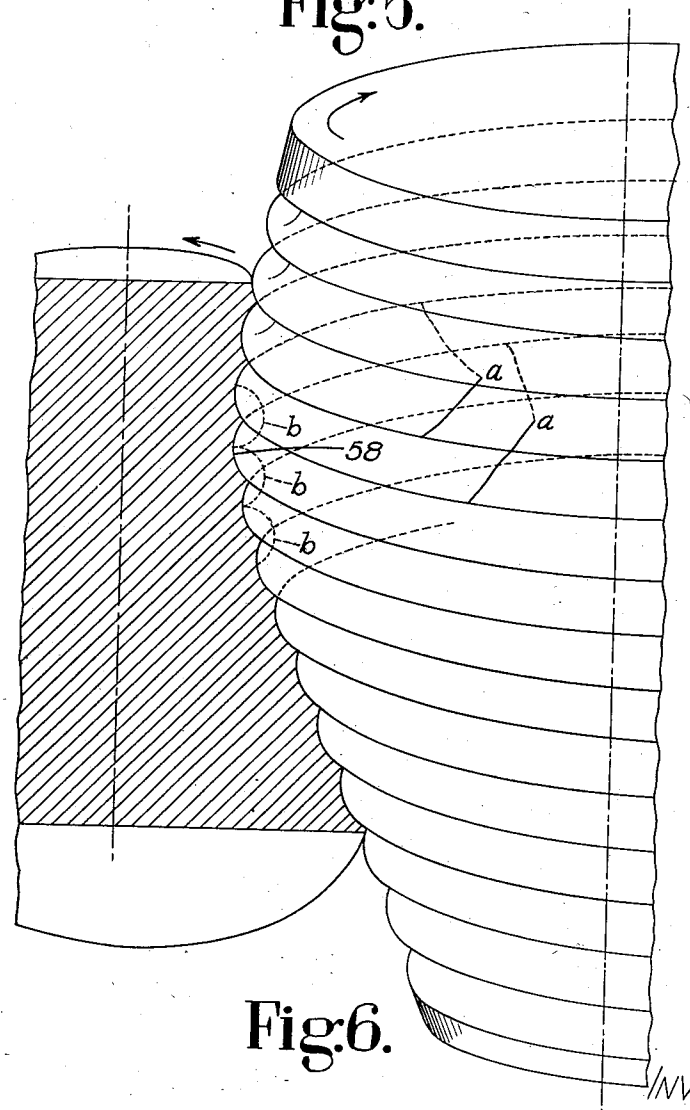


Fig. 6.

INVENTOR

Fred C. Lovejoy

By his attorney

Hartson M. Davis

Patented Aug. 11, 1936 2,050,348

UNITED STATES PATENT OFFICE

2,050,348

METHOD AND APPARATUS FOR MAKING A HEEL

Fred C. Lovejoy, St. Louis, Mo., assignor to United Shoe Machinery Corporation, Paterson, N. J., a corporation of New Jersey

Application January 24, 1935, Serial No. 3,324

5 Claims. (Cl. 12—147)

The present invention relates to the making of heels and, in particular, to the making of wood heels. It contemplates a novel method of making heels, a machine comprising a novel combination for use in the practice of the method, and the novel heel resulting therefrom.

The lateral and rear surfaces of wood heels are shaped in a turning machine, such as is shown in United States Letters Patent No. 1,488,534, granted April 1, 1924, upon application of Folsom, Vinton and Whitney, in which the heel blank is held upside down upon a jack which rotates upon a vertical axis located under the breast portion of the blank. The jack is also tiltably mounted on an axis perpendicular to the first described axis, and extending from side to side of a heel blank in the jack. The tilting movement is effected by a cam track (known as the "upper track") upon which rests that end of the jack arm which is handled by the operator to swing the jack. The vertical axis of rotation is physically represented by a shaft which carries the jack and which has an arm at its lower end extending at right angles to the shaft. This arm rests upon a second cam track (known as the "lower track") which, like the upper track, is high at its middle and low at its ends, and which lifts the jack shaft and jack as the jack turns to move one side of the heel over the cutter.

The heel is cut from the breast portion around to the center line of the back in one swing of the jack, and the other side of the heel is similarly cut on a second cutter, the machine being a twin machine. The vertical shaft-axis of the jack is swingable, in a gate member, from one cutter to the other, and when in position before either cutter has a slight in-and-out movement controlled by a heel-shaped form on the jack and a gage or "rub" collar which extends around in front of the cutter shaft. The form determines the depth to which the heel falls into the cutter and determines generally the shape of the horizontal cross-section of the heel, for example, the shape of the attaching face.

Thus, the sides and back of the heel will both fit the profile of the surface of revolution generated by the cutter, but, owing to the lifting of the jack by the lower track as the jack turns, the back of the heel fits higher up on the profile than the breast portions do. In other words, the heel blank, aside from the progressive tilting movement caused by the upper track, moves over the surface of revolution generated by the cutter head with a screwing or helical motion, the axis of the screw or helix being parallel to that of the cutter head.

I have found that a novel and ornamental heel shape can be generated by passing a heel blank over a suitable cutter by the movements above described. The contemplated cutter head is of ordinary mechanical formation, its peculiarity residing in the shape of its cutting edges. Instead of being ground on a continuous curve, these edges are nicked, and consist, at least in part, of a series of teeth joined by concave arcs. The surface of revolution generated by this part of the cutter head is composed of circular flutes lying in planes perpendicular to the axis of rotation of the cutter head, and the helical movement of the heel blank over this surface results in a shape at any point which is substantially complemental to the projection of the profile of the surface on a plane passing through that point of the heel and perpendicular to the actual direction of movement of that point at the time, relatively to the cutter, that is, a plane passing through the ideal instantaneous axis on which the heel blank is actually turning at the instant, and also through that locality on the heel which the cutter is finishing at that instant.

The central part of both cam tracks is substantially horizontal, so that when the back of the heel is being cut the pitch of the helical movement is negligible, the movement of the surface at the back of the heel being therefore substantially at right angles to the cutter axis. This results in impressing the effective profile of the cutter head on this part of the heel, which therefore has a series of beads, corresponding to the flutes of the cutter head surface of revolution, at this locality. The lifting movement of the jack is more pronounced as the breast is approached (regarding the cut as being from the back to the breast), and the profile of the cutter surface of revolution then projects into a series of shallow beads joining one another at obtuse angles, which causes the beads at the rear of the heel to shade into shallow flutes at the sides.

Accordingly, the method of the present invention, in a broad aspect, may be defined as moving a rotating cutter blade with a cutting edge portion formed of teeth joined by concave arcs, and a heel blank surface, past each other in a direction oblique to the cutter axis.

As herein illustrated, the practice of the above method involves the use of a rotating cutter head having an effective surface of revolution comprising a series of arcuate flutes in planes perpendicular to the axis of the cutter head, a jack shaft

rotatable on an axis parallel to the cutter head axis and arranged to carry the side and rear surfaces of a heel blank past the cutter head, and a cam for moving the jack shaft in a direction substantially parallel to the cutter head axis as the cut between the breast and the back of the heel blank is made, and invention is to be recognized in the provision of such mechanism.

Regarded in another aspect, invention is further to be recognized as residing in the novel heel produced by the above method, the characteristics of which have already been pointed out.

These and other aspects of the invention will be understood from the annexed specification and drawings, in which

Fig. 1 is a side view of the machine by means of which the invention is practiced;

Fig. 2 is a plan view, which, like Fig. 1, shows the condition of things at the finish of the cut, at the back of the heel;

Fig. 3 is a detail showing the condition at the beginning of the cut at the breast;

Fig. 4 is an enlarged view showing the end of the cut;

Fig. 5 is a diagram illustrating the intermediate portion of the cut;

Fig. 6 is an enlarged view showing the beginning of the cut; and

Figs. 7 and 8 are lateral and perspective views of the heel produced.

A machine by means of which the method is practiced will be first described. It comprises a vertical frame **10** having two vertical cutter shafts **12**, **14** at the top of each of which is mounted a cutter head **16**. Each cutter head has two blades **18** the edges of which have generally the profile of the side and rear surfaces of an inverted heel, but are ground to exhibit a series of teeth **20** joined by concave arcs **22**. All four of the cutter edges are ground alike and the blades are set so that each tooth on one blade swings exactly in the path of a tooth on the other blade of that cutter head.

A vertical rotatable shaft **24** is mounted in bearings on the front face of the frame **10** and carries a gate member **26** having bearings **28** in its outer end to support the vertical jack shaft **30**. The shaft **30** is both rotatable and slidable in the bearings **28**, and its height is determined by its arm **32** which rests on a cam or "lower track" **34**. This track is roughly semicircular, and is higher in the middle than at the ends. The upper end of the jack shaft **30** carries a head **36** in which the jack is pivoted at **38**. The jack consists of a frame **40**, pivoted to the head **36** at **38**, the frame having a fixed lower jaw **42** and a movable upper jaw **44** operable by a handle **46** to clamp a heel blank **48**. The pivoted axis **38** extends in a direction running across the heel blank **48** from side to side, and is located below the heel blank. The jack with the blank in it is rotated in front of a cutter head **16**, from a position in which the vertical central plane of the heel blank lies across the front of the machine (Fig. 3), parallel to the plane of the two cutter shafts, to a position at right angles to this (Fig. 2), thus making a quarter turn about its axis **30**. During this turn the handled end of the jack rides around on a cam or "upper track" **50** which is preferably hingedly mounted on the front of the frame **10**. (This pivoted mounting of the track is explained in United States Letters Patent No. 1,247,335, granted November 20, 1917, on the application of H. W. Russ.)

The depth of cut into the heel blank **48** is determined by a form **52** mounted on the jack shaft **30** under the head **36**, which runs against an adjustable rub collar **54** which extends around in front of the cutter shaft. The gate member **26** swings a little during the heel cutting to permit the form and rub collar to remain in contact.

The operation above described cuts the lateral heel surface from the breast to the center of the back, on one side, and the other side is cut against the other cutter in the same way. The two cutter heads run in opposite directions such that each cutting edge travels rearwardly on the heel blank, and the two cutter heads are necessary in order to avoid cutting against the grain of the wood, which runs from front to back.

Thus, in cutting from one side of the breast to the back, the heel blank is tilted into the cutter by the upper track and is raised along the effective shape of the cutter so that the back of the finished heel corresponds to a locality farther up on the cutter profile than the breast portions do. The central portion of the lower track is horizontal so that as the locality adjacent to the center of the back of the heel is cut the movement past the cutter of the heel surface then being cut is perpendicular to the axis of the cutter. This will cause the exact profile of the effective shape of the cutter to be shaped on the heel in this neighborhood, which is cut into a series of beads **56** (Fig. 4). At the sides of the heel, however, the heel rises vertically during the cut, so that the movement of a lateral point of the heel over the cutter is oblique to the axis of the cutter (see Fig. 6).

The effective shape of the cutter head is thus changed and becomes the projection of the periphery of the actual whirling shape it generates upon a plane correspondingly oblique to its axis, that is, on a plane perpendicular to the line of relative travel of the heel surface and a point on a cutting edge at that instant. In this way the lateral heel surface is shaped into a series of shallow flutes **58** or concave grooves which gradually merge into the beads **56** formed at the back.

This is illustrated in Figs. 4, 5 and 6, the former of which shows a shape like that of the cutter head when viewed in a direction perpendicular to its axis, and the latter of which shows the appearance of the same shape when viewed in a direction oblique to its axis.

The intermediate Fig. 5 illustrates the phenomenon of transition from the condition shown in Fig. 6 to that shown in Fig. 4. The whirling shape of the cutter head is illustrated in all three of these figures. The profile of this whirling shape is composed of elliptic arcs taken (see Fig. 5) from the ellipses *a*, which represent the circular paths of the teeth and the approximate ellipses *b* which are the projections of the approximately circular arcs between the teeth of the cutter. It will be seen that as the angle between the direction of movement of the work and the cutter axis becomes more and more oblique, that is, as the Fig. 4 position changes toward the Fig. 6 position (regarding the cut as made backwards) the ellipses *a* gradually overlap the ellipses *b*, until the effect of the latter completely disappears.

It will be noticed (Fig. 7) that the flutes **58** diverge as they approach the breast of the heel blank. This is due to the tilting action of the upper track. Again regarding the cut as made in the reverse direction, from the back to the breast, the jack tilts backward, away from the cutter, and the top-lift end of the heel blank is

carried nearly horizontally away from the cutter, while the attaching face end of the heel blank is lifted vertically, partially counteracting the drop due to the slope of the lower track. This causes a progressive change in the slope of the flutes, from top-lift end to the attaching face end of the blank.

If the lower track were horizontal, the heel blank would be beaded all the way around, and if the upper track were horizontal, the flutes would all be parallel.

It may be remarked that, owing to the facts that the direction of relative movement between the heel blank and the whirling shape of the cutter is continually changing and that the teeth of the cutter are not absolutely sharp-pointed, Fig. 5 is a suggestive, rather than a rigorously accurate, showing of the conditions intermediate between Fig. 4 and Fig. 6.

While the cutters have been shown as toothed throughout their cutting edges, the claims are not to be understood as limited to such construction. The invention also contemplates ornamentation of heels over a part of their side and rear surfaces, merely.

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

1. That improvement in the art of making wood heels which comprises rotating a heel blank past a rotating cutter the cutting edge of which consists of substantially equally spaced teeth joined by concave arcs, the direction of movement of that part of the surface of the heel blank that is in contact with the cutter being generally oblique to the axis of the cutter.

2. That improvement in the art of making wood heels which comprises rotating the side and rear surface of a heel blank past a rotating cutter the cutting edge of which comprises a plurality of teeth joined by successive concave arcs, the axis of rotation of the heel blank being parallel to that of the cutter, and shifting the heel blank parallel to the axis of the cutter during the cut between the breast and the back of the heel blank, whereby the movement of that part of the surface being operated on at any instant is generally oblique to the axis of the cutter.

3. That improvement in the art of making wood heels which comprises effecting a relative helical movement between the lateral and rear surfaces of a heel blank and a rotating cutter head, the effective surface of revolution generated by which comprises a plurality of circular flutes, the axis of the said helical movement being parallel to the axis of the cutter head.

4. That improvement in the art of making wood heels which comprises moving past each other with a helical motion the side and rear surfaces of a heel blank and a rotating cutter head having an effective surface of rotation composed of circular flutes lying in planes perpendicular to the axis of the cutter head, the axis of the cutter head and the axis of the helical motion extending generally in the same direction.

5. In a machine for turning heels, a rotating cutter head having an effective surface of revolution comprising a series of arcuate flutes in planes perpendicular to the axis of the cutter head, a jack shaft rotatable on an axis parallel to the cutter head axis and arranged to carry the side and rear surfaces of a heel blank past the cutter head, and a cam for moving the jack shaft in a direction substantially parallel to the cutter head axis as the cut between the breast and the back of the heel blank is made.

FRED C. LOVEJOY.